# Contents

# Chairman's Review

**This review summarises Austpac's activities during the 1998–99 year and introduces the Company's fourteenth published Annual Report.**

In progressing the Company during the year under review, the clear objective of the Board and management was to complete corporate agreements leading to commercial application of the ERMS and EARS proprietary technologies.

In this regard, the year was successful and as announced to shareholders, we have completed:

- two important licence agreements with Iscor of South Africa as part of their new Heavy Minerals Project.
- the majority joint venture with Indian Rare Earths Limited to build and manage a 10,000 tonnes per annum synthetic rutile plant using the ERMS technology.

Details of our achievements are covered by this annual report. They herald a new era for Austpac and are the necessary pre-requisites to the company moving into its next phase of revenue-earning commercial activities following the successful development of its first class processing technologies for mineral sands.

As a technology development Company, shareholders have almost completely carried the cost to the Company of our mineral processing activities for many years. This process reaches a point which tests the dedication and forbearance of both stakeholders and financial markets.

Your Directors are very conscious of these pressures and have to balance calls for shareholder funds and dilution through placements with the need to maintain the Company as a viable entity, while at the same time convince the financial markets of the worth of our technologies. However, as attested by this year's achievements, we are now moving forward and there is a growing recognition of Austpac's place and value within the mineral sands processing industry.

Without the dedication and commitment of the Managing Director and the small group working with him, Austpac could not have travelled the road it has. In reaching and passing the staging points in this continuing development of Austpac, the 1998–99 year and the initial months of the current year are probably the most significant in the Company's history. The tangible evidence is the firm program now in place for the construction and commissioning of the 10,000 tpa ERMS synthetic rutile plant at OSCOM in Orissa State. As shareholders are well aware, the approval for and completion of a small commercial plant to prove our technology has been a prime goal for the Company. With stringency of funds, finding the right commercial opportunity has been an extremely challenging task.

We have created a valuable opportunity in India and aim to progress it in a manner which will maximise the benefits to shareholders. Your Directors are presently considering a number of options to achieve this and expect to be in a position to announce developments in this regard before the end of the year. I look forward to the year ahead, wherein we will move closer to our goal of synthetic rutile production and thereby create wealth for our shareholders.

*Alfred L. Paton*
Chairman

# Directors' Report

## on Technology and Mineral Sands

### Highlights

A definitive joint venture agreement was signed in August 1999 with Indian Rare Earths (IRE) to construct a 10,000 tpa ERMS synthetic rutile plant in India. Austpac will have a 74% and IRE a 26% participating interest in AusRutile India Pvte. Limited, a joint venture company formed to construct the plant. Austpac will manage the project.

AusRutile aims to commence construction in 2000 with synthetic rutile production in 2001. AusRutile will then consider establishing additional larger synthetic rutile plants. The combination of IRE's resources and Austpac's technologies means that AusRutile has the potential to meet the Indian Government's objective – the production of at least 200,000 tpa of synthetic rutile for export within the next decade.

During the year under review two technology licences were issued to Iscor Limited of South Africa; the first in July 1998 for aspects of the ERMS beneficiation process, and the second in November 1998 for the EARS hydrochloric acid regeneration process. These licences are a significant endorsement of the Company's technologies.

Opportunities to use the ERMS process to reduce deleterious chrome levels in Murray Basin ilmenites continued to be assessed.

The ERMS Research and Development syndicate between Austpac, Rothschild and Bankers Trust, which had been in existence since June 1993, was replaced by a new joint venture between Austpac and Rothschild, in which Austpac holds an improved 90% interest and Rothschild a 10% interest in the technology.

*Dr T.K. Mukherjee, Managing Director, IRE and Mr M.J. Turbott, Managing Director, Austpac, sign the AusRutile Joint Venture agreement, observed by Mr V.M. Karve, Austpac's Indian Representative, Mr V.K. Verma, Executive Director – Marketing, IRE, Mr H. Hines, and Mr A.L. Paton, Director and Chairman respectively, Austpac and Mr A. Dasgupta, Director, IRE; Sydney, August 1999.*

## ERMS and EARS Technologies

Austpac has two proprietary processes which have direct application to the mineral sand/titanium dioxide industry. These are:

- ***ERMS: Enhanced Roasting and Magnetic Separation, and***
- ***EARS: Enhanced Acid Regeneration System.***

