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## Australia's Faltering Uranium Revival

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The existence of uranium in Australia has been known since the 1890s. In the 1930s ores were mined at Radium Hill in South Australia to recover minute amounts of radium for medical purposes. As a result a few hundred kilograms of uranium were also obtained and used mostly to produce colours in glass and ceramics.

The first major producer of uranium in Australia was the government-owned Rum Jungle project in the Northern Territory which operated from 1954 to 1971. It was closely followed by Radium Hill in South Australia, then Mary Kathleen in Queensland.

As a result of intensive exploration in the late 1960s, Australia began to emerge as a potential major source of uranium for the world's nuclear electricity production. At the beginning of the 1970s a series of important discoveries was made, particularly in the Northern Territory. Ranger, Jabiluka, Koongarra and Nabarlek, all in the Northern Territory; Yeelirrie in Western Australia; and Olympic Dam (Roxby Downs) in South Australia.

Ranger started in 1980 and is operated by Energy Resources of Australia Ltd. Nabarlek opened in 1979 and the mill operated to 1988, then allowing the site to be rehabilitated with conspicuous success. Olympic Dam opened in 1988 and is part of WMC Ltd.

### **Resources**

Today Australia's share of the world's uranium resources in the low cost category is about 25%, according to the 1998 "Red Book" (see Table 1). Other countries with major uranium deposits are Canada and Kazakhstan.

Australia in 1998 supplied about 14% of the world's ex-mine uranium (7.5% of reactor demand) from two mines, Ranger and Olympic Dam. (Uranium directly from mines provided 54% of the world demand, the balance being from utilities' stockpiles, military material and recycled material.) Australian suppliers see some scope for further mine production in the market place over the next couple of decades, though low prices suggest the expectation that ex-military supplies may take up some of the slack.

### **Uranium Production**

The Ranger mine opened in 1981 at a production rate of about 3300 tonnes of U<sub>3</sub>O<sub>8</sub> (2800 tU) per year and has since been expanded to 6000 tU<sub>3</sub>O<sub>8</sub>/y

(5090 tU/y) capacity. In 1999 it has reduced production to 4000 tU<sub>3</sub>O<sub>8</sub> (3400 tU) due to softer markets while it develops the adjacent Jabiluka mine. Sales are to Japan, South Korea, France, Spain, Sweden, Germany, the UK, Canada and the USA. Ranger is owned by Energy Resources of Australia Ltd (ERA).

During 1988 the Olympic Dam project, then a joint venture of Western Mining Corporation and BP Minerals, began operations. This is a large underground copper mine in central South Australia, producing significant gold and uranium by-products. Annual production capacity has been recently increased to 4600 tU<sub>3</sub>O<sub>8</sub> (3900 tU), as part of a major A\$1.9 billion (US\$1.2 billion) expansion, primarily of the copper mining and refining process. Economies of scale achieved in the expansion reportedly reduced production costs by about 40%. Sales of uranium are to the USA, Canada, Sweden, the UK, Belgium, France, Finland, South Korea and Japan. The mine is now wholly owned by WMC Ltd.

Both Ranger and the now-closed and rehabilitated Nabarlek mines are on Aboriginal land in the Alligator Rivers region of the Northern Territory, close to the Kakadu National Park (in fact the Ranger and Jabiluka leases are surrounded by the National Park). Ranger is served by the township of Jabiru, constructed largely for that purpose. During the operation of Nabarlek mine, employees were based in Darwin and commuted by air (fly-in, fly-out).

The Olympic Dam mine is on formerly pastoral land in the middle of South Australia. A town to accommodate 3500 people was built at Roxby Downs to service the mine, and this has recently been expanded.

Production and exports from both mines are shown in Table 2. Australian uranium exports are depicted in Figure 1.

Two or three new mines are expected to come into production in the next couple of years (see below). Collectively these will increase Australian production capacity to over 12 500 tU<sub>3</sub>O<sub>8</sub>/y (10 600 tU) (see Figure 2).

