# The Kintyre Uranium Project

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**SUMMARY** The Kintyre Uranium Project is being developed by Canning Resources Pty Ltd, a subsidiary of Rio Tinto (formerly CRA). The work on the project includes the planning and management of a number of background environmental studies. The company has also commissioned studies by external consultants into process technologies, mining strategies and techniques for extracting the uranium ore from the waste rock. In addition, Canning Resources has made a detailed assessment of the worldwide market potential for Australian uranium in the late 1990s and into the 21st century.

## 1. INTRODUCTION

The discovery of the Kintyre uranium deposit in 1985 was made by Rio Tinto Exploration Pty Ltd, a wholly-owned subsidiary of Rio Tinto Limited. Rio Tinto's ongoing investigations of the Rudall River area began in 1972 and they remain responsible for identifying the geological potential of the region. The company employs about 100 geoscientists and is one of Australia's largest explorers. From its Western Region office in Perth, Rio Tinto Exploration conducts several large-scale exploration programmes in the western half of Australia.

The development of the proposed Kintyre uranium mine is the responsibility of Canning Resources Pty Ltd, also a wholly-owned subsidiary of Rio Tinto (formerly CRA). Canning Resources is a small team of engineering and commercial specialists based in Perth. The company conducts feasibility and development studies on energy resources throughout Western Australia.

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The Rio Tinto Group is the world's largest mining enterprise. The Group was formed in December 1995, when CRA Limited and The RTZ Corporation PLC formed a A$26.7 billion group under a Dual Listed Companies structure. A global restructure followed shortly after along with a group name change to Rio Tinto. Each company retains its stock exchange listing and share register in its own country.

The Group includes wholly and partly owned companies, with interest in copper, iron ore, coal, titanium dioxide feedstock, aluminium, gold, diamonds, salt and other minerals. Rio Tinto's world-wide operations comprise exploration, mining, mineral processing, research and development, and marketing activities.

The diverse range of mines and processing facilities controlled by the Group are world-class and generally low-cost. At the present rate of production, the company's ore reserves are sufficient to support existing operations well into the next century.

A sustained programme of exploration and research and development is also securing future growth. In addition to uranium, the company has made significant new discoveries of coal, heavy minerals and gold, ensuring that Rio Tinto will add new operations to its portfolio in the next decade and beyond.

## 2. RIO TINTO AND URANIUM

Rio Tinto has had extensive experience in the uranium industry, having been involved in uranium exploration, mining and rehabilitation almost continuously since 1952. In that year, the company Rio Tinto, was appointed/commissioned by the Federal Government to manage the Rum Jungle mine in the Northern Territory.

However, Rio Tinto's main involvement with uranium in Australia has been through Mary Kathleen Uranium Ltd (MKU). In 1955, Rio Tinto (later to merge with Consolidated Zinc to form CRA) decided to bring into production the Mary Kathleen uranium deposits, discovered just a year earlier in Queensland. In 1956, the UK Atomic Energy Authority contracted to purchase 4,080 tonnes of uranium concentrate, and in June 1958 only 27 months later a uranium mine was brought into production and a complete town was constructed near the site.

Production continued until 1963, when the contracts were fulfilled, and the operations were then placed on a care and maintenance programme. However, the search for new markets continued and in the early 1970s new contracts were obtained. Production of concentrates was recommenced in 1976.

MKU's contracts in the 1970's and 1980's included deliveries to power utilities in Japan, the United States and Europe. By 1982, with contracted tonnages produced and reserves diminished to uneconomic levels, operations ceased at the Mary Kathleen mine. By the end of the mine's second life, 8,800 tonnes of U3O8 had been produced.

MKU has successfully rehabilitated the Mary Kathleen operations to the highest environmental standards, at a cost of about $19 million. The rehabilitation of the Mary Kathleen Uranium Mine was awarded the 1988 Engineering Excellence Award by the Institution of Engineers, Australia.