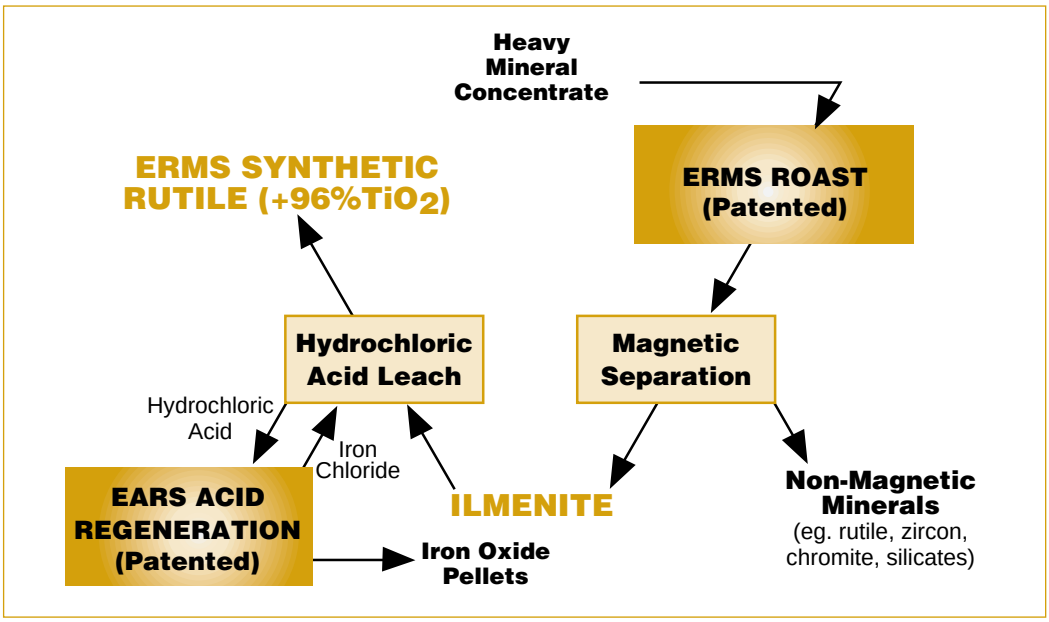
The ERMS process selectively magnetises ilmenite so it can be easily separated from other minerals. This has applications where heavy mineral concentrates contain deleterious minerals, such as chromite, (eg. the production of a saleable ilmenite concentrate from the Murray Basin). The ERMS roasting process also conditions ilmenite for leaching with hydrochloric acid. Leaching removes most of the iron in the ilmenite, thus making a high value, titanium rich product; synthetic rutile.

Synthetic rutile is a premium feedstock for the manufacture of titanium dioxide ($TiO_2$) pigment and titanium metal. The $TiO_2$ form is the brilliant white pigment used in the paint and plastics industry and to a lesser extent in the paper industry. Over 3 million tonnes (Mt) of $TiO_2$ pigment are sold annually, with a market value of more than US$6 billion.

The key to the economic viability of acid leach synthetic rutile processes, such as ERMS, is low cost acid regeneration. The iron chlorides in the spent leach liquor must be reconverted into hydrochloric acid, and Austpac's EARS process achieves this at significantly less capital and operating cost than other acid regeneration systems. The only solid waste produced by EARS is iron oxide (magnetite) pellets, which can be used as feedstock for the steel industry, for shotblasting, or for inert land fill.

While EARS assists the economics of the ERMS synthetic rutile process, it also has a direct application in the steel industry. Hydrochloric acid baths are used to 'pickle' (ie. clean) steel, and this process is more economic if the iron chloride-rich spent pickle liquors are reconverted to hydrochloric acid with regeneration facilities.

A simplified flow diagram of the ERMS and EARS processes is shown below.




*Simplified flow diagram of the ERMS and EARS processes*

## India

India's mineral sand resources are among the largest and least exploited in the world today. The country has a resource base of 278 million tonnes of ilmenite or almost 20% of the world's known ilmenite. It is estimated that approximately half of this is available for mining and that the deposits generally contain 20–30% heavy minerals which is considered high grade by world standards. The heavy mineral suites in the Indian deposits comprise valuable minerals such as rutile, zircon, monazite, together with ilmenite, which generally constitutes half of the heavy minerals.