## Government Policy

In 1975 the Australian government set up the Ranger Uranium Environmental Inquiry — often referred to as the “Fox Inquiry”, to investigate and advise on both uranium policy in general and on uranium mining in the Northern Territory’s Alligator Rivers area in particular. It lasted almost two years, heard 300 witnesses and produced two reports.

Following publication and consideration of the inquiry’s reports, the Liberal Party federal government announced in August 1977 that it would approve the development and export of Australia’s uranium. To enable mining of the three main orebodies in a region also proposed for a large national park, the Kakadu National Park was set up excluding from the outset the three mineral leases (Ranger, Jabiluka and Koongarra). The approval was subject both to stringent environmental requirements and safeguards to prevent the diversion of uranium from peaceful uses. These export arrangements, involving the application of both international and bilateral safeguards, have remained virtually unchanged through successive governments. However, in other respects federal government uranium policy has varied.

In 1983 the Australian Labor Party (ALP) government of Prime Minister Hawke was elected, and early in 1984 the ALP National Conference amended the party platform to what became known as the “three mines policy”. Ranger and Nabarlek were then operating, and these two plus the proposed Olympic Dam mines were nominated as the only projects from which exports would be permitted. Provisional approvals for marketing from other prospective uranium mines were cancelled. Proposals for Jabiluka, Koongarra and Yeelirrie were shelved, although in most cases mining, environmental and Aboriginal approvals had been obtained. There were even sales commitments for several years’ production from Jabiluka.

Also in 1983 the Australian government banned uranium exports to France because of its nuclear testing programme in the South Pacific. This ban cut across contractual arrangements then in place between Queensland Mines and Electricité de France (EDF) for supply of uranium from the Nabarlek mine. The Australian government therefore purchased this uranium for its stockpile.

In 1984 the Australian Science and Technology Council (ASTEC) report on Australia’s role in the nuclear fuel cycle, commissioned by the Labor government, recommended not only proceeding with uranium mining, but also becoming involved with other stages of the fuel cycle such as enrichment.

In August 1986 the embargo on exports to France was lifted and supplies from Nabarlek to EDF resumed. In 1987 ERA signed a contract with EDF for the supply of uranium from the Ranger mine. However, early in 1988 the Labor Party resolved not to permit any further uranium contracts with France, or the extension of existing contracts. The ban was later (in 1994) made more specific, to ban further contracts until France entered the Comprehensive Test Ban Treaty (CTBT).

Meanwhile, the so-called “three mines” policy was being increasingly seen as illogical, and in 1988 the Labor Party established a committee to review it (by then only two mines were operating anyway). This recommended that

the federal government should relax the policy so that other orebodies could be developed. The report also recommended that uranium enrichment should be allowed in Australia. Despite these recommendations (and similar ones from the Industry Commission), at its National Conference in 1991 the ALP left its uranium policy unchanged.

In 1996 a Liberal/National Party coalition government came to power and uranium mining was then treated the same as any other mining, except that export controls remained as before, to effect non-proliferation objectives. Although expansion plans for Ranger and Olympic Dam were pending (the former in the light of stronger world uranium markets), proposals for Jabiluka and other mines were then able to be brought forward and other prospects re-examined.

The ban on exports to France was initially continued by the new government. However, in October 1996, following France's signing of the CTBT and its decision to end production of fissile material for weapons, the ban was lifted. In January 1997 WMC Ltd signed a long-term uranium contract with EDF.

In 1998 the ALP National Conference, with the Labor Party in opposition, adopted a "no new mines" policy, to the effect that it will not allow any new uranium mines to be developed after it regains office, but will allow those which have gained full approvals to proceed.

### **Indigenous Land Rights**

This is a complex area, and native title issues are currently having considerable impact on mineral exploration generally, particularly in northern and Western Australia. By way of preamble: the proportion of self-acknowledged Aboriginals in the population is about 2%, and most of these are not traditional in lifestyle.

The Northern Territory Land Rights Act 1976 (a federal law) has resulted in about half of that (putative) state becoming Aboriginal land. This at least clarifies ownership and enables negotiation to proceed regarding exploration or mining access, subject only to traditional owners' agreement.

Elsewhere in Australia the concept of native title is largely more recent and continues to be clarified through legislative change by the federal and state parliaments and through judicial interpretations. The full impact of it may not be evident for 20 years.