Since the mid 1970s, uranium has remained one of the target commodities in Rio Tinto's exploration programme and it is this approach that led to the delineation of the Kintyre deposit and the identification of the uranium potential of the Rudall region.

The development of the proposed Kintyre uranium project by Canning Resources will further extend Rio Tinto's impressive record in uranium and add significantly to the wealth of Australia.

## 3. PROJECT DESCRIPTION

### 3.1 Introduction

Canning Resources has completed a pre-feasibility study into the proposed development of the Kintyre uranium resource in the North West of Western Australia. The discovery of this world-class uranium resource came after surface investigation of a number of radiometric anomalies detected during airborne surveys of Rio Tinto leases in the Rudall region. Despite the deposits having a very small surface expression, ground surveys and drilling confirmed the presence of a significant ore body at Kintyre.

### 3.2 Location

The Kintyre uranium Project lies on the edge of the Great Sandy Desert in the Eastern Pilbara region of Western Australia, about 1,200 kilometres NNE of Perth. *(see figure 1)*.

The Kintyre Project area of 6 sq km is adjacent to the northern boundary of the Rudall River National Park, which was designated in 1977 to preserve and demonstrate an arid desert dry river eco-system.

With an area of about 15,000 square kilometres, Rudall River National Park is the largest national park in Western Australia, and the second largest in Australia.

## 4. ESTIMATED ORE RESOURCE

A resource of 36,000t of U3O8 has been estimated in the immediate Kintyre area. This includes the Kintyre, Whale, and Pioneer ore deposits.

Drilling has identified an indicated resource of 24,000t of U3O8 and more than 11,000 tonnes of inferred resources at a 0.5kg/t U3O8 cut off grade. Drilling has begun to upgrade these resources and prove up additional reserves.

The potential value of the associated bismuth, gold, platinum and palladium mineralisation has yet to be assessed.

## 5. THE KINTYRE ADVANCEMENT PROGRAMME (KAP)

In anticipation of a change to the Federal Government, preparatory work commenced in September 1995 to revisit the project. In May 1996, approval was given to progress the project to a full feasibility status, sufficient to seek Board approval to proceed to the production stage. This study is now underway and includes :-

- A review of the technical parameters and the completion a full engineering study and financial analysis.
- Environmental approval from both State and Federal Governments.
- Accommodation with Aboriginal Traditional Owners and neighbouring communities, and
- Indications from potential customers for the purchase of the product.

### 5.1 Technical Issues

#### 5.1.1 The Resource

The primary mineralisation at Kintyre does not outcrop and the mineral occurs in discrete veins, with minimal dissemination through the host rock. *(see figure 2)*. Both of these factors make accurate definition of the resource, based on drilling data, difficult. In order to obtain more detailed information on the mineralisation, closer spaced drilling and an underground excavation were undertaken. The latter included a small shaft, a drive and a crosscut to intersect the ore body. The objectives of this exercise were to:-

- see the mineralisation and assess its nature and continuity.
- establish the control on vein locations and density.

- investigate grade control procedures and amenability to selective mining.
- compare grade estimates from drill holes and bulk grades.
- provide data on close spaced grade variability to develop variograms for grade predictions.
- compare radiometric measurements with chemical assays.
- provide a bulk sample for metallurgical purposes.

A comprehensive programme of sampling the mined sections, channel sampling and sub-horizontal drilling was completed in the excavation. The walls were logged and photographed.

The data gained has resulted in a geological model which varies from the original and has assisted in gaining a more accurate picture of the mineralisation. This model has been tested with the previous drill data to better define the complex geology and has highlighted that extra data is necessary to more accurately plan an efficient mining strategy.

Geochemical and geophysical data are being studied to define the parameters that could lead to better selection targets in existing resources and other potential sites, to improve the quality and quantity of the resource in the immediate vicinity of Kintyre. The study has indicated that part of the ore body may be more economically recovered by underground mining methods.

