FINAL REPORT
FOR
EXPLORATION LICENCES 7137, 7240, 7241 & 7242,
IN THE ROPER RIVER AREA NORTHERN TERRITORY

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May, 1999
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SUMMARY

The Exploration Licences were applied for in October 1990, with the object of assessing previously reported iron ore resources, in the context of new infrastructure developments in the region, new technology in iron and steel production, and anticipated markets demands in Southeast Asia. The Licenses 7137, 7240, 7241 and 7242 enclose a combined area of some 87 square kilometres in the Roper River region of the Northern Territory, located approximately 450 kilometres southeast of Darwin and 200 kilometres east-southeast of Katherine (Figures 1 & 2).

The ironstones of the Roper River region are typical of a category of oolitic marine iron ores which were formerly exploited worldwide on a huge scale. Such low grade iron ores are still widely used for domestic steel production, both in Europe and USA, and particularly in industrialising countries such as China. Their exploitation therefore needs to be viewed in the context of processing to value-added products such as pig iron, using recently developed processes which are viable through the optimum use of particular local factors. In the case of Roper River, these factors include – easy mining and crushing, reasonable proximity to a gas pipeline, adequate water supplies, availability of limestone flux, good road access and proximity to potential sea and/or rail transport, proximity to expanding markets in Asia, with no exceptional environment sensitivities.

Joint venture partners where sought to fully appraise the project, in order to establish a viable industry based on positive financial returns and supportive Government backing. It is proposed that on negotiation of a satisfactory joint venture, the mining tenements would be transferred to a company in which the venturers would be offered equity in exchange for a commitment to fund the feasibility studies. However, this did not preclude a simple royalty arrangement, subject to the necessary feasibility being established.
PREVIOUS EXPLORATION WORK

The only past exploration work which was significant with regard to the iron ore potential of the Roper area was that carried out by BHP between 1955 and 1957. They completed regional and detailed geological mapping, channel sampling of ironstone outcrops, blasting and sampling, drilling of 31 diamond drill holes and metallurgical testing of composite samples.

The bulk of the surface mapping and sampling work was done in the Shirwin Creek and Mount Scott areas (EL's 7241 & 7242), and these also yielded the bulk samples used in the metallurgical test work.

Diamond drilling was done at Hodgson Downs (ten holes in EL7137), at Shirwin Creek (eleven holes in EL7241), Mount Fisher (three holes in EL7240) and Mount Scott (one hole in EL7242).
WORK CARRIED OUT DURING THE TERM OF LICENCES

Prior to commencing field surveys photogeological interpretation maps were prepared for each Exploration Licence using enlargements to 1:40,000 scale of the 1:80,000 RC9 monochrome air photography of 1969. The interpretations were revised after completion of the fieldwork.

Field activities comprised reconnaissance mapping, to verify the interpreted outcrop are of the ironstone beds and establish their thickness and lithology, and collection of bulk samples from selected sites. The sample sites were chosen as providing good exposure of ironstone judged on field characteristics to be of good grade and representative of a substantial body of material. The bulk samples were analysed by AMDEL for CaO, Fe, Al2O3, TiO2’Mn, P, MgO, SiO2, S and loss on ignition.

A 25kg sample was also sent to Denver Sala in Sweden for beneficiation tests. The results are in Appendix II.

In addition to the fieldwork, considerable time and effort went into marketing the Project. A Conceptional Development Proposal titled PROPOSAL FOR DEVELOPMENT OF IRON RESOURCES AT ROER RIVER NORTHERN TERRITORY AUSTRALIA was prepared and used as the focal point for marketing the Project. A copy is attached at Appendix III.

Expenditure during this term of the Licences was approximately $70,900, broken down into the following categories:

- Licences and Rental $ 13,000
- Technical and Professional Consultancy $ 19,100
- Legal $ 4,100
- Sample Testing $ 12,500
- Marketing $ 16,600
- Transport $ 5,600
Exploration Licence 7137, Hodgson Downs

The exploration target here is a single bed of ironstone which forms a nearly continuous outcrop (locally disrupted by faulting) along a length of some 15 kilometres on the southeastern margin of a shallow synclinal fold (Figure 7). In the northeast, the dip of the formation is relatively high at angles up to 20 degrees to the northwest; in the central part of the outcrop gentle dips of about 5 degrees to the west predominate; in the south, in the axial region of the fold, bedding is near horizontal.

The bed is massive, and of uniform thickness of between 3.5 and 4.5 metres. It has clear cut contacts, at the hanging wall with a thinly bedded white quartz sandstone, and in the footwall with grey-brown ferruginous sandstones and siltstones.

The lithology is is very uniform, and consists of closely packed hematite ooliths/pisoliths, of about 1mm diameter, in a matrix of earthy and specular hematite. Very well rounded quartz grains of 0.2 to 1.00mm size, form cores to some ooliths, and irregular sandy pockets within the rock. The formation is soft, but due to its massive unbedded nature forms a prominent escarpment (Plates 1 & 2).

Analyses of two bulk samples (327526 & 327527) from the southern part of the outcrop reported 54.1% Fe and 51.3% Fe over measured vertical thickness of 2.5m and 4.2m respectively, which are somewhat less than the full formation thickness. Silica contents at 17.7% and 19.9% are surprisingly high considering the low content of visible quartz grains, and may in part reflect supergene silification. Phosphorus contents are low (0.09% and 0.10%) as is sulphur (0.05% or less).

The area of outcrop of the ironstone bed within the EL is estimated from air photography to be about 300 hectares; including areas with shallow overburden an estimated areal extent of about 400 hectares of ironstone would be potentially available for open pit mining. Assuming an average thickness of 3.5 metres, and an average bulk density of 3.0 tonnes per cubic metre, this implies a resource of about 40 million tonnes.

The Drill testing of the deposit in 1957 by BHP comprised eleven holes which intersected the ironstone bed at depths of between 16 and 71 metres. Locations of the drill holes are only known approximately; it is indicated by the intersection depths that the holes are mostly sited will down dip from the portions of the bed which could be considered as possibly exploitable by open pit mining. The drill core is described as consisting of chamosite, siderite and hematite, and in all cases is probably primary unoxidised material. The thickness ranged from 0.4 to 5.1 metres, with grades of between 21.9% and 45.6% Fe, and with between 14% and 42.4% SiO2. The best intersections were as follows:=

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Final Report -6- 30/05/1999
T19  3.4m @ 41.3% Fe and 15.5% SiO₂ from 41m.
U18  3.9m @ 45.6% Fe and 14.0% SiO₂ from 56m.
W26  4.5m @ 42.9% Fe and 12.5% SiO₂ from 19m.

Discounting three intercepts which contained less than 30% Fe, the average of the remaining eight intercepts was 38.6% Fe and 18.1% SiO₂ over 3.3m. This may be considered as a reasonable indication of the composition of the deposit in the primary zone down dip from the open pit resource. The recent sampling indicates that the oxidised ironstone is relatively enriched in iron and silica compared to the primary zone, perhaps due to the leaching of carbonate radicle in the siderite.

The depth of the oxidation is unknown, and may be quite variable. On a conservative assumption that the formation is entirely oxidised to a vertical depth of ten metres below surface, the total resource of oxidised pisolith is probably about twice that present below the areas of its outcrop.

The above considerations indicate that EL7137 has potential for a resource of about 60 million tonnes of oxidised pisolith ironstone containing 50% to 55% Fe and 15% to 20% SiO₂.

This is in reasonable conformity with previous estimates by Cochrane (BHP 1955) that ‘some 30 million tonnes averaging 50% Fe would be reasonably accessible’, and by Canavan (1965) of 200 million tonnes grading between 37% and 52% Fe and 7% and 16% SiO₂; the latter estimate presumably includes large tonnages of deep unoxidised ironstone which could not be regarded as a resource in the foreseeable future.

**Exploration Licence 7240, Mount Fisher**

Here the main ironstone bed dips gently southeast forming a strong escarpment on the northwestern margin of a shallow basinal fold (Figure 8). The outcrop length is about 3.5 kilometres within the EL, and is usually narrow (averaging about 50m) with the bed soon disappearing down-dip beneath an overlying white flaggy quartz faults with vertical displacements of 5 to 10 metres.

The ironstone is massive and poorly bedded (Plate 3) with a uniform thickness of between 3 and 4 metres. It has a distinctive lithology consisting of large spherical hematite pisoliths, averaging 4mm diameter, in a matrix of fine hematite ooliths and well rounded quartz grains (Plate 4).

A single bulk sample (327529) of a 4.0m thickness of the pisolith contained 46.2% Fe and 26.3% SiO₂, with relatively high phosphorus (0.23%) and low sulphur (less than 0.05%).

Four holes were drilled in this vicinity by BHP, and two appear to have been within the current EL. As at Hodgson Downs all the drilling intersected the ironstones deep in the primary zone (22 to 80 m) will below any conceivable
depth for open pit mining. The only hole of interest in the present context was M17 which intersected 3.75m @ 47.2% Fe and 26.3% SiO2 from 22 metres. This hole was situated about 600m southwest of the outcrop of the main ironstone at the escarpment edge (Figure 8). A second ironstone bed, overlying the main one, is interpreted in this vicinity from air photography. It is possible that the drill intercept may be of this upper bed.

Making similar assumptions to those applied to the Hodgson area it is estimated that the main ironstone bed in EL7240 has potential for a resource of about 4 million tonnes in the oxidised zone. The resource is probably of lower grade and higher in silica than the Hodgson resource because of the high sand content of the matrix. However the texture of the rock is such that the hematite pisolites and oolites freely break away from the sandy matrix, suggesting that a simple benification by crushing, screening and gravity separation may be possible. The possibility of a substantially larger resource is indicated by the presence of a second ironstone bed, and extensions of both beds along strike to the south of the present EL area.

Canavan (1965) gives a resource of 9 million tonnes @ 47% Fe and 26% SiO2 “minor deposits” which are presumed to include this one.

**Exploration Licence 7241, Shirwin Creek**

The Shirwin Ironstone Member forms extensive outcrop on the main escarpments and dip slopes at the northern and eastern margins of a major regional syncline (Figures 6 and 9). A strike length of some 12 kilometres is included in the EL area.

The Shirwin Ironstone Member includes three main ironstone beds. The two upper beds, which crop out mainly on the extensive dip slopes, are ferruginous oolitic sandstones containing a high proportion of detrital quartz. They are low grade and silica-rich. They were the object of most of BHP’s exploration work, and are estimated to have a resource of 200 million tonnes containing 27% to 33% Fe and 40% to 45% SiO2 (Canavan 1965). These formations are not considered to be of interest in the present context.