The federal Labor government passed a flawed 1993 Native Title Act, which has not properly been rectified since, and state governments and the Northern Territory government have yet to pass matching legislation. As a result of this federal act, Aboriginal land claims (often overlapping) cover about half of the country. It is likely to take some years to process and determine all of these claims. In the meantime there will be delays and additional costs associated with negotiating access to land, particularly for exploration purposes. However, the advent of native title has not stopped or significantly delayed any ongoing resource developments which have passed the exploration stage. Amendments to the act in 1997 improved the situation slightly.

Aboriginal people receive royalties of 4.25% on sales of uranium from Northern Territory mines. The total received is now over A\$160 million (US\$100 million), mostly from Ranger.

Olympic Dam in South Australia is on a freehold lease and is not affected by any native title claim. Ranger and Jabiluka in the NT are on Aboriginal land, granted to traditional owners in 1977, and ERA has secure leases. Beverley and Honeymoon in South Australia are on land which is under claim, but agreements with claimants are in hand.

### **Environmentalism Opposition**

There is ongoing opposition to uranium mining from the green lobby in Australia. This dates from the early 1970s and is essentially ideological, in my view. The main green groups are the Australian Conservation Foundation (ACF), Greenpeace, the Wilderness Society, and Friends of the Earth (FOE), in order of decreasing activity and influence. The Movement Against Uranium Mining is affiliated with FOE and publishes a quarterly journal. A very vocal Jabiluka Action Group is closely linked with ACF, the Wilderness Society and FOE.

It is starting to dawn on the ACF and Greenpeace that both opposing uranium mining and making a fuss about global warming is straining credibility. Greenpeace has largely abandoned its active opposition to uranium as such. The main pressure, with attendant media action this year, has been focused on the Jabiluka mine proposal.

The anti-Jabiluka protest was initially conducted under the banner of "Saving Kakadu" (National Park). This basis is fraudulent because the three mineral leases in that area (Ranger, Jabiluka and Koongarra) were granted before the national park was set up in 1979 and 1984, and were then quite deliberately excluded from it 20 years ago so that uranium mining could proceed without disturbing it.

The major Ranger operation over 19 years has not led to any damage to the national park and Jabiluka is even less likely to do so. It involves land disturbance of less than 20 hectares and all wastes will be contained. Meanwhile, there are some real ecological threats to the Kakadu National Park (aquatic weeds, exotic grasses, the relentless advance of the introduced and toxic Cane Toad, and fire management), but they are not being addressed by any of the environmental groups or protesters. Incidentally the national park is now some 198 000 square kilometres, about the size of Israel, or half the size of Switzerland.

A June 1998 Newpoll, commissioned by the ACF, has been much quoted. In response to the loaded and misleading question, "Do you yourself support or oppose the development of the Jabiluka uranium mine within the Kakadu National Park?", of the sample of 500, 67% were opposed, 17% supported, with 16% neutral/do not know. This was less negative than it might have been, given the wording of the question and the fact that the poll was conducted in three major cities. Women opposed were 73%. This certainly shows why the green groups are working the "Kakadu National Park" theme as hard as they can. A 1996 Australian Bureau of Statistics survey showed that Australians give a very high priority to environmental protection relative

to economic growth, but with uranium mining and use being way down the list of concerns when unprompted, at about 5%.

Jabiluka protesters increasingly play on the theme of Aboriginal land rights, pointing out that the current traditional owner of the land concerned is opposed to the mine. She, with a small group of protesters carrying cans of paint, hand-held flares and egg bombs, was arrested in July 1998 for trespass on the mine site. That case was heard, held over for six weeks, and she was then found guilty on the basis that her actions were not those of a person pursuing their cultural activities on the land, which was granted for that purpose. It was her father who signed the original mining agreement, which has been upheld since. The Jabiluka project is also supported by other local Aboriginal people and by many members of the (Aboriginal) Northern Land Council.