### 5.1.2 Process

Whilst the vein type mineralisation at Kintyre is difficult to quantify with traditional exploration methods, this property provides opportunities to simplify the processing stage. The difference between a vein type deposit and a more common disseminated type is demonstrated in, *figure 3*. When a disseminated ore is broken down into smaller pieces, the pieces vary only marginally in Uranium content from each other and from the original ore. However, in the case of a vein type deposit, many barren pieces are produced and the Uranium is concentrated in a smaller volume of ore. By using the natural properties of the Uranium mineral which differ from the host rock, these Uranium rich pieces can be separated to produce an upgraded product.

The properties used to sequentially upgrade the ore at Kintyre are its radioactivity and relatively high density. The processes used to achieve this are radiometric sorting and gravimetric separation. A simplified flow of ore using these techniques are shown in (*figure 4*). The figure also shows how the ore can be sequentially upgraded prior to it entering the hydro-metallurgical section of the process, with minimal loss in contained metal. Significant savings in capital costs from a small, compact plant with reduced reagent consumption and the minimisation of the volume of a waste product (solid tailings) are also major gains.

The bulk sample produced from the trial excavation was the subject of a series a pilot scale trials:-

1. Crushing and screening,
2. Ore Sorting,
3. Heavy Media Separation, and
4. Hydro-metallurgical process.

The first three of these trials were conducted at site, whilst the wet processing pilot scale testing was conducted at the Australian Nuclear Scientific Organisation's facility at Lucas Heights. The trials confirmed our expectations from previous work and our preferred flow-sheet .

The radiometric sorter and heavy media separation (HMS) trials confirmed the earlier test results. Typical results from these trials are shown in *figures 5&6.* Other information from the tests enabled the project team to develop models to assess the economic benefit of the pre-concentration phase and establish a design envelope of optimum feed grades to the hydro-metallurgical process. Optimum feed grades to the Hydro-metallurgical plant were developed at various production rates as shown in *figure 7*. Design data such as process flows, rheology and reagent addition rates were also established.

Also of major importance was the successful application of the selective precipitation step which will allow the project team to proceed with flow-sheet design which may permit the exclusion of the solvent extraction step.

The preferred flow-sheet for the processing of the Kintyre ore shown in *figure 8* was successfully trialled.

### 5.1.3 Environmental

The environmental approval process was triggered in June 1996, with the application to the Federal and State governments for project designation. As expected the highest level of assessment for a resource project, an Environmental Review and Management Programme (ERMP) with the State and an Environmental Impact Statement (EIS) in Federal arena, was required. Guidelines for these submissions have been approved at both levels.

The major issues to be addressed are the disposal of solid and liquid wastes, Occupational Health and Safety and site rehabilitation.

Data for the completion of the submissions has been gathered since the early exploration. Further analysis and testing during the hydro-metallurgical pilot plant has provided further data on waste disposal options and radiometric criteria. The finalisation of mining strategy and process design will allow the draft documents to be completed early next year. A further period of 9-12 months is expected before final approval from both governments is obtaine

### 5.1.4 Native Title

Negotiations are continuing with a team representing the three Aboriginal claimant groups. These discussions are being conducted in a friendly and cooperative atmosphere. Overall relationships with the Aboriginal people remain cordial.

A Social Impact Study initiated by Canning Resources is being carried out.

### 5.1.5 Market

Under the restructural global group. CRPL reports to the Rio Tinto Energy Group, along with Rossing Uranium Limited (RUL) and Rio Tinto Mineral Services Limited (Minserve). This arrangement will provide stronger market support through Minserve's expertise in marketing the product. The development of the Kintyre project has the potential to offer Rio Tinto's customers a more diverse and reliable supply from a broader base in two separate countries.

## 6. CONCLUSIONS

The Kintyre Uranium project has an opportunity to achieve production status by the turn of the century, some fifteen years after its discovery. The removal of the Three Mine Policy has given renewed hope to it's revival.