The lower ironstone bed is soft and poorly exposed, and forms restricted outcrop soon disappearing beneath thick overburden. In character it is similar to the formations at Hodgson and Mount Fisher, being a massive, uniform hematitic pisolite. It is the main target in EL7241 for the present exploration project. During the 1992 field work only one good exposure for bulk sampling was located (327522). This was a thin (0.5m) coarse-grained pisolite bed, which may not be the main formation.
In 1956 BHP collected bulk samples at ten exposures of the lower bed. These gave average analyses of 45.8% Fe and 28.5% SiO2m and an average thickness of 7.3 metres. The data indicate that some of the samples include intervals of low-grade material. A recalculation using a 45% Fe cut off gives an average of 52.3% Fe and an average thickness of 5.1 metres.

BHP estimated that the lower bed contained a resource of 56.2 million tonnes, with a stripping ratio of 2.3 to 1. Applying the 45% cut off, this resource is reduced to approximately 30 million tonnes.

Metallurgical test work was also undertaken by BHP on a composite sample of the bottom pisolite ironstone from this locality (BHP, 1958). The head grade of the same was 45.8% Fr and 28.5% SiO2, containing 88.7% of the original iron. Gravity separation using jigs did not produce worthwhile concentration. Lower grade ironstones from the upper beds failed to respond usefully to any method of benification.

**Exploration Licence 7242, Mount Scott**

In this Licence the Shirwin Ironstone Member forms two separate areas of outcrop (Figure 10). In the east is forms a strong outcrop along a mainly easterly facing escarpment on the eastern edge of a north-south syncline. Plates 5 & 6: dips are very gently towards the west or nearly horizontal. In the western area, separated from the eastern outcrop by a north-south fault zone, the ironstones form an extensive outcrop towards the bottom of a shallow westerly dipping dip-slope. This is essentially the southern extension of the ironstones of the Shirwin Creek Area.

In the eastern outcrop the ironstones occur along a strike length of some nine kilometres. There are two main beds of hard, sandy, cross bedded ferruginous oolite, separated by about seven metres of sandstone and siltstone. One bulk sample was collected (327528) over a 4.5 metre thickness of the upper bed. This reported 50.4% Fe and 23.8% SiO2, with low phosphorus and sulphur. BHP obtained an average of 46.9% Fe over 4.5m thickness for four samples from the upper bed, and an average of 45.4% Fe over 3.4m for two samples from the lower bed.

The western ironstones crop out over a length of some five kilometres, and a width averaging about 400 metres. There is a single bed of sandy, cross-bedded oolite. Bulk samples taken by BHP averaged 43.6% Fe over a thickness of 3.1m for five samples.

No indications of an underlying, high grade pisolitic bed were seen in these areas. The ironstones observed are all of the relatively silica-rich types which form the upper beds at Shirwin Creek. They are unlikely to be amenable to benification and are accordingly afforded low priority in the present project, although the potential tonnages are quite large, possibly in the order of 50 million tonnes.
General Discussion

The ironstones of the Roper River region are typical of a category of oolitic marine iron ores which were formerly exploited worldwide on a huge scale, notable in Alsace/Lorraine in France, the Clinton ores of eastern USA, and the Northampton Sands and Cleveland Hills ironstones in England. The composition of the Roper "ore" is quite similar to that of the "soft" i.e. Oxidised Clinton ores which contained 50.44% Fe, 12.1% SiO2, 0.46% P and 0.07% S. The unweathered "hard" ore by comparison contained 37.0% Fe and 7.14% SiO2. Typical ore from Lorraine contained 31% to 40% Fe, from 7% to 20% SiO2 and 1.6% to 1.8% P. Average Cleveland Hills ore contained 30% Fe, 8.51% SiO2 and 1.3% P (all analyses from Lindgren 1933). This suggests that on global comparisons the oxidised pisolitic "ores" of Roper are relatively high in iron and silica, and low in phosphorus.
CONCLUSION

Low grade iron ores are still used widely for domestic steel production, both in Europe and USA, and particularly in industrialising economies such as China. However for export they have been entirely superseded by high grade ores such as those from Brazil and Pilbara. It is obvious that the Roper “ores”, even if beneficiated, cannot compete seriously with the Pilbara in the export market, although particular market niches in Asia may be available.

If the Roper resource is to be fully exploited it needs to be viewed in the context of processing to valued-added products such as iron sponge, pig iron, DRI or possible Billets, Blumes and Slabs, making optimum use of particular favourable factors, including such things as; easy mining and easy crushing; reasonable proximity to gas pipeline, adequate water supplies, limestone flux, infrastructure and workforce; good road access and proximity to potential sea and/or rail transport and proximity to expanding markets in Asia. There are no exceptional environmental sensitivities.

Exploration of the iron resource is at an early stage, and ore reserves are not yet identified. However, on the results so far, it can be expected that continued exploration would have a high probability of identifying a resource of more than 50 million tonnes at grades exceeding 50% Fe within the current group of Explorations Licences, with the possibility of substantially greater resources in the region as a whole. The identification of ore reserves demands consideration of economic factors as well as the technology to value add to this ore.

The magnitude of the resource appears adequate to support a mini steel mill producing up to one million tonnes of steel annually. Whether the metallurgy and economics could be (or become) favourable remains to be established. In addition to these factors a considerable amount of venture capital is required to undertake these detailed studies.
REFERENCES


APPENDIX I

Sample Description and Analytical Report
Mr Alan Ciplys
Amdel Laboratories Limited
PO Box 58
BERRIMAH
NT 0828

F I N A L  A N A L Y S I S  R E P O R T

Your Order No: 2DN1276
Our Job Number : 2AD3296
Samples received : 13-NOV-1992
Results reported : 04-DEC-1992
No. of samples : 5
Report comprises a cover sheet and pages II, 1 to 1

This report relates specifically to the samples tested in so far as that the samples as supplied are truly representative of the sample source.

Note:
If you have any enquiries please contact Miss Anne Reed quoting the above job number.

Approved Signatory:

for John Waters
Laboratory Manager - Adelaide

CC Mr Alan Ciplys NT

Report Codes:
N.A. - Not Analysed.
L.N.R. - Listed But Not Received.
I.S. - Insufficient Sample.

Distribution Codes:
CC - Carbon Copy
EM - Electronic Media
MM - Magnetic Media

Amdel Laboratories Limited A.C.N. 009 076 555
### Analysis code OI 18

NATA Certificate Order No. 2DN1276

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| Scheme  | MET6A |
APPENDIX II

Beneficiation Report
Subject: HGMS separation tests on a Hematite Iron ore, Australia.

Summary:

Tests to investigate suitable parameters for the separation of an oolitic hematite iron ore by the HGMS - technique have been performed at the laboratory of Denver Sala, Sweden.

The HGMS - tests have been performed after grinding at about 5, 10 and 15 kWh / tonne with various combinations of HGMS - parameters: type of matrix, magnetic field strength and pulp flow velocity, all important parameters to control the result of the separations. In total 17 different tests have been performed.

The best result, after a two stage separation, has been reached at the finest grind tested with a Fe-grade of just over 59% and 10% acid insoluble at a Fe-recovery of over 72%.

The tests show that, even at the finest grind tested (all - 105 μm and 80% passing 41μm), high quality Fe-concentrate cannot be reached and indications are that a complex mixed-particle situation still occurs.

Further testing is recommended to investigate combinations of HGMS-separation technique with methods like desliming, selective flocculation and flotation in order to reach to a better Fe-concentrate grade.

Sala 1994 - 05 - 08

Gustav von Wachenfeldt
HGMS separation tests on a Hematite Iron ore, Australia.

INTRODUCTION:
On behalf of A M S, Australia, HGMS separation tests have been performed at the laboratory of Denver Sala, Sweden, on a sample of oolitic hematite iron ore for: Geoff Fanning - Iron Ore Project.

SAMPLE:
A test-sample of about 25 kg moist ore, crushed to about minus 50 mm, was received to the laboratory.
After drying, the total sample received was crushed in a laboratory jaw-crusher, in closed circuit with a screen, to all - 5,6 mm (3 1/2 mesh).
A head assay on a sample riffled out from the crushed sample was 51.2% Fe (HCl soluble).
(All Fe analysis in this report are given as % HCl soluble Fe).

GRINDING:
Grinding were performed in a laboratory Rod Mill, dia. 200 x 300 mm, charged with a graded rod charge of 17 kg. The crushed ore charge for each grinding test was 1.0 kg (dry solids) and 0.67 kg water resulting in 60% solids by weight in the grinding.
Three different grindings were performed and the grinding times were chosen to give grinding net power inputs of about 5, 10 and 15 kWh/tonne resulting in grinding products of -212 µm (65 mesh), -125 µm (115 mesh) and -105 µm (150 mesh) respectively. The corresponding k80's (80% passing) were 96 µm, 54 µm and 41 µm respectively.
Particle size distribution curves for the crushed ore and the three grinding products are shown in Appendix 1.

HGMS TESTS:
The HGMS tests were performed using a SALA HGMS 10 - 15 - 20 laboratory unit equipped for batch testing. A simplified sketch of this unit is shown in Appendix 2.

Standard HGMS batch test procedure:
- Type of matrix is chosen mainly based on max. particle size of the feed sample to be separated and the diameter of the matrix canister on pulp flow velocity to be used and to some extent on the availability of test material.
- Matrix loading, grams of feed (dry solids) per cm3 of matrix volume, could often be chosen based on experiences from earlier applications on similar material and expected weight recovery of the magnetic product.
- Magnetic field strength, regulated from the power supply, and pulp flow velocity, regulated by the calibrated flow control orifices, could often be chosen based on experiences from earlier applications on similar material.
- In preparation for testing air has to be expelled from the separation system by the addition of water via the feed tank and with the manual ball valve and the automatic pneumatic diaphragm valves No. 1, 2 and 3 open. When a steady flow of water is discharging from the flow control orifice, the water level in the feed tank is adjusted to a suitable level and the above mentioned valves are closed.
- A predetermined quantity (dry solid basis) of the material to be tested is then slurried in the feed tank together with water up to a preset pulp level. The agitator speed is adjusted to ensure good mixing, the magnet is turned on and the valves No. 1, 2, 3 and the manual ball valve are opened.
- The material to be separated is thus fed by gravity, and at predetermined magnetic field strength, pulp flow velocity and matrix loading, into the magnet system matrix where the separation takes place.
- At the same time as the last of the material slurry leaves the feed tank rinse water is added into the feed tank and this is kept on for a set time or to get a set volume of the non-magnetics (P-product) collected into a pail below the flow control orifice.
- After the rinse water addition is finished the valves No. 1, 2, 3 and the manual ball valve are closed and the magnet is turned off.
- To clean out the magnets, trapped in the magnetic system matrix, back-flush water is added at normal water line pressure by opening the valves No. 2, 5 and 7. The flush water is pulsed several times by opening and closing valve No. 7 until all magnetics is flushed out of the matrix and collected into the pail for the magnetics (M-product).
- The batch test is now finished and the separator is ready for another test.