In the Northern Territory, whose economy depends substantially on mining, and whose mining future depends substantially on Jabiluka proceeding, there is little support for the protesters and they are generally seen as "southern ferals". A protest camp near the mine site was occupied during the drier part of 1998, and was popular during the mid year (between semester) university vacation, but declined thereafter. It has not been revived in 1999. Anti-Jabiluka efforts in the first half of the year were directed at international lobbying to bring pressure to bear through UNESCO. This largely failed, as the World Heritage Committee realised the lack of substance in the environmental case against the mine, and that they were being manipulated.

### **Mines and Deposits**

Presently the situation at each of the uranium mines and deposits in Australia is as follows (see also Figure 3):

**Ranger** has undergone a mill expansion to enable it to produce over 5000 tU<sub>3</sub>O<sub>8</sub> (4200 tU) per year from Ranger ore, or at least 6000 tU<sub>3</sub>O<sub>8</sub> (5100 tU) if using a blend of Jabiluka ore. However, it is now running at 4000 tU<sub>3</sub>O<sub>8</sub> (3400 tU) per year production rate. If the mill depends wholly on Ranger, ore from there will be depleted by 2010 unless some of its measured and indicated resources are proven, which would give up to a further 16 years of production. The actual Ranger #3 orebody will be mined out in 2004 in any case and the mill run from stockpiled ore.

**Jabiluka** mine construction has started nearby, and some 1870 metres of underground development is complete, including the 1150 metre access decline. ERA is undertaking detailed evaluation of the orebody to develop a mining plan. This orebody has 90 400 tU<sub>3</sub>O<sub>8</sub> (77 000 tU) and hence will be able to maintain local output for many years. ERA prefers to mill the ore at the existing Ranger mill, 22 km away, but this is not yet agreed with the traditional owners. Production will be phased in from 2001 to 2009 as Ranger #3 ore is depleted.

**Olympic Dam** has completed and commissioned its expansion to 4600 tU<sub>3</sub>O<sub>8</sub> (3900 tU) per year, plus enhanced copper output (uranium is by-product). It has reserves of 356 000 tU<sub>3</sub>O<sub>8</sub> (302 000 tU), plus even greater indicated resources, hence a projected mine life of more than a century.

**Beverley** in South Australia has resources of 21 000 tU<sub>3</sub>O<sub>8</sub> (17 800 tU). Heathgate Resources, an affiliate of General Atomics, undertook very successful in situ leaching (ISL) field trials in 1998 and now has all approvals in place to proceed with mining. Construction of the ISL mine is under way and production at 1000 tU<sub>3</sub>O<sub>8</sub> (850 tU) per year is expected by mid 2000.

**Honeymoon**, in the same region of SA as Beverley, has resources of 6800 tU<sub>3</sub>O<sub>8</sub> (5800 tU). Southern Cross Resources is aiming for similar ISL production to commence in 2000. Its treatment plant is already largely built (dating from the early 1980s, now refurbished).

**Manyingee** in Western Australia has a resource of nearly 8000 tU<sub>3</sub>O<sub>8</sub> (6800 tU) and development plans are under consideration by Paladin Resources for in situ leaching.

**Kintyre** in Western Australia has resources of 36 000 tU<sub>3</sub>O<sub>8</sub> (30 500 tU), and had plans to produce some 2000 tU<sub>3</sub>O<sub>8</sub> (1700 tU) per year from a very small plant. However, it is not at this stage proceeding with development and the project is on care and maintenance.

**Koongarra**, the prospective third mine in the Alligator Rivers region of the NT, is undergoing feasibility study with a view to possibly proceeding with development. It has reserves of 14 500 tU<sub>3</sub>O<sub>8</sub> (12 300 tU).

**Ben Lomond**, a small deposit containing some molybdenum, was under consideration for development, but is not now likely to proceed due to the Labor government in Queensland.

**Westmoreland**, in northwest Queensland, has some 21 000 tU<sub>3</sub>O<sub>8</sub> (17 800 tU) resources but there are no development plans. The project is similarly devalued by the political context.

**Valhalla**, near Mount Isa in northwest Queensland, is a deep orebody with some 26 000 tU<sub>3</sub>O<sub>8</sub> (22 000 tU) of resources. Summit Resources has had some spirited disagreements with the state Labor government. Geological and metallurgical work during 1998 and 1999 has been encouraging.