The Kintyre Advancement Programme has confirmed a number of favourable aspects of this project, particularly the processing stage, which ensures that the project can be developed using a low cost, compact and flexible plant.

Nevertheless the most significant factor affecting the future of this project and, many other potential projects, is the current product price. This price is insufficient to justify the necessary investment to bring this project to production.

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# *Map Showing Location of the Kintyre Deposit*

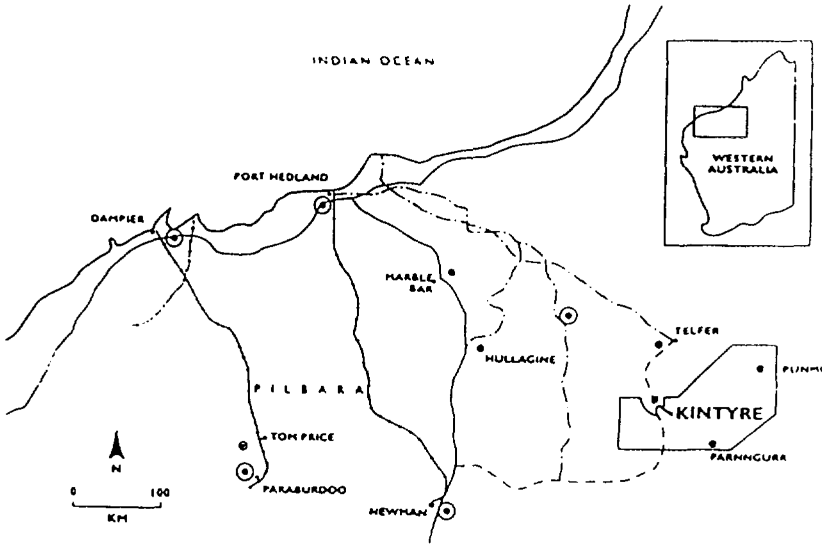


Figure 1

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# *Cross-Section of the Kintyre Deposit*

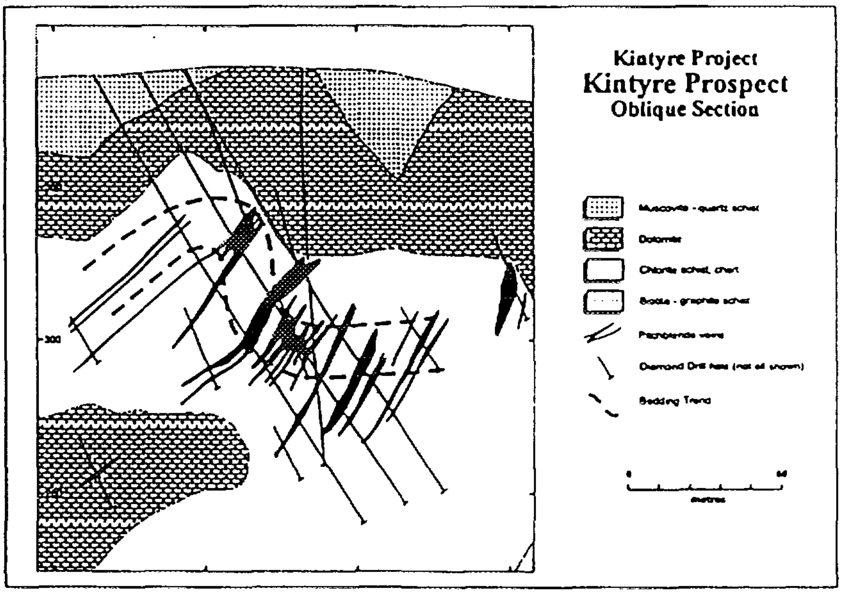


Figure 2

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## *Types of Mineralisation*