Over 80% of India's ilmenite occurs along the east coast in Tamil Nadu, Andhra Pradesh and Orissa States. It is a 'high iron' variety containing 50-53% $TiO_2$, which is suitable feedstock for upgrading to synthetic rutile by an acid leach process. It is not economically amenable to the Becher synthetic rutile process used in Australia. While this ilmenite could be used for titania slag manufacture, the cost and unreliability of supply of electricity in India preclude slag making. Some synthetic rutile is produced in India by the more technically complex Benilite acid leach process, but most plants are either under-performing, or are high cost operations. However, Indian ilmenites are highly amenable to Austpac's cost effective ERMS process.

Only wholly-owned Indian companies can export ilmenite and the country's mineral sand industry is dominated by Government agencies. Foreign companies can only participate in Indian mineral sand projects which include processing ilmenite to synthetic rutile or $TiO_2$ pigment, and the Government insists on a minimum 26% participation. The Government's aim is to create a world class $TiO_2$ industry based on the country's vast resources with at least two 100,000 tonne synthetic rutile plants in operation by the end of the next decade, generating US$100 million per year in export earnings.


*Location of mineral sand deposits in India*

Because the Government insists on value addition, the key to the development of India's mineral sand deposits is a beneficiation technology appropriate for Indian ilmenite; Austpac has that key.

### Indian Rare Earths Limited

Indian Rare Earths Limited (IRE) is an Indian Government undertaking, which was established in 1950 under the administrative control of the Department of Atomic Energy. It entered the mineral sand business in the mid-1960s and is involved in mineral sand operations at Chavara in Kerala State, Manavalakurichi in Tamil Nadu and at Chatrapur in Orissa State where, based on a resource of greater than 20 Mt of ilmenite, it has developed the Orissa Sands Complex (OSCOM). IRE has

also explored the Kudiraimouzi deposit in Tamil Nadu (77 Mt of ilmenite) and the Kalingapatnam/Bhimlipatnam deposit in Andhra Pradesh (22 Mt of ilmenite).

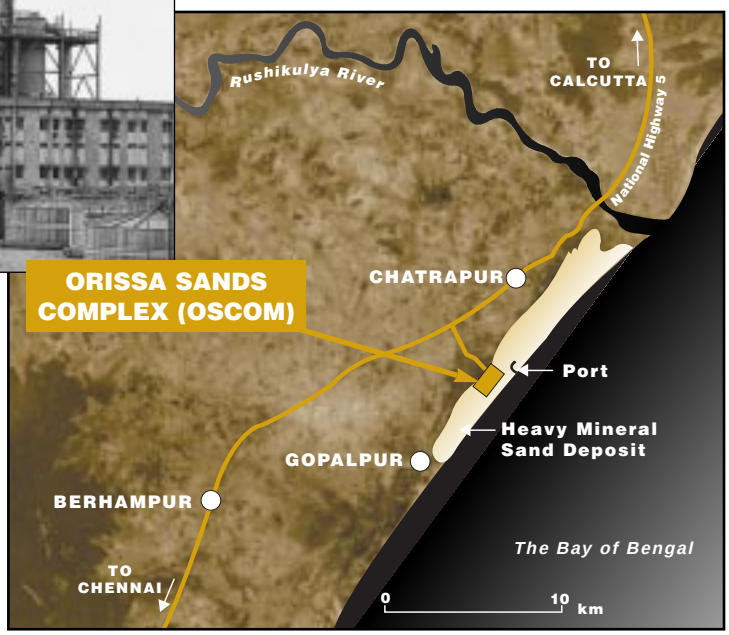
The Chatrapur, Kalingapatnam/Bhimlipatnam and Kudiraimouzi resources make up around 8% of the world's resources; they contain sufficient ilmenite to satisfy the world's synthetic rutile needs for more than 75 years. At present they are only being exploited at Chatrapur.

The OSCOM facility consists of a dredge and mineral separation plant with a nameplate production capacity of 220,000 tonnes per annum (tpa) of ilmenite, and a Benilite synthetic rutile plant with a nameplate capacity of 100,000 tpa. Since its start-up in the mid-1980s, the Benilite plant has encountered technical problems and is currently producing approximately 5,000 tpa of synthetic rutile. The OSCOM operation is presently capable of producing about 180,000 tpa of ilmenite which is far in excess of the Benilite plant's needs. IRE has for some time therefore been examining new synthetic rutile processes that have the potential to fully exploit the resources in Orissa, Andhra Pradesh and Tamil Nadu.