**Yeelirrie**, in Western Australia, is uneconomic at present uranium prices and is on care and maintenance. It has indicated resources of 52 000 tU<sub>3</sub>O<sub>8</sub> (44 000 tU) and is the world's largest calcrete uranium deposit. It is owned by WMC Ltd.

### Uranium Exploration in Australia

Following requests from the British and United States governments, systematic exploration for uranium began in 1944. In 1948 the federal government offered tax-free rewards for the discovery of uranium orebodies. As a result several significant discoveries were made in 1949-56 in northern Australia. These were developed primarily for weapons programmes at that time.

The development of civil nuclear power stimulated a second wave of exploration activity in the late 1960s, and most of Australia's major orebodies were discovered as a result (see Figure 4). This phase was marked

by the involvement of major companies with large budgets, using advanced exploration techniques and equipment.

Exploration expenditure decreased during the period of the Labor government of 1972-75 due to particular government policies, although that government supported uranium development and took equity in both Mary Kathleen and Ranger.

Stimulated by buoyant prices, expenditure increased again after 1975 until the advent of a further Labor government in 1983. Labor policy by then had become inimical to new uranium development, and exploration expenditure generally declined to the mid 1990s as a result, but also in sympathy with low uranium prices.

Australia's known uranium resources have increased little since 1982, which may be correlated with diminished exploration expenditure. (By way of contrast, over the last ten years, uranium exploration in Canada has proceeded strongly, resulting in its known resources increasing by 62%.)

In the three years to 1998 there was a resurgence of uranium exploration, including the float of a company, Acclaim Uranium NL, set up for this purpose, and the funding of a number of programmes by other companies. But native title problems and ALP policy have dampened this. In 1999 the main uranium exploration seems to be by Cameco Australia, which is spending A\$4 million (US\$2.6 million) investigating evident geological similarities between Arnhem Land (NT) and northern Saskatchewan.

In the next few years the level of exploration for uranium will inevitably depend on expectations of whether a Liberal/National coalition or a Labor government will be in power when the time comes to develop anything, though the level of actual uranium production in the short term will be little affected.

With a few years of energetic exploration, if that eventuates, it is likely that Australia's known uranium resources could be increased significantly.

### **Pangea International Repository Proposal**

In March 1999 Pangea Resources unveiled its plans for an international repository for high level nuclear wastes. It suggests that such a deep geological repository might very suitably be located somewhere in a large tract of outback Australia, due to its stable geology and stable political tradition. Participants are BNFL of the UK, NAGRA of Switzerland, and EHL of Canada (the holding company of Golder Associates). So far about A\$10 million (US\$6.5 million) has been invested in the venture. Both BNFL and Nagra form part of the in-house technical group. Pangea intends to widen the organisation to include Australian partners and to interact closely with Australian industry.

The decision to concentrate effort on Australia was the result of adding to the fundamental safety arguments considerations of a societal and political nature, and to a lesser extent, economics. The result is that Pangea is focusing on extensive contiguous sedimentary basins extending from central Western Australia into northern South Australia. The repository would be a commercial undertaking and would have dedicated port and rail

infrastructure. It would take spent fuel and other wastes from commercial reactors, and possibly also material from weapons disposal programmes.

Pangea has submitted its project proposal to the Australian government, though the initial response from the Industry Minister, Senator Minchin, was to reiterate Australia's long standing and bipartisan policy of not importing nuclear wastes and saying that he had no immediate intention of considering the proposal.

The project concept envisages a dedicated port and rail link to an inland repository site covering perhaps 5 km<sup>2</sup> on the surface and 20 km<sup>2</sup> underground (500 metres down). There would be a fleet of 35 dedicated and purpose-built ships, built locally. Pangea's business plan is based on taking 75 000 tonnes of spent fuel and high level waste from reprocessing spent fuel, plus some intermediate level wastes from decommissioning nuclear facilities, over some 40 years. Spent fuel would be shipped at a rate of about 3000 tonnes per year once it was fully operational. The projected size of the repository is thus similar to that proposed at Yucca Mountain, Nevada. The capital