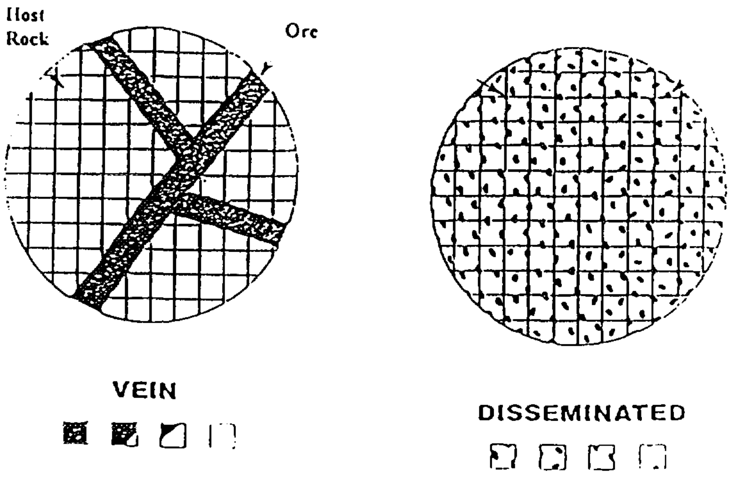


Figure 3

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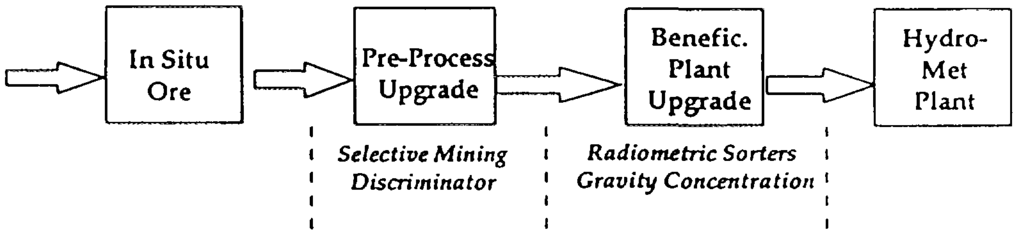
## *Upgrade of Hydro-Metallurgical Plant Feed*




| | | | |
|---|---|---|---|
| Grade kg/t | 2 | 6-7 | 18-27 |
| Recovered % $U_3O_8$ | 100 | 87 | 75-80 |

Annual production at a fixed feed rate at various fees grades:
18kg/t = 1500 tpa (3.2M lbs)
27kg/t = 2200 tpa (5.0M lbs)

Figure 4

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## *Predicted Performance Curve for Radiometric Sorter*

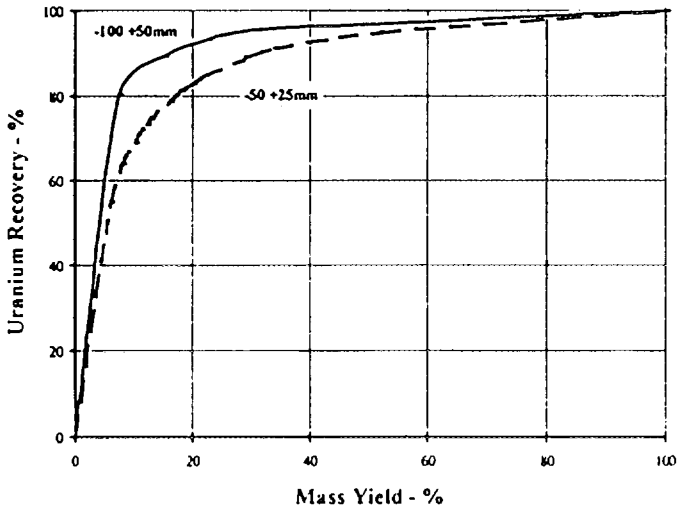


Figure 5

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## *Predicted Performance Curve for HMS Plant*

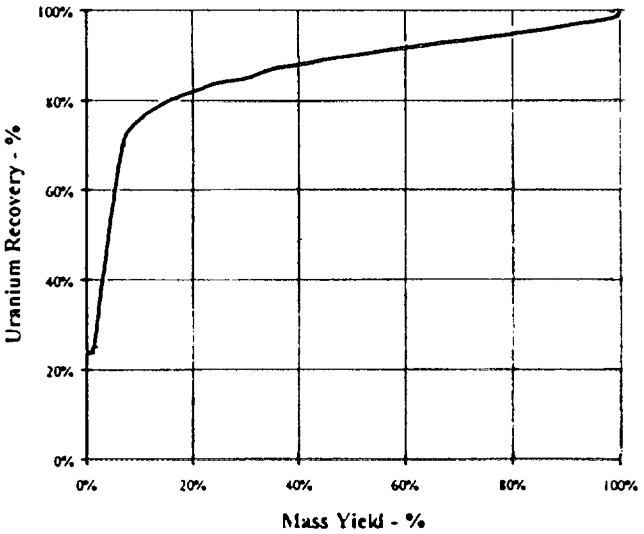


Figure 6

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## *Optimum Hydro-Metallurgical Plant Feed Grade*

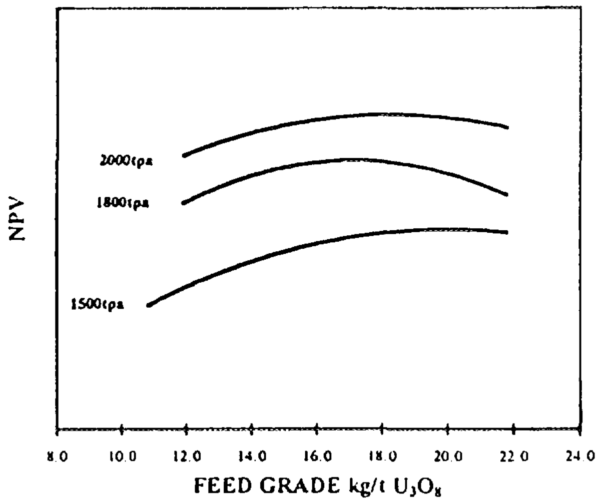


Figure 7

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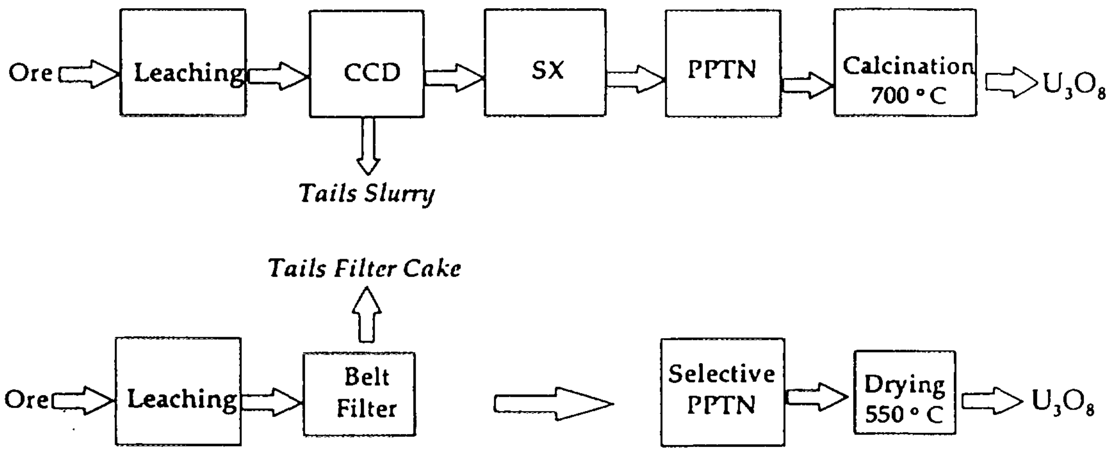
## *Kintyre's Simple Flowsheet*

### *Most Common*




### *Kintyre*

Figure 8