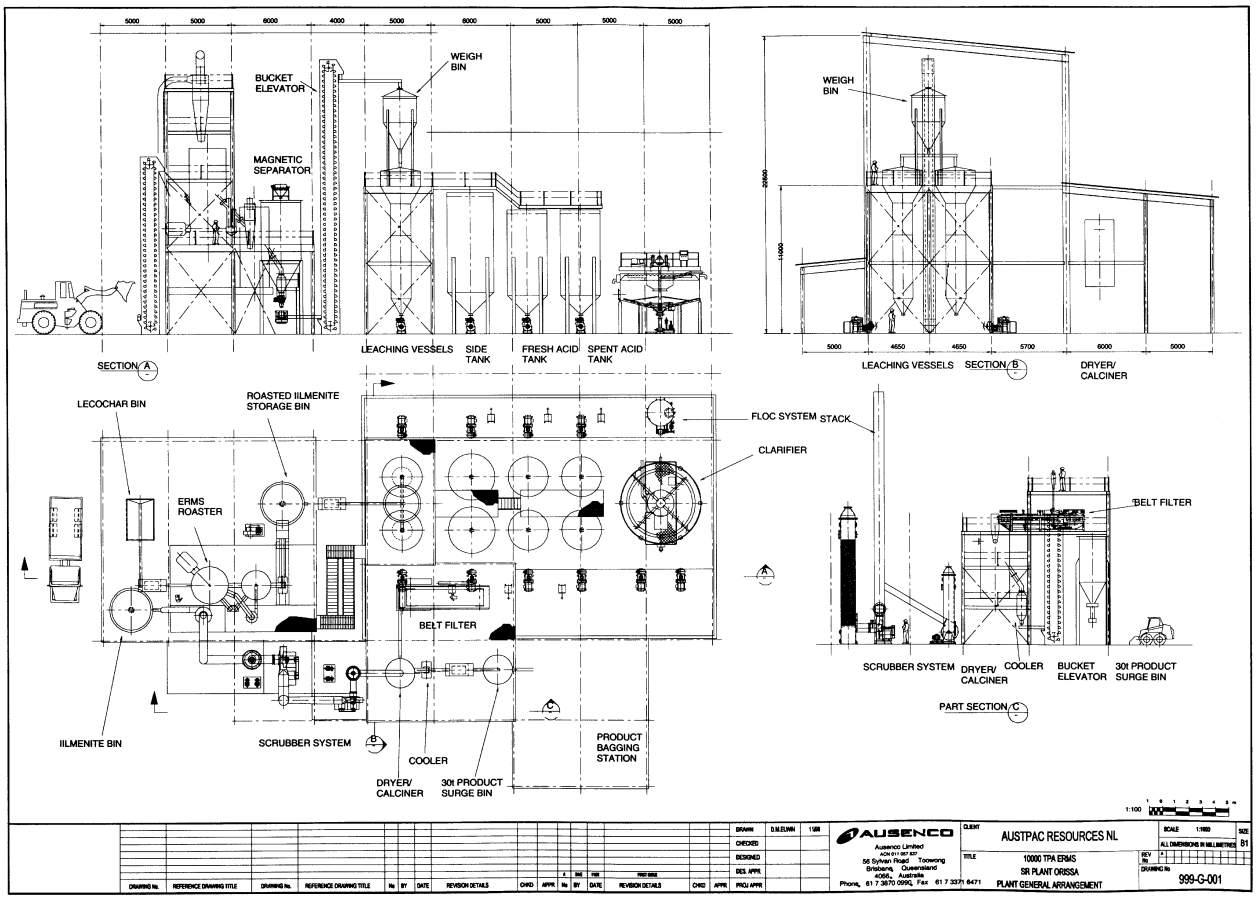
*John Winter explaining the operations of the ERMS roaster at the Newcastle Pilot Plant to executives of Indian Rare Earths Limited*

## Austpac in India

In 1996 Austpac introduced its technologies to IRE, who commenced technical review of the ERMS and EARS processes. In




*Location of IRE's Orissa Sands Complex, Orissa State, India. The 10,000 tpa plant will be constructed adjacent to the OSCOM facility*