Each of the three grinding products have been separated at various HGMS parameter combinations except for the matrix loading which has been kept constant at 0,35 g / cm³.

Tests No. 1 - 5 after grinding at ab. 5 kWh / t:

The test conditions and results are shown in Appendix 3 and a Fe-grade / recovery diagram in Appendix 4.

The results show that the Fe-recovery increases with increasing magnetic field strength and decreasing pulp flow velocity, which would be to expect. The Fe-grade shows a different, and rather odd, behaviour with the Fe-grades being the lowest at the lowest as well as the highest Fe-recovery but somewhat higher and about the same in the intermediate recovery range. This might be an indication of a complex mixed-particle situation.

It is however obvious that the magnetic field strength has to be at least 5,6 kGauss or higher in order to reach a reasonable Fe-recovery of this type of hematite ore.

Tests No. 6 - 12 after grinding at ab. 10 kWh / t:

The test conditions and results are shown in Appendix 5 and a Fe-grade / recovery diagram in Appendix 6.

The test results show a more reasonable behaviour, probably because the magnetic field strengths were kept at 5,6 kGauss or higher and appear to follow a rather logic Fe-grade / recovery curve. Magnetic field strength over 6,9 kGauss does not seem to give any improvements in the results.

In spite of the finer grind the Fe-grade does not show any improvement.

Tests No. 13 - 17 after grinding at ab. 15 kWh / t:

The test conditions and results are shown in Appendix 7 and Fe-grade / recovery diagrams in Appendix 8 for tests 13 - 15 and in Appendix 9 for tests 16 - 17.

Tests 13 - 15:

At the same recovery the grade has improved slightly, about 1%, in comparison with grinding at 10 kWh / t, but as the grade does not increase when the recovery decreases again could point to a complex mixed-particle situation also at this fineness of grind.

Tests 16 - 17:

When cleaning the primary magnetics the grade has increased with about 1% and in test 16 the highest grade of 59,1 % Fe has been reached at a recovery of 72,4 %.

However, it is to note that the tests at this grind have a higher calculated Fe-grade in the feed than the tests at coarser grindings and this will have some influence the results. The reason for this could be as simple as differences in the preparation, sample riffling, of the samples used for each of the grinding tests or maybe that at this fineness of grind more Fe has been released from complete inclusions in gangue-minerals. The fact that the analysed head-assay of 51,2 % Fe, where the sample was pulverised to analysing fineness, corresponds better with the average calculated Fe-grade in the feed of 51,3 % Fe (tests 13 - 17) might indicate that the
second explanation could be correct and if so, also indicate that liberation grinding still has not been reached.

The assays called "SiO2" as shown in the metallurgical balances, Appendices No. 3, 5 and 7, are analysis of acid (HCl) insoluble and should be regarded as the sum of various silicates and other acid insoluble mineral components.
A diagram showing the correlation between the Fe-grade and acid insoluble in the magnetic products is found in Appendix No. 11.

SUMMARY:

A summary of all the tests performed is shown in the diagram of Appendix 10 as Fe-grade / recovery.
Here it could be seen that in single stage separations and at the coarsest and intermediate grindings, the range of Fe-recoveries from about 75 - 85 % could be reached at Fe-grades from about 58 - 56 %. At the finest grinding 80 % Fe-recovery at slightly over 58 % Fe-grade was reached.
In a two-stage separation (cleaning of the primary magnetic product) and at the finest grinding the highest Fe-grade of over 59 % with acid insoluble of just over 10 % was reached at a Fe-recovery of about 72 %.

In spite of grinding to all - 105 µm (150 mesh) with 80 % passing 41 microns (less than 325 mesh) high quality Fe-concentrate grade has not been reached even if the Fe-recovery could be regarded as acceptable.
If a combination of the HGMS-separation technique together with other separation methods like desliming, selective flocculation or flotation could result in a better Fe-concentrate grade is not known as this has not been the aim of this investigation. It could however be recommended that such combined separation methods ought to be investigated.
GEOFF PANNING, IRON ORE PROJECT

1. CRUSHED TO 100% - 5.6 mm, K80 = 650 um
2. GROUND -5 kWh/t, K80 = 96 um
3. GROUND -10 kWh/t, K80 = 54 um
4. GROUND -15 kWh/t, K80 = 44 um

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Fe-grade / recovery, test 13 - 15

Graph showing the relationship between recovery and grade, with values on the y-axis ranging from 50.0 to 60.0 and on the x-axis ranging from 30 to 100.
APPENDIX III

Development Proposal Report
PROPOSAL FOR DEVELOPMENT OF IRON RESOURCES AT ROPER RIVER NORTHERN TERRITORY AUSTRALIA

ROPER RESOURCES PTY LTD

Mr Geoff Fanning,
Managing Director,
Roper Resources Pty. Ltd.,
ACN 068572074.
GPO Box 333, DARWIN, NT 0801.

Phone: 61 89 811614.
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DARWIN, NT.
FEBRUARY 1997.
ROPER RESOURCES PTY LTD

CONFIDENTIAL

PROPOSAL FOR THE DEVELOPMENT
OF IRON RESOURCES AT ROPER RIVER
NORTHERN TERRITORY AUSTRALIA

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Cover photograph shows an outcrop of the bed of pisolitic iron ore near Hogson Downs.
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   3.2 Geology of the Ironstones.

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   4.2 Direct Reduction and Smelting.
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5. MARKETING.

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ROPER RESOURCES PTY LTD

PROPOSAL FOR THE DEVELOPMENT OF IRON RESOURCES AT ROPER RIVER
LIST OF MAPS, FIGURES AND PHOTOGRAPHS.

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MAP 2. Roper River Location Plan.
MAP 3. Hodgson Downs Location Plan.

FIGURE 1. Schematic Diagram of Ausmelt Furnace.

PHOTO 1. Escarpment formed by pisolithic ironstone bed near Hodgson Downs.
PHOTO 2. Outcrop of pisolithic ironstone 4.5m thick averaging 46.2% Fe; Mount Fisher locality.
PHOTO 3. Escarpment formed by outcrop of sandy oolitic ironstones averaging 50.4% Fe, with a thickness of 4.5m; Mount Scott locality.
PHOTO 4. Detail of Mt Fisher ironstone outcrop showing coarse pisolithic texture.
A. SUMMARY

Undeveloped iron resources in the Roper River Region of the Northern Territory comprise several hundred million tonnes of mainly low to moderate grade ores which are favourably located in relation to existing or potential infrastructure and markets.

Although they were initially explored by BHP in 1955, they were not developed at that time due to the discovery of the relatively higher grade Pilbara deposits which were more suitable for the then rapidly growing export demand for direct shipping lump iron ores.

With the development in recent years of innovative smelting technology, such as the Ausmelt and Hysmelt processes, which can economically utilise lower grade ores and operate on relatively small scales compared to the traditional methods, the utilisation of the Roper iron ores to produce value added products, such as pig iron, for export to Asian markets, now appears economically attractive.

Roper Resources Pty Ltd hold approximately 85 square kilometres under Exploration Licence which include almost all of the presently known iron resources of the region. The Company also has applications for Exploration Licences over other areas having exploration potential for discovering further resources.

Exploration by the Company since 1991, and by the NT Department of Mines in 1995, has identified a resource of approximately 60 million tonnes of moderate grade (40% - 60% Fe) iron ore within the Tenements at Hodgson Downs. This occurs as a bedded soft hematite pisolite ore with low stripping ratios and low anticipated mining and development costs. The deposit is approximately 100km from the gas pipeline and proposed railway line at Mataranka, and 120km from navigable waters of the Roper River. Earlier work by BHP in 1955 identified a resource of approximately 30 million tonnes of similar soft hematite oolite averaging 52% Fe within Roper Resources tenements at Sherwin Creek.

A number of other locations have been identified within the tenements which have potential to produce iron ores of a similar nature to the Hodgson and Sherwin deposits.

Preliminary financial evaluations have been made of two possible scenarios for development. The Roper Port Option consists of a single Ausmelt smelter module, producing approximately 500,000 tonnes of pig iron annually to be shipped out
through a loading facility to be constructed on the Roper River. This scheme has a life of 30 years based on a resource of 30 million tonnes of ore grading >50% Fe at Sherwin Creek. Capital costs are estimated at AUS$159 million, with operating costs of $131/t and revenue of $213/t of product, giving an internal rate of return of 16%; cumulative cash flows over the project life are AUS$544 million.

The Mataranka Rail option consists of five Ausmelt modules, producing 2.5 million tonnes of pig iron annually, to be shipped out through the port of Darwin using the proposed new rail link. This scheme has a life of 20 years based on resources of 100 million tonnes of ore, grading 50% Fe, at Hodgson and other locations. Capital costs are estimated at AUS$615 million, with operating costs of $129/t and revenue of $213/t giving an internal rate of return of 19%; cumulative cash flows over the project life are AUS$2.1 billion.

Roper Resources Pty Ltd are seeking a joint venture partner to complete the exploration and metallurgical test work and pre-feasibility study, and to proceed to a full feasibility study, and development, if results are positive.

The program of exploration, metallurgy and pre-feasibility would require an expenditure of $600,000 and a period of six months to complete. The full feasibility would require a further expenditure of approximately $1.5 million over a twelve month period.
1. INTRODUCTION

Since 1991 Roper Resources Pty Ltd have been investigating iron resources within their Exploration Licences in the Roper River region of the Northern Territory. These resources, although substantial, were not previously exploited due principally to their relatively low grade which made them unattractive as direct shipping iron ores for the export market when compared with the higher grade deposits of the Pilbara region.

In recent years however several factors have emerged which impact favourably on the possibility of developing the Roper iron deposits to produce value added products such as pig iron and mild steel. Most important are new smelting technologies which are capable of utilising lower grade ores at relatively small scales of production (upwards of 500,000 tonnes annually). Also, significant improvements have been made, or are planned, in the local infrastructure relating to road, rail and sea transport and availability of natural gas. Potential export markets (particularly in nearby Southeast Asia) for value added end products are strong and are expected to grow substantially over the next decade. Also significant are Commonwealth and NT Government initiatives to fast-track resource developments in the Gulf of Carpentaria region, of which the recent opening of the McArthur River lead/zinc mine at Borooloola is an example.

Work by Roper Resources Pty Ltd over the last five years has included preliminary geological surveys and sampling, metallurgical investigations and evaluation of alternative processing options, including detailed discussions with suppliers of various innovative, high technology smelting and processing systems such as Ausmelt, Hismelt and Allis Mineral Systems.

These first stage investigations have been taken to the point where the resource, the metallurgical/smelting route and the potential markets are all identified with reasonable assurance. The next stage of pre-feasibility studies, proceeding through to full feasibility studies assuming results are encouraging, is now proposed, involving expenditures of approximately $2.1 million over the next 18 months. The Company is seeking joint venture partners to participate in these pre-feasibility and feasibility studies, and ultimately the development of an iron/steel export industry in the Northern Territory.
2. EXPLORATION AND MINING TENEMENTS

Titles covering exploration for minerals and mining are granted by the Government of the Northern Territory under the Mining Act which is administered by the Department of Mines & Energy. Exploration is normally conducted under Exploration Licences which provide the licenceholder, within a specified period of time, exclusive right to explore for minerals in the areas covered by the Licence, and also exclusive right to apply for Mining Leases or Exploration Retention Leases within the areas. Mining Leases allow for the mining of mineral deposits according to a mining plan proposed by the applicant, and approved by the Department of Mines, and subject to any particular conditions (such as environmental protection) which may be required by the Department. Exploration Retention Leases are an interim title which may be held to protect land containing identified mineral deposits during the course of feasibility studies.

The Hodgson Downs Exploration Licence area falls within Aboriginal Lands. Prior to mining, terms will have to be negotiated with the traditional owners covering compensation for disturbance. Traditional owners do not have the right to veto mining since the Exploration Licence was granted prior to the granting of Aboriginal Title.

None of the other areas are the subject of Aboriginal Land Claims or Native Title Claims. A Sacred Sites Survey has been conducted over the areas held under Exploration Licence; no registered sacred sites are present, and no important sites of cultural significance have so far been recorded.
3. GEOLOGY OF THE IRON DEPOSITS

3.1 GEOGRAPHICAL FEATURES.

The Roper River region is in the monsoonal tropics of northern Australia, on the southeastern margin of the Gulf of Carpentaria, lying 450 kilometres southeast of Darwin (Map 1). The topography varies from undulating country to moderately rugged hill ranges, interspersed with broad alluvial floodplains along the main rivers such as the Roper and the Hodgson. Vegetation consists of fairly open savannah of tussock grasslands with scattered shrubs and small trees, mainly species of Eucalypt and Acacia (Photo 2). The sole land use is for beef cattle production. The areas have no outstanding environmental values.

The region is very sparsely populated, and the sites known to contain potentially valuable iron resources are remote, generally lying 10km to 30km from existing habitations.

3.2 GEOLOGY OF THE IRONSTONES.

The ironstones of the Roper area are of marine sedimentary origin and occur as extensive beds of pisolite, oolite and ferruginous sandstones interbedded with shales and quartz sandstones. Iron ores of this type were formerly of major importance worldwide, and were exploited on a huge scale for domestic steel production, notably in Alsace/Lorraine, and in the Clinton ores of eastern USA.

In the Roper field the ironstone beds occur in the Sherwin Ironstone Member of the McMinn Formation which occurs near the top of the Mesoproterozoic Roper Group of the McArthur Basin. The Sherwin Ironstone Member is known to occur regionally over an area of some 20,000 square kilometres, but known deposits of possible commercial interest are restricted to areas near Hodgson Downs and Roper Bar.

The sedimentary strata are, in the main, only gently folded and unmetamorphosed, and the ironstone beds, which are relatively resistant, commonly form strong outcrops and pronounced ridges and escarpments (Photos 1 to 3).

In the type section, at Sherwin Creek, there are up to six ironstone beds from one to ten metres thick, contained within a total thickness of approximately 100m of strata. In the Hodgson, Mount Scott and Mount Fisher areas only one bed of 4m to 5m thickness is present.
The primary (i.e. unweathered and unoxidised) ironstones consist of ooliths and pisoliths of siderite, hematite and chamosite in a matrix of siderite and hematite. Silica occurs as a varying proportion of clastic quartz grains and cryptocrystalline silica in the matrix. In the weathered zone (from surface to depths of between 6m and 15m) the siderite and chamosite are altered to hematite and ochreous limonite. Iron grades are enriched in the oxidised zone relative to the primary zone.

Present interest is focussed on oxidised outcrops of relatively high grade hematite oolites and pisolites which occur at Hodgson Downs and Mount Fisher, and in the lowermost bed at Sherwin Creek. These formations are soft and easily mined, with potential for substantial tonnages with low stripping ratios due to their flat-lying structure (Photos 1, 2 & 3). The unoxidised ironstones are not presently considered to be of economic interest because of their relatively low grades and thick overburden.

At Sherwin Creek the bottom bed, consisting of a soft, massive hematite pisolite, is up to 9.0m in thickness, and crops out over a strike length of 2500m. Ten samples collected by BHP in 1955 averaged 52% Fe over 5.1m thickness, applying a 45% Fe cut off. Approximately 30 million tonnes of such material is available with low to moderate stripping ratios.

At Hodgson Downs the single pisolite bed crops out along an escarpment edge over a length of some 15 kilometres (Photo 1 & cover). Highest grades and thicknesses appear to occur in the southern half where sampling by Roper Resources Pty Ltd in 1992, and by the Department of Mines & Energy in 1995, recorded thicknesses of up to 4.5m and grades up to 62.6% Fe, with a total of 14 samples averaging 51.2% Fe over a thickness of 3.3m (Map 3 & Appendix I). On the basis of this preliminary work it is estimated that the Hodgson area has potential to produce about 60 million tonnes of such material at low stripping ratios.

Only limited work has been undertaken so far at Mt Scott and Mt Fisher. Preliminary results suggest that the ironstones are similar to those at Hodgson Downs and the bottom bed at Sherwin Creek, but are probably less extensive. The areas are considered to have potential to provide limited tonnages of iron ore supplementing the Hodgson/Sherwin resources.
4. METALLURGY

4.1 BENEFICIATION.

The hematite pisolite ironstones at Hodgson Downs and Sherwin Creek show a fairly wide range of compositions, varying from 40% to >60% Fe, 7% to >30% SiO2 and 0.02 to 0.27% P (Appendix I). Until systematic drilling is done the likely grade of ore to be produced is unknown, but from available data the composition could be expected to be approximately 52% Fe, 19% SiO2 and 0.15% P.

Although it is possible to utilise ores of this composition in the Ausmelt process, beneficiation of the ore to reduce the high silica content, and upgrade the percentage iron, would decrease the consumption of fluxes and energy, and decrease the quantity of slag produced, with significant improvements in the economics of the process.

In 1958 BHP succeeded in beneficiating a composite sample of bottom bed-type ore (from Sherwin Creek) from a head grade of 48% Fe to a concentrate grading 64.9% Fe and 7.4% SiO2, containing 88.7% of the original iron. This was achieved in bench-scale testwork by a process of reduction roasting, magnetic separation, demagnetisation and classification. Attempts to concentrate the ores by dry magnetic separation and jig concentration were not successful.

In 1984 Roper Resources submitted a bulk sample from Hodgson Downs to the laboratories of Allis Mineral Systems in Sweden to determine whether a high grade concentrate (66% Fe), suitable for the Allis Mineral Systems direct reduction process, could be produced by high intensity wet magnetic separation. Results were discouraging, probably due to the incomplete liberation of hematite from silica at the grind used.

Ausmelt have indicated that, in their view, the relatively high phosphorus content would not present a problem for their process, since it is probable that phosphate would report preferentially in the slag.

Much more metallurgical testwork is required to determine the optimum method and degree of beneficiation for a commercial operation. The limited data presently available indicate that there is a high expectation that an upgrading from about 52% Fe to >60% Fe should be readily achievable.
4.2 DIRECT REDUCTION AND SMELTING.

A number of high technology direct reduction and smelting processes for iron, which could have application in the Roper Project, are now available, or are at advanced stages of development.

Direct reduced iron (DRI) is produced without a melt stage, using either gas (eg. Midrex Process) or coal (eg. Davy McKee & Lurgi processes) as reductant and energy source. In 1993 world DRI production was 23.7 million tonnes (compared with 1.3 million tonnes in 1970), most of which was produced by the Midrex process. Currently almost all DRI is captive to domestic steel mills, where it is used as a substitute for scrap iron in electric arc furnaces, and very little is exported.

DRI processes require a very high grade feed (67% Fe) since there is no slag phase to remove impurities, while the product (sponge or briquetted sponge) is an unstable product (particularly in warm humid climates) liable to oxidation and ignition. For these reasons DRI is at present discounted for the Roper Project, although it could have application, in the longer term, if an integrated mini steel mill was constructed and a suitable ore beneficiation process developed.

Advanced smelting processes include the Hlsmelt system (CRA Limited & Midrex) and the Ausmelt process, both of which produce pig iron using coal as reductant and energy source. Both processes have the advantages of using low cost raw materials, high energy efficiency, high process intensity, low capital costs and competitive economics at small scales of production. The Ausmelt process has been used commercially for more than ten years for treating base and precious metals, but has not so far been used on a commercial scale for iron. Ausmelt have made the decision to construct a pig iron demonstration plant at Dandenong Victoria, with the expectation that full scale commercial production plants would be available from about 1998. The use of this technology is proposed for a joint venture between the South Australian Government, Ausmelt Limited and Meekatharra Minerals Limited, for a major pig iron smelting complex, using iron and coal resources in the Arckariga Basin, near Coober Pedy in South Australia.

The Hlsmelt process has been under development since the early 1980's, but it is not expected to be available commercially until about 2002. Accordingly the Ausmelt process is presently the preferred option for the Roper Project, but other options need to be continually reviewed as the project develops.
4.3 AUSMELT TECHNOLOGY.

Ausmelt top-submerged lance technology was invented in the early 1970's, developed by CSIRO and subsequently licenced to Ausmelt Limited. It is radically different to conventional processes in that oxygen and fuel (coal, liquid hydrocarbons or gas) are delivered through non-consumable steel lances beneath the surface of a liquid slag bath. Iron ore and lime (for slag formation) are fed into the top of the furnace. Highly turbulent conditions in the bath promote very rapid reactions with high thermal efficiency and high smelting capacity relative to the small size of the furnace. Reduced iron forms a molten metal bath in the bottom of the furnace. Metal and slag are tapped off at intervals as the furnace reaches capacity. The iron is cast into ingots, and the slag is granulated for sale as a byproduct.

Figure 1 schematically illustrates the furnace operation.

The system has the capacity to produce electricity surplus to the plant’s requirements. Potentially this excess power can be sold to the local grid system or used for other integrated metal refining processes (steel, aluminium, manganese).

Ausmelt Limited provide a variety of services to assist a client in developing a project including:

* Laboratory scale metallurgical testwork to define optimum processes for beneficiation and smelting, and to identify parameters for pilot plant testwork and design.

* Pre-feasibility study, including design of preliminary flowsheet and estimates of capital costs and operating costs to ~20%.

* Pilot plant optimisation, with trial treatments of bulk ore samples and production of market samples of pig iron.

* Feasibility study, comprising detailed trials of processing conditions to formulate final design and estimate capital and operating costs to ~10%.

* Plant establishment, including supply, construction, detailed design work, training and commissioning.

In the case of the Roper project the first two items above are essential, and are of first priority as soon as suitable representative bulk ore samples can be obtained from the exploratory drilling programs. The cost of these items would be of the order of $200,000.
5. MARKETING.

World steel production was about 720 million tonnes in 1994, and is forecast to rise to 750 million tonnes in 1995. It is expected to increase through the remainder of the decade reaching 825 million tonnes by the year 2000.

Asian countries, other than Japan, accounted for 28% of world consumption in 1994, and with rapid growth rates of more than 7% their consumption is expected to increase by around 65 million tonnes to 270 million tonnes in 2000.

Since the early 1970's the improved efficiencies of small scale operations, the associated lower capital costs, and the greater flexibility of electric arc furnaces (EAF) in the production of an increasing range of steels from scrap, has seen the EAF share of world steel output double to about 30% in 1994, and this is projected to increase to 32% by 2000.

This trend has resulted in an increase in the demand for high quality scrap steel, and due to the pressure on world supplies attention is being turned toward substitutes for scrap in the electric arc furnaces. Direct reduced iron is providing one source of scrap substitute, but for technical reasons can only form part of the furnace feed. Furthermore most DRI is used domestically and little is available for export.

At present pig iron is produced mainly from conventional blast furnaces, and is reprocessed directly to steel in domestic complexes, and exports are insignificant. Potentially pig iron is an excellent substitute for high quality scrap and DRI in the feed mix for EAF's, and there is no doubt that a very large potential market is developing for this product in east Asia. Forecasts are that EAF steel production in Asia (excluding Japan) will increase by 20 million tonnes by the year 2000. The pressure on scrap steel supplies, particularly in newly industrialised countries which do not have a large scrap supply base, implies that demand, and prices, for substitutes will increase significantly. Pig iron production from the Roper iron resources would be excellently placed to enter this potential market.
6. INFRASTRUCTURE AND PLANT REQUIREMENTS

The Roper iron resources are reasonably well located in terms of access to existing and proposed infrastructure. They are 450 km from Darwin, and 150 km from Katherine, while the Territory's north-south gas pipeline, the all-weather Stuart Highway and the route of the proposed Darwin - Alice Springs rail link are located at Mataranka 100km to the west of the deposits. The local infrastructure at Mataranka (housing, medical, schooling, general services) could readily be expanded to accommodate the relatively small workforce associated with a modern smelter complex. The Roper River is also a viable transport alternative being potentially navigable to a point some 60 km to the east of the deposits.

The construction of a rail link from the existing rail head at Alice Springs to Darwin is strongly supported by the South Australian and Northern Territory Governments working in conjunction with the South Korean Daewoo Corporation. The realisation of this long-held concept of a land bridge would link southern Australia's industrial centres with Asia through the extensive new bulk cargo and container cargo facilities now under construction at Darwin's East Arm.

Two out of many possible proposals for development of the Roper iron resources are being studied. The Roper Port Proposal is to produce 500,000 tonnes of pig iron annually from a single Ausmelt furnace operation sited close to the navigable part of the Roper River. Major plant would comprise an ore dressing/benificiation system, power generator and smelter. Product, in 15,000 tonne shipments, would be exported through a loading facility to be constructed on the River, and 730,000 tonnes annually of coal, for reductant and energy source, would be imported through the same facility. Professional staff would be resident in Darwin or Katherine and flown in and out of the smelter site on a two weekly cycle. Civil works would include a transportable camp, airstrip, dam and pipeworks, and upgrading of the Roper Highway. Such an operation could have a 30 year life based on resources at Sherwin Creek located about 50km west of the plant. Mining, primary crushing and transport of the ore, and rehabilitation of the sites, would be carried out by contractors. The capital cost of this option is estimated to be approximately $159 million.

The Darwin Port Proposal is to produce 2.5 million tonnes of pig iron annually, from a five furnace Ausmelt complex located at or near Mataranka, taking advantage of the proposed rail link and the local infrastructure and services available at Mataranka.
and Katherine. Product would be shipped from Darwin, and some 3.6 million tonnes of coal would come by rail freight from Darwin (sourced in Indonesia) or from South Australia. This operation would have a life of at least 20 years based on resources at Hodgson Downs and Sherwin Creek. Mining, pre-crushing and haulage of ore would be under contract. The capital cost of this option is estimated to be approximately $615 million.
7. CAPITAL AND OPERATING COSTS

7.1 GENERAL.

Estimates for capital and operating costs at this stage should be accepted as essentially preliminary or "ball park" figures, intended to provide a guide as to the viability of the proposals, and to justify the expenditures required to progress the project to the pre-feasibility and full feasibility stages.

The figures used have been estimated from costs of comparable operations planned and in existence worldwide, and from information provided by potential tenderers for supply of plant and contracted services.

7.2 SCENARIO 1 - ROPER PORT OPTION.

Approximately one million tonnes of ore will be mined annually with rippers and scrapers, crushed on site and transported by tippers to the smelter stockpiles. Pit rehabilitation will proceed progressively with the mining. An indicative quote of $4.60/t has been obtained for this operation.

Ore reclaimed from the stockpile will be crushed, roasted and beneficiated magnetically to >60% Fe and fed to the furnace with lime flux obtained locally. Crushed coal and oxygen enriched air (supplied under contract) will be introduced through the lances and the iron drawn off and cast as ingots for transport by haulage contractor to the loading facility for export. Imported coal will be transported to the smelter by the same haulage contractor. Slag will be peletised and used locally for construction material as required, or marketed if possible. The smelter would be provided with a power co-generation facility providing 75 MW of electricity as a by-product of the smelting. This would provide an excess of about 30MW of power for other uses in integrated industries or for sale to the local power grid.
Capital costs for the Roper Port Option are estimated as follows:

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td>Road construction and upgrades</td>
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<td>Ausmelt furnace module</td>
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<td>Power station</td>
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<td>Dam, pumps and pipes</td>
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<td>Port facilities</td>
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<td>Dredging and navigational aids</td>
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<td>Contingency (10%)</td>
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**Total Capital Estimate**

159.0

Estimated operating costs per tonne of product are as follows:

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Mining and ore haulage</td>
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<td>Oxygen</td>
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<tr>
<td>Haulage to port</td>
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<td>Shiploader &amp; port costs</td>
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</table>

**Total operating costs/t product**

$131.12
7.3 SCENARIO 2 - DARWIN PORT OPTION.

Approximately five million tonnes of ore will be mined annually, crushed and hauled by road to the smelter complex by contractor as for the Roper Port Option. At the smelter complex, located near Mataranka, ore would secondarily crushed, roasted and magnetically concentrated, and fed with lime, coal and oxygen to five Ausmelt furnaces. Approximately 2.5 million tonnes/annum of pig iron product will be railed to Darwin for shipment overseas by bulk carriers and coal will be brought in by rail from Darwin or South Australia. The complex will generate approximately 150MW of excess electricity to be sold to the NT grid or used in satellite industries.

Capital costs for this scenario are estimated as follows:-

<table>
<thead>
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**Total capital estimate**  
614.6
Estimated operating costs per tonne of product follow. A conservative element is introduced in that no credit is allowed for possible sales of excess power or slag products. Also mining costs/tonne are estimated as for the Roper option although they are in fact likely to be lower considering the larger scale of operation.

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</table>

**Total operating costs/tonne of product** $129.21
8. PRELIMINARY FINANCIAL EVALUATIONS

8.1 GENERAL.

Preliminary cash flow projections, and rate of return calculations, have been made for each of the Roper Port and Darwin Port Options. These are presented in detail in Appendixes III and IV. The results are summarised in the following sections.

8.2 ROPER PORT OPTION.

This option envisages a single furnace producing 500,000 tonnes of pig iron per annum, over a thirty year life, with shipment through a newly constructed facility on the Roper River. The main financial factors are summarised as follows:

- capital investment $159 million.
- operating costs per tonne of product $131
- export price per tonne of product $213
- gross revenues $3.1 billion
- cumulative cashflows $544 million
- internal rate of return 16%

8.3 DARWIN PORT OPTION.

This option envisages a five furnace smelter complex at Mataranka, producing 2.5m tonnes of pig iron per annum, over a twenty year life, with shipment of product through the port of Darwin, utilising the proposed rail link. The principal financial factors are summarised as follows:

- capital investment $615 million
- operating costs per tonne of product $129
- export price per tonne of product $213
- gross revenues $10.6 billion
- cumulative cashflows $2.1 billion
- internal rate of return 19%

9. PROPOSALS FOR PROJECT DEVELOPMENT.
9.1 EXPLORATION AND PRE-FEASIBILITY STUDIES.

The next stages of work required, under the terms of the Exploration Licences, and to progress the project as a whole, have a number of objectives, viz:-

* firm up reserves of iron ore of at least 30 million tonnes, sufficient to provide a 30 year life for the Roper Port Option.

* outline sufficient reserves and resources (at least 100 million tonnes) to allow realistic consideration of the Darwin Port Option.

* obtain representative bulk samples of ore from the drilling programs to undertake bench scale and pilot plant scale metallurgical testwork to determine optimum procedures for benification, and to test the performance of beneficiated products in the Ausmelt process.

* continue preliminary studies in the fields of mining, processing, transport, marketing, navigation, water supplies, environment and other issues impacting on the economic feasibility of the project, sufficient to allow costings for capitalisation and operation within limits of ~20%.

The initial programs of exploration and identifying resources and reserves, including drilling, require an expenditure of approximately $300,000, and would take approximately four months to complete. A detailed proposal for this work is given in Appendix II.

The entire program of exploration and pre-feasibility work would cost approximately $600,000 and would take about six months for completion.

9.2 DETAILED FEASIBILITY STUDIES.

These studies would provide for detailed investigations of the feasibility of the proposed development and costings to within limits of ~10%. They would require full investigation and detailed planning and engineering design of such matters as:-

* mining methods, mine development and rehabilitation works.
* design of processing flow sheet and plant for benification of the ores.
* design for the processing, smelting and power plants, and associated works.
* hydrology, and design for dams, borefields and water supplies for the melter complex.
* environmental impact studies.
* negotiation of terms for mining on Aboriginal lands where required.
* design and proposals for civil works including roads, airstrips, camps, marine and railway loading facilities.
* preliminary approaches to suppliers of major raw materials including, coal, oxygen and lime.
* preliminary negotiations for sale of products including pig iron, slag products and excess electrical power.

At this stage it is considered that these feasibility studies would require expenditures of the order of $1.5 million over a period of twelve months. Firmer costs and schedules will be made on completion of the pre-feasibility programs.
10. PROPOSED TERMS OF INVESTMENT AND JOINT VENTURE

A number of possible options are available under which an incoming party (or parties) could acquire an equity in the Roper Project, and none are specifically excluded at this stage. However a pre-condition for agreement would be that the incoming party makes a minimum commitment to fund the $600,000 program of exploration and pre-feasibility studies which are necessary to take the Project to the next decision point.

A favoured option is that on signing a Joint Venture agreement the tenements would be transferred to a new company in which the incoming party would hold the major interest, with the agreement that they would continue to sole funding of the project through to feasibility, thereafter all parties contribute (or are diluted) according to their equity.

A possible alternative would be a staged option arrangement under which the incoming party could acquire 100% of the project in return for annual option payments, and exercise of an agreed purchase price, with royalties on production to be paid to Roper Resources.
11. REFERENCES


APPENDIX I

Analytical Reports on Iron Ores from Roper River Region.
Amdel Laboratories Limited
Brown Street, Thebarton, 5031
Telephone: (08) 416 5300  Facsimile: (08) 234 0321

Mr Alan Ciplys
Amdel Laboratories Limited
PO Box 58
BERRIMAH
NT 0828

FINAL ANALYSIS REPORT

Your Order No: 2DN1276  Our Job Number : 2AD3296

Samples received : 13-NOV-1992  Results reported : 04-DEC-1992
No. of samples : 5
Report comprises a cover sheet and pages Il, 1 to 1

This report relates specifically to the samples tested in so far as that
the samples as supplied are truly representative of the sample source.

Note:
If you have any enquiries please contact Miss Anne Reed quoting the
above job number.

Approved Signatory:

for John Waters
Laboratory Manager - Adelaide

CC  Mr Alan Ciplys  NT

Report Codes:
N.A.  - Not Analysed.
L.N.R.  - Listed But Not Received.
I.S.  - Insufficient Sample.

Distribution Codes:
CC  - Carbon Copy
EM  - Electronic Media
MM  - Magnetic Media

Amdel Laboratories Limited A.C.N. 009 076 555
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**Units**

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**Detn limit**

**Units**

(0.010)(0.010)

%  %
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<td>327529</td>
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**Units** %
**DL** 0.05
**Scheme** MET6A
APPENDIX II

Phase 1 Exploration Proposals.
Mr G Fanning,
Managing Director,
Roper Resources Pty Ltd,
1st Floor, 28 The Mall, DARWIN, NT0801.

Dear Mr Fanning,

RE. PROGRAM & BUDGET FOR EXPLORATION WORK AT ROPER RIVER.

Following on from our meeting with Mr Bob Adams at the Department of Mines & Energy on April 11th, I submit the following proposals for exploration work and exploration budgets for evaluation of iron ore resources in the Roper River region of the Northern Territory.

The program is divided into two stages. Stage One comprises regional and semi-detailed geological surveys, outcrop sampling and preliminary wide-spaced drilling, with the threefold objectives firstly of establishing a realistic figure for potentially minable resources of the field as a whole, secondly to identify and carry out first stage drill testing of target areas having the best prospects for delineating ore reserves, and thirdly to obtain representative large composite samples for metallurgical testwork. Stage Two comprises detailed surveys and systematic relatively close-spaced drilling of selected target areas with the objective of identifying reserves in the probable ore reserve category sufficient to embark on a preliminary feasibility study.

At this time it is possible only to give firm proposals and budgets for the first phase of Stage One, that is for geological surveys and outcrop sampling, since the details of the drilling programs are dependant on the results of this work; preliminary programs and budgets are given for the drilling in Stages One and Two with expenditure totals which are considered sufficient to achieve the stated objectives. These programs and budgets will need to be revised as the work progresses.
STAGE 1; Phase One - Geological Survey & Outcrop Sampling.

PROGRAM.

Works to be carried out in this phase are as follows:-

1). Acquisition of colour aerial photography at a scale of 1:25,000 covering all the currently held exploration tenements. It is understood that the areas have already been flown by government and by CRA, and it is expected that coverage can be accessed at normal commercial costs without requiring additional flying.

2). Preparation of photogeological maps at photoscale showing the outcrop areas and structural features of the ironstone beds of the McMinn Formation, and also areas where the ironstones may occur beneath shallow overburden. Using this information it will be possible to highlight areas having best potential for substantial tonnages of iron ore with little or no overburden.

3). Acquire enlarged aerial photography at 1:10,000 scale covering the target areas selected under [2] above, and prepare detailed photogeological maps for use in field mapping.

4). Carry out field geological traversing of all outcrop areas of ironstones on a reconnaissance basis [at say 1km intervals], and of the selected areas on a more detailed basis [say at intervals of 200m], in order to confirm photointerpretations of outcrop and structure and to determine thicknesses of ironstones and overburden. This will require accurately measured and levelled cross sections of selected profiles.

5). Cut vertical channel samples of the ironstone beds at selected sites where exposure conditions are suitable, splitting the section into 1.5m vertical sample intervals. All samples will be analysed for iron, and selected composites analysed for silica, sulphur, phosphorus and loss on ignition.

6). Prepare a detailed technical report on the results of this work, including a preliminary assessment of resources, and making detailed recommendations, with budgets, for the next exploration phase of preliminary drilling.

This field program would be carried out by a team comprising one senior geologist, one assistant geologist, and two field hands, equipped with two 4X4 vehicles and light mobile camp. The field work would have a duration of approximately 16 days. The entire program, from acquisition of photography to completion of report, would take approximately six weeks.
BUDGET.

Senior geologist; 22 days @ $450 9,900
Assistant geologist; 16 days @ $350 5,600
Field assistants; 32 days @ $140 4,480
4X4 vehicles; 32 days @ $100 3,200
Provisions & camp; 32 mandays @ $25 800
Fuel for 3000km @ $0.10/km 300
Survey and sampling consumables; 200
Air photographs; 1,700
Analytical services; 60 Fe @ $20, 5 Fe/Si/P/Si/loi @ $50 1,450
Drafting services; 32 hrs @ $25 800

TOTAL  $ 28,430

STAGE 1: Phase 2 - Preliminary Drilling.

PROGRAM.

For the purpose of planning and budgeting it is assumed that three target areas for preliminary drill testing will have been selected on the basis of the geological mapping and surface sampling. The areas targetted will be those showing the best thicknesses and grades of ironstone, and most extensive outcrop or sub-outcrop beneath shallow overburden, reasonable conditions of access, and without insurmountable problems relating to environmental impacts or Aboriginal sensitivities. On present information it appears likely that one area may be selected in the Hodgson Downs area, one in the Gum Creek area and one in the Mount Fisher or Mount Scott areas.

The objectives of this drilling stage are to establish the continuity of the ironstone beds down dip-away from the natural exposure, to determine the thickness and nature of the overburden, and to ascertain the thickness and grade of the deposits to a higher level of reliability than was possible from outcrop sampling. Together this information will permit a reasonably reliable statement of indicated resources in each of the selected areas. It is hoped to identify indicated resources of approximately 30 million tonnes at this stage.

The pattern of drilling will vary from area to area depending on the local topography and nature of the ironstone outcrop. Where the target bed forms a narrow outcrop along an escarpment edge [as at Hodgson] drillholes will be laid out on “fences” across strike, extending down dip to the point at which overburden thickness is judged to be excessive. In areas of more extensive outcrop [as at Mt. Scott] the holes may be laid out on a square grid pattern. The spacing between holes will be such that each hole may add approximately 100,000 to 200,000 tonnes to the resource. Hole spacing will vary from 50m to 100m on traverse lines, and spacing between traverses will be between 200m and 500m.
Because of the rough topography a bulldozer will be required to prepare access to the drill sites.

All holes will be vertical and drilled by down-the-hole hammer with samples collected in a cyclone at vertical intervals of one metre. Hole depths will range up to a maximum depth of about 20 metres, the majority being between 6 and 10 metres. Samples of ironstone will be split on site to provide two splits of approximately two kilograms, one for assay and one as a reference sample which can be used as required for compositing for metallurgical work. All ironstone samples will be assayed for Fe, and selected composites assayed for Fe, Si, P, S and loss on ignition.

Drill hole positions will be laid out by tape and compass survey, and will be subsequently picked up and levelled by theodolite survey.

A total of 900 metres of drilling is proposed for this program.

The field party will consist of a geologist and field assistant, with one 4X4 vehicle and a light mobile camp. The drilling contractor will provide plant, transport, operators camp and provisioning as required.

The field work and drilling program will have a duration of approximately three weeks, and the entire program to reporting stage approximately six weeks.

**BUDGET.**

- Senior geologist; 10 days @ $450 = 4,500
- Assistant geologist; 20 days @ $350 = 7,000
- Field assistant; 20 days @ $140 = 2,800
- 4X4 vehicles; 25 days @ $100 = 2,500
- Camp and provisions; 44 man days @ $25 = 1,100
- Fuel for 4000km @ $0.10 = 400
- Survey and sampling consumables = 1,350
- Bulldozer; 72 hours @ $125 = 9,000
- Drilling; mobilisation $2,500 and 900m @ $20/m = 20,500
- Analytical work: 600 Fe @ $20 and 10 Fe/Si/P/loil @ $50 = 12,500
- Drafting work; 30 hrs @ $25 = 750

**TOTAL $ 62,400**
STAGE 2: Systematic Drilling & Ore Reserve Definition.

PROGRAM.

This second stage of drilling is designed to upgrade the resources indicated by the Stage 1 work to the status of measured resources which, subject to the application of mining, treatment and marketing constraints, are well enough known to be considered as an ore reserve. Provision is also made for preliminary drilling to establish additional resources in areas identified as promising by the Stage 1 program, but which had not been previously drilled.

Specific details of the drilling programs are dependent on local conditions and cannot be specified at this time. The drilling procedures will be essentially the same as described for Stage 1, but with the drillhole collar spacing closed in to possibly a 40m X 40m or 80m X 80m pattern, depending upon the degree of uniformity and predictability in the grades and thicknesses of the deposits as indicated by the results of Stage 1 drilling.

A total program of 3,500m of drilling is proposed. When this work is completed it would be hoped to have established measured resources of 10 million to 20 million tonnes, together with substantial additional resources in the indicated and inferred categories.

The drilling operations would take approximately one month to complete, and the entire Stage 2 program to completion of final report approximately ten weeks.

BUDGET.

Senior geologist: 24 days @ $450  
10,800
Assistant geologist: 40 days @ $350  
14,000
Field assistant: 35 days @ $140  
4,900
4 X 4 vehicles: 50 days @ $100  
5,000
Camp and provisions for 80 man days @ $25  
2,000
Fuel for 5000km @ $0.10/km  
500
Survey and sampling consumables:  
5,200
Contract surveying: 10 days @ $850  
8,500
Bulldozing: 120 hrs @ $125  
15,000
Drilling: mobilisation $2,500, 3500m @ $20  
72,500
Analytical work: 3000 Fe @ $20, 40 Fe/Si/P/Si/loi @ $50  
62,000
Drafting work: 100 hrs @ $25  
2,500

TOTAL $ 202,900

G R Orridge.

roprog 1 page 5
APPENDIX III

Roper Port Option Cash Flow Projections.
Operating Scenario 1

1 Smelter using the Roper Port

Operating Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual mine production rate</td>
<td>960,000</td>
<td>annual tonnes</td>
<td>$4.60 per tonne mined</td>
</tr>
<tr>
<td>Assumed mining grade</td>
<td>50% Fe</td>
<td></td>
<td>$60,000 including 20% overhead</td>
</tr>
<tr>
<td>Smelter labour force</td>
<td>52 Fe</td>
<td>staff at a salary of</td>
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</tr>
<tr>
<td>Assumed feed grade</td>
<td>64% Fe</td>
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<td></td>
</tr>
<tr>
<td>Furnace module input feed volume</td>
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<td>annual tonnes</td>
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</tr>
<tr>
<td>Power requirement</td>
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<td></td>
<td>6.0000 cents per KW hour</td>
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<tr>
<td>Market coal cost</td>
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<td>per tonne</td>
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</tr>
<tr>
<td>Coal requirements</td>
<td>726,819</td>
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<td>Oxygen</td>
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<td>annual tonnes</td>
<td>$30.00 per tonne</td>
</tr>
<tr>
<td>Water</td>
<td>1,080</td>
<td>annual Mlirites at</td>
<td>5.0000 cents per KIitre</td>
</tr>
<tr>
<td>Limestone requirements</td>
<td>296,246</td>
<td>annual tonnes</td>
<td>$8.00 per tonne delivered to smelter</td>
</tr>
<tr>
<td>Annual iron production rate</td>
<td>497,409</td>
<td>annual tonnes</td>
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</table>

Operating Costs (SAUD)*

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<thead>
<tr>
<th>Cost Item</th>
<th>Cost</th>
<th>Reference</th>
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<tr>
<td>Mine and transport operating cost</td>
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<td>refer to note 1</td>
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<tr>
<td>Smelter labour cost</td>
<td>$6.27</td>
<td>refer to note 2</td>
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<tr>
<td>Electricity</td>
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<tr>
<td>Coal</td>
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<tr>
<td>Oxygen</td>
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<tr>
<td>Water</td>
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<td>Limestone</td>
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<tr>
<td>Freight product to port facility</td>
<td>$3.60</td>
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<tr>
<td>Ship loader and port operating costs</td>
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<tr>
<td><strong>Total operating cost</strong></td>
<td><strong>$131.13</strong></td>
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</tr>
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</table>

Export price                                   | 160.00     | US$ per tonne FOB port of Darwin  |
Exchange rate                                   | 0.75       |                                    |
Export price                                    | 213.33     | AUD$ per tonne FOB Port of Darwin  |

* All costs are in AUD$'s per tonne of product produced
Operating Scenario 1

1 Smelter using the Roper Port

Capital Expenditure (,000 AUDS)

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<thead>
<tr>
<th>Item</th>
<th>Cost</th>
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<tr>
<td>Powerstation</td>
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<td>Airstrip upgrade</td>
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<td>Dam, pumps and pipes</td>
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<td>Dredging and navigational aids</td>
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<td>Port Facilities</td>
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<td>Environmental study</td>
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<td>Consulting</td>
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<td>Contingency (10%)</td>
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Total Capital Expenditure            | $158,950 |
Operating Scenario 1

1 Smelter using the Roper Port

Cashflow Model

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<tr>
<td>Sales</td>
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</tr>
<tr>
<td>Operating costs</td>
<td>$131.13 per tonne of product</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Capital Expenditure</th>
<th>Gross Sales Income</th>
<th>Gross Profit</th>
<th>Net Profit</th>
<th>Add Back</th>
<th>Net Cashflow</th>
<th>Cumulative Cashflow</th>
<th>IRR</th>
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</thead>
<tbody>
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<td>-2</td>
<td>$79,475</td>
<td>$106,114</td>
<td>$21,814</td>
<td>$13,961</td>
<td>$15,895</td>
<td>($79,475)</td>
<td>($79,475)</td>
<td></td>
</tr>
<tr>
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<td>$79,475</td>
<td>$106,114</td>
<td>$21,814</td>
<td>$13,961</td>
<td>$15,895</td>
<td>($79,475)</td>
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<td>$29,856</td>
<td>($79,475)</td>
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<tr>
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<td>$106,114</td>
<td>$21,814</td>
<td>$13,961</td>
<td>$15,895</td>
<td>$29,856</td>
<td>($79,475)</td>
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<td>$106,114</td>
<td>$21,814</td>
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<td>$106,114</td>
<td>$21,814</td>
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<td>$29,856</td>
<td>($79,475)</td>
<td></td>
</tr>
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<td>$106,114</td>
<td>$21,814</td>
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<td>$106,114</td>
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<td>$29,856</td>
<td>($79,475)</td>
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<td>$106,114</td>
<td>$21,814</td>
<td>$13,961</td>
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<td>$29,856</td>
<td>($79,475)</td>
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</tr>
<tr>
<td>7</td>
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<td>$106,114</td>
<td>$21,814</td>
<td>$13,961</td>
<td>$15,895</td>
<td>$29,856</td>
<td>($79,475)</td>
<td></td>
</tr>
</tbody>
</table>

Less:
- Operating costs: $65,226
- Asset Maintenance (2% Capex): $3,179
- Depreciation (10 yrs SL): $15,895

Less:
- Company Tax @ 36%: $7,853

Add Back:
- Depreciation: $15,895

IRR: 16%
Operating Scenario 1

1 Smelter using the Roper Port

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
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</tbody>
</table>

Capital Expenditure
- Gross Sales Income: $106,114
- Less:
  - Operating costs: $65,226
  - Asset Maintenance (2% Capex): $3,179
  - Depreciation (10 yrs SL): $15,895

Gross Profit: $21,814
- Less:
  - Company Tax @ 36%: $7,853

Net Profit: $13,961
- Add Back:
  - Depreciation: $15,895

Net Cashflow: $29,856
- Cumulative Cashflow: $79,899
Operating Scenario 1

1 Smelter using the Roper Port

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
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<th>Year</th>
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</tr>
</thead>
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<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
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<td>27</td>
<td></td>
</tr>
<tr>
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<td>$0,000</td>
<td>$0,000</td>
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<td>$0,000</td>
<td>$0,000</td>
<td>$0,000</td>
<td>$0,000</td>
</tr>
</tbody>
</table>

Capital Expenditure


Less:

- Operating costs: $65,226
- Asset Maintenance (2% Capex): $3,179
- Depreciation (10 yrs SL): $0

Gross Profit: $37,709


Net Profit: $24,134

Add Back:

- Depreciation: $0

Net Cashflow: $24,134

Cumulative Cashflow: $278,692
Operating Scenario 1

1. Smelter using the Roper Port

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>$0,000</td>
<td>$0,000</td>
</tr>
</tbody>
</table>

Capital Expenditure
Gross Sales Income $106,114 $106,114

Less:
Operating costs $65,226 $65,226
Asset Maintenance (2% Capex) $3,179 $3,179
Depreciation (10 yrs SL) $0 $0

Gross Profit $37,709 $37,709

Less:
Company Tax @ 36% $13,575 $13,575

Net Profit $24,134 $24,134

Add Back:
Depreciation $0 $0

Net Cashflow $24,134 $24,134

Cumulative Cashflow $520,030 $544,164
Notes

1. This is the tonnes mined multiplied by the quoted mining rate of $4.60 per tonne and divided by the tonnes of product produced. This cost includes the operating cost of coarse ore beneficiation.

2. This based on a staff of 42 to operate the smelter and 10 staff to operate the powerstation at an average salary of $60,000 per person including overheads. This cost is then divided by the tonnes of product produced to give the labour cost per tonne.

3. No power cost is assumed as a co-generation unit will be used that generate an excess of 30MW of power.

4. This is the tonnes of coal required multiplied by the cost of that coal delivered to the smelter and divided by the tonnes of product produced. The cost of delivering the coal to the smelters includes $4.00 per tonne for transport and $15.00 per tonne for shipping and handling.

5. This is the tonnes of oxygen required multiplied by the cost of $30.00 per tonne divided by the tonnes of product produced. It is assumed that the oxygen plant will be a build, own and operate establishment.

6. This is the amount of water required by the smelters and the town, at a cost of 5 cents per kilolitre, divided by the tonnes of product produced.

7. This is the tonnes of limestone required multiplied by the cost and divided by the tonnes of product produced.

8. This is based upon an estimate allowing for the distance travelled.

9. This is based on an estimate of contract rates.

10. All mining, transport and port operations will be contracted.

11. The contract mining operation includes mining, crushing and ore preparation for the smelter feed.

12. Based on this mining rate and with recoverable reserves of approximately 200m tonne, the life of mine would be of the order of 200 years.

13. This model is based on using 1 Ausmelt furnace, with a feed rate of 750,000 tonnes per annum.
14. The pig iron produced will be merchant grade with 96.5% Fe and 3.5% carbon.
APPENDIX IV.

Darwin Port Option Cash Flow Projections.
Operating Scenario 2

5 Smelters using the Mataranka to Darwin Rail and Port

Operating Parameters

- Annual mine production rate: 4,800,000 annual tonnes at $4.60 per tonne mined
- Assumed mining grade: 50% Fe
- Ore trucking to smelters: 3.00 AUD$ per tonne
- Smelter labour force: 260 staff at a salary of $60,000 including 20% overhead
- Assumed feed grade: 64% Fe
- Furnace module input feed volume: 3,750,000 annual tonnes
- Power requirement: 0 MW at 6.0000 cents per KW hour
- Market coal cost: 28.00 US$ per tonne
- Coal requirements: 3,634,095 annual tonnes at $52.50 per tonne delivered to smelter
- Oxygen: 1,674,000 annual tonnes at $30.00 per tonne
- Water: 5,400 annual ML at 5.0000 cents per KL
- Limestone requirements: 1,481,230 annual tonnes at $8.00 per tonne delivered to smelter
- Product loading to rail: 0.50 AUD$ per tonne
- Rail transport cost: 1.00 cents per tonne/km
- Annual iron production rate: 2,487,047 annual tonnes

Operating Costs (AUD)*

- Mine and transport operating cost: $8.88 refer to note 1
- Ore trucking to smelters: $5.79 refer to note 2
- Smelter labour cost: $6.27 refer to note 3
- Electricity: $0.00 refer to note 4
- Coal: $76.71 refer to note 5
- Oxygen: $20.19 refer to note 6
- Water: $0.11 refer to note 7
- Limestone: $4.76 refer to note 8
- Load Product to rail: $0.50 refer to note 9
- Freight product to port facility: $4.00 refer to note 10
- Ship loader and port operating costs: $2.00 refer to note 11

Total operating cost: $129.22

Export price: 160.00 US$ per tonne FOB port of Darwin
Exchange rate: 0.75
Export price: 213.33 AUD$ per tonne FOB Port of Darwin

* All costs are in AUD's per tonne of product produced
Operating Scenario 2

5 Smelters using the Mataranka to Darwin Rail and Port

**Capital Expenditure (,000 AUDS)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnace Modules</td>
<td>$275,000</td>
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<tr>
<td>Powerstation</td>
<td>$225,000</td>
</tr>
<tr>
<td>Road construction and upgrades</td>
<td>$20,000</td>
</tr>
<tr>
<td>Infrastructure and civil</td>
<td>$20,000</td>
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<tr>
<td>Airstrip upgrade</td>
<td>$1,500</td>
</tr>
<tr>
<td>Dam, pumps and pipes</td>
<td>$5,000</td>
</tr>
<tr>
<td>Smelter bulk product handling</td>
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</tr>
<tr>
<td>Environmental study</td>
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<td>Consulting</td>
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<tr>
<td>Contingency (10%)</td>
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Total Capital Expenditure: $611,600
Operating Scenario 2

5 Smelters using the Mataranka to Darwin Rail and Port

Cashflow Model

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<thead>
<tr>
<th>Capital Expenditure</th>
<th>2,487,047 tonnes @ $129.22 per tonne of product</th>
<th>2,487,047 tonnes @ $129.22 per tonne of product</th>
<th>2,487,047 tonnes @ $129.22 per tonne of product</th>
<th>2,487,047 tonnes @ $129.22 per tonne of product</th>
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<th>2,487,047 tonnes @ $129.22 per tonne of product</th>
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</thead>
<tbody>
<tr>
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<td>$530,570</td>
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<tr>
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<td>$12,232</td>
<td>$12,232</td>
<td>$12,232</td>
<td>$12,232</td>
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<td>$135,802</td>
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<td>$135,802</td>
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<tr>
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<td>$48,889</td>
<td>$48,889</td>
<td>$48,889</td>
<td>$48,889</td>
<td>$48,889</td>
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**Operating Scenario 2**

5 Smelters using the Mataranka to Darwin Rail and Port

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital Expenditure</th>
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<th>Operating costs</th>
<th>Asset Maintenance (2% Capex)</th>
<th>Depreciation (10 yrs SL)</th>
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<th>Company Tax @ 36%</th>
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<th>Net Cashflow</th>
<th>Cumulative Cashflow</th>
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</table>
Operating Scenario 2

5 Smelters using the Mataranka to Darwin Rail and Port

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<th>Year 17 000</th>
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<th>Year 19 000</th>
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<tbody>
<tr>
<td>Capital Expenditure</td>
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<tr>
<td>Gross Sales Income</td>
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<td>$530,570</td>
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<tr>
<td>Less:</td>
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<tr>
<td>Operating costs</td>
<td>$321,376</td>
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<tr>
<td>Asset Maintenance (2% Capex)</td>
<td>$12,232</td>
<td>$12,232</td>
<td>$12,232</td>
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<tr>
<td>Depreciation (10 yrs SL)</td>
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<td>$0</td>
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<tr>
<td>Company Tax @ 36%</td>
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<td>$70,906</td>
</tr>
<tr>
<td>Net Profit</td>
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<td>$126,056</td>
<td>$126,056</td>
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<tr>
<td>Add Back:</td>
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<td>$1,877,582</td>
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</table>
Notes

1. This is the tonnes mined multiplied by the quoted mining rate of $4.60 per tonne and divided by the tonnes of product produced. This cost includes the operating cost of coarse ore beneficiation.

2. It is assumed that the coarse ore will be trucked to the smelters using 100 tonne trucks at a cost of $3.00 per tonne. Each truck will consist of a prime mover with a 10 tonne payload and 3 x 30 tonne trailers.

3. This based on a staff of 210 to operate the smelters and 50 staff to operate the powerstation at an average salary of $60,000 per person including overheads. This cost is then divided by the tonnes of product produced to give the labour cost per tonne.

4. No power cost is assumed as co-generation units will be used that generate an excess of 30MW of power each.

5. This is the tonnes of coal required multiplied by the cost of that coal delivered to the smelter and divided by the tonnes of product produced. The cost of delivering the coal to the smelters includes US$8.00 per tonne for cargo freight and AUD$4.50 per tonne handling and transport to the smelters.

6. This is the tonnes of oxygen required multiplied by the cost of $30.00 per tonne divided by the tonnes of product produced. It is assumed that the oxygen plant will be a build, own and operate establishment

7. This is the amount of water required by the smelters and the town, at a cost of 5 cents per kilolitre, divided by the tonnes of product produced.

8. This is the tonnes of limestone required multiplied by the cost and divided by the tonnes of product produced.

9. This is an assumed operating cost 50 cents per tonne to load the product onto rail cars.

10. This is the cost of rail freight based on 1 cent per tonne per kilometer for 400 kilometers.

11. This is based on an estimate of contract rates.

12. All mining, transport and port operations will be contracted.
13. The contract mining operation includes mining, crushing and ore preparation for the smelter feed.

14. Based on this mining rate and with recoverable reserves of approximately 200m tonne, the life of mine would be of the order of 40 years.

15. This model is based on using 5 Ausmelt furnaces, each with a feed rate of 750,000 tonnes per annum.

16. The pig iron produced will be merchant grade with 96.5% Fe and 3.5% carbon.
PHOTO 1: Escarpment formed by pisolitic ironstone bed near Hodgson Downs.

PHOTO 2: Outcrop of pisolitic ironstone 4.5m thick averaging 46.2%: Mount Fisher locality.
PHOTO 3: Escarpment formed by outcrop of sandy oolitic ironstones averaging 50.4% Fe over 4.5 metres thickness: Mount Scott locality.

PHOTO 4: Detail of Mount Fisher ironstone outcrop showing coarse pisolitic texture.
Complete Reactor System for Ausmelt Process

**FIGURE 1.**
MAP 3.
Simplified Geological Map of Iron ore deposits within EL 7137, Hodgson Downs (modified after Orridge, 1993)
PHOTO 1: Escarpment formed by pisolitic ironstone bed near Hodgson Downs.

PHOTO 2: Outcrop of pisolitic ironstone 4.5m thick averaging 46.2%: Mount Fisher locality.
PHOTO 3: Escarpment formed by outcrop of sandy oolitic ironstones averaging 50.4% Fe over 4.5 metres thickness: Mount Scott locality.

PHOTO 4: Detail of Mount Fisher ironstone outcrop showing coarse pisolitic texture.
CAINozoic
Qa alluvium
Czs soils

PROTEROZOIC
Pdz dolerite sills

Roper Group Pry Kyalla Member
(McMinn Prz Sherwin Ironstone Mmr.
Formation) Prk Moroak Sandstone Mmr.

EL 7137 GEOLOGICAL MAP
scale 1 : 250,000

figure 5.
CAINozoic
Qa alluvium
Czs soils

PROTEROZOIC
Pdz dolerite sills

Roper Group
Pry Kyalla Member
(Mcminn
Prz Sherwin Ironstone Mmr.
Formation)
Prk Moroak Sandstone Mmr.

EL'S 7240, 7241 & 7242
GEOLOGICAL MAP
scale 1 : 250,000

figure 6.
**LEGEND.**

**Cainozoic.**
- Qa alluvium.

**Proterozoic: Roper Group.**
- Pr1 dolerite.
- McMinn Rpe. Shirwin Prz ferruginous colitic sandstone.
- Ironstone Member. Przp pisolite ironstone.
- Undifferentiated. Pr sandstone, siltstone, shale.

- + horizontal bedding.
- \( \Delta \) bedding trace - low dip.
- \( \gamma \) bedding trace - moderate dip.
- \( \beta \) bedding trace - steep dip.
- --- edge of major escarpment.
- ----- fault.
- \( \Delta \) bulk sample site & number.

--- main road.
--- bush track.
--- approximate EL boundary.

**EXPLORATION LICENCE 7240**
Mount Fisher
**PHOTOCHEMICAL INTERPRETATION MAP**

Figure 8.
LEGEND.

CENozoic.  Qa alluvium.

PROTEROZOIC: Roper Group.

Pd dolerite.

McKinlay Fm, Shirwin Prz ferruginous colitic sandstone.
Ironstone Member.  Przp pisolith ironstone.

Undifferentiated.  Pr sandstone, siltstone, shale.

bedding trace - low dip.
bedding trace - moderate dip.
bedding trace - steep dip.

edge of major escarpment.
fault.

375764 bulk sample site & number.

main road.
bush track.

approximate EL boundary.

EXPLORATION LICENCE 7241
Shirwin Creek

PHOTOGEOLOGICAL INTERPRETATION MAP

Figure 9.
LEGEND.

CAINozoic.

Ga alluvium.

PROTEROZOIC: Roper Group.

Pd dolerite.

McKinn Form. Shirwin Prz ferruginous colitic sandstone.
Ironstone Member. Prz pisolite ironstone.
Undifferentiated. Pr sandstone, siltstone, shale.

Symbols:
horizontal bedding.
bedding trace - low dip.
bedding trace - moderate dip.
bedding trace - steep dip.
edge of major escarpment.
 fault.

Aggr.
△ bulk sample site & number.

Roads:
main road.
bush track.

Approximate EL boundary.