*Layout of the proposed 10,000 tpa ERMS Synthetic Rutile Plant at Orissa, India*

January 1997 Austpac and IRE signed a Memorandum of Understanding to investigate the technical and economic feasibility of using the ERMS process to produce high grade synthetic rutile for export from the Kudiraimouzi deposit in Tamil Nadu and the Kalingapatnam/ Bhimlipatnam deposits in Andhra Pradesh. ERMS bench scale testwork produced an excellent synthetic rutile from both types of ilmenite. In 1998 testwork at the Company's pilot plant in Newcastle demonstrated that a >96% $TiO_2$ synthetic rutile could also be produced from Chatrapur (OSCOM) ilmenite.

IRE was encouraged by the results from these three deposits, and while the possibility of building a full scale plant was discussed, the need for an initial smaller scale plant was recognised. To minimise capital costs, IRE suggested establishing a 10,000 tpa ERMS synthetic rutile plant at OSCOM, where ilmenite production and acid regeneration facilities were already established, rather than at a greenfields location.

### The 10,000 tpa ERMS Synthetic Rutile Plant – India

In August 1998 IRE and Austpac agreed to examine the feasibility of using the existing ilmenite production and acid regeneration facilities at OSCOM to support a 10,000 tpa ERMS synthetic rutile plant. It was envisaged that this plant would share other facilities such as coal, water and power supplies as well as the local infrastructure.

*Senior staff from Austpac and an executive team from Indian Rare Earths Limited observe a demonstration run at the Newcastle pilot plant*

A pre-feasibility study into this 10,000 tpa ERMS synthetic rutile plant concept was completed in December 1998. This indicated that the total capital cost of the plant would be in the range US$5–6 million, including working capital and commissioning, and concluded that the project would be economically viable.

In April 1999 Austpac and IRE reached agreement on the commercial parameters to govern the development and operation of the 10,000 tpa plant, and on 2 August 1999 the parties signed a definitive joint venture agreement for the project. Austpac and IRE will respectively hold a 74% and 26% contributing interest in an Indian joint venture company, AusRutile India Pvte. Limited, formed to effect the project.

The Brisbane-based engineering group, Ausenco Limited, has been commissioned to undertake a site specific study to finalise plant layout and capital cost, and Austpac will complete definitive testwork at its Newcastle pilot plant on a bulk sample of OSCOM ilmenite to supplement Ausenco's investigation. The study is scheduled to take 18 weeks and the final report is expected to be completed by early next year. Plant construction will take 15 months, so provided all necessary approvals and financing are in place by mid-2000, AusRutile will commence synthetic rutile production during the second half of 2001.

Once the demonstration plant is fully operational, AusRutile will consider establishing larger synthetic rutile plants in India. The mineral sand deposit at Chatrapur is a world class resource, with the potential to produce sufficient ilmenite to support the manufacture of 200,000 tpa of ERMS synthetic rutile for over 50 years. IRE also has access to other very large heavy mineral sand deposits along the East Coast of the country.

The combination of IRE's resources and Austpac's technologies means that AusRutile has the potential to meet the Indian Government's objective; the production of at least 200,000 tpa of synthetic rutile for export within the next decade. This would also achieve Austpac's goal of becoming a profitable, world-class producer of high-grade feedstock for the $TiO_2$ industry, so creating significant wealth for the Company's shareholders.

## South Africa

Following two years of collaboration, including a $670,000 testwork program at Austpac's Newcastle pilot plant, Austpac signed the first commercial licence in July 1998 for the use of some aspects of the ERMS process with Iscor Limited, South Africa's major steel producer. This was followed in November 1998 by a second licence with Iscor for the use of the EARS

process. These licences were the first endorsement of the commercial potential of Austpac's technologies.

The licences are for the use of the ERMS and EARS processes within Iscor's Heavy Mineral Project. This project encompasses a sand mine which will supply heavy minerals to a separation plant and a 250,000 tpa titania slag smelter complex at Empangini, near Richard's Bay in KwaZulu-Natal Province, South Africa. Details of the licences remain confidential until construction commences on the Heavy Mineral Project.

Since signing the licences, Austpac personnel have provided technical assistance to Iscor. Construction of the Heavy Mineral Project was originally scheduled to commence this year, but economic conditions led to its postponement. A decision on the implementation of the project is expected before the end of 1999.

## Murray Basin, Australia

Large fine-grained heavy mineral deposits have been known in the Murray Basin for some time, but in the last few years the Basin has become the focus of intense exploration resulting in the discovery of coarser grained deposits. These deposits contain the valuable heavy minerals, rutile and zircon, as well as high grade, 'high-Ti' ilmenite (+60% $TiO_2$). High-Ti ilmenite can sell for as much as 50% more than lower grade ilmenite, and the Murray Basin deposits are probably the last significant resource of premium ilmenite in Australia. However, when traditional magnetic separation is used to process Murray Basin heavy minerals, the resulting ilmenite concentrate generally contains more than 1% $Cr_2O_3$, derived from the deleterious mineral, chromite. If $Cr_2O_3$ levels are above 0.4%, the ilmenite concentrate is either unsaleable or will not command a premium price.

Austpac has successfully used its ERMS process to remove chromite from a number of high-Ti ilmenite concentrates from around the world. For example, in one test on a Murray Basin concentrate, the $TiO_2$ content increased from 56% to 62% and the chrome content was reduced from 1.25% to 0.14%. While other roasting-magnetic separation methods are known, they are not effective on high-Ti ilmenites.

During the year Austpac undertook ERMS testwork for a number of groups actively exploring in the Murray Basin. In addition, two technical papers were presented at a symposium on Murray Basin mineral sands held in Mildura in April 1999. The effectiveness of the Company's ERMS process is now well-recognised and its application awaits the development of the mineral sand resources in the region. Austpac's objective is to licence its technology to potential producers in the Murray Basin. While most deposits are still in the exploration stage, Austpac is well placed to benefit when they are ultimately developed.

## Westport, New Zealand

In 1988 Austpac formed a joint venture with the Nissho Iwai Corporation of Japan and Buller Minerals Ltd of New Zealand to investigate the feasibility of manufacturing titania slag from ilmenite deposits at Westport, New Zealand.

In 1989 Austpac started a research program to find a way to beneficiate the low grade ilmenite at Westport. This led to the discovery in 1990 of the ERMS roasting process, which successfully increased the $TiO_2$ content of Westport ilmenite to 47–48% $TiO_2$. The grade increase was still insufficient to make Westport ilmenite suitable for the sulfate route pigment process because of the high silica content of the concentrate. The titania slag project was also not economic. While the Westport

joint venture was terminated in 1994, Austpac retained the exploration tenements and continued to develop the ERMS process.

Austpac subsequently discovered that hydrochloric acid leaching of ERMS-roasted Westport ilmenite produced a 92–94% $TiO_2$ buff-coloured synthetic rutile containing as much as 6% silica. However the silica content and grain size of this material mitigate against its use as a chloride-route pigment feedstock. While the silica can be reduced to 1–2% with caustic leaching, the product is still too fine grained to be acceptable. It is possible to micronise this material to make a low grade pigment, but the market for such a product is very limited.

Further ERMS processing of the low silica Westport synthetic rutile produces results in a very pure (>99% $TiO_2$) white synthetic rutile, which when micronised becomes an uncoated, off-white $TiO_2$ pigment. However, to make such a product acceptable in the very competitive $TiO_2$ pigment market, an extensive research and development effort would be required. The likelihood of establishing a market for Westport pigment in the foreseeable future was very low, so in early 1999 the project was terminated.

## Ohui, New Zealand

Austpac's remaining gold prospect, Ohui, has been explored through a joint venture between Austpac, Imperial Mining and Spectrum Resources. Exploration during the current year was conducted on a low key basis. During mapping and sampling in the northern portion of EP 40–292, strong silicification and hydraulic brecciation was located in rhyolites at the McGregors Prospect, however most samples contained low precious metal values.

*Sampling and mapping on McGregors Ridge*

## Schedule of Mining Tenements

| NATURE OF TITLE | AREA | NAME | STATUS | REGISTERED HOLDER | BENEFICIAL INTERESTS OF AUSTPAC RESOURCE N.L. GROUP |
|---|---|---|---|---|---|
| **NEW ZEALAND** | | | | | |
| 1. Exploration Permit 40–292 | 1,200 ha | Ohui | Granted 19/6/96 for 5 years | Austpac Gold Exploration (NZ) Ltd, Spectrum Resources Ltd and Imperial Mining NL | 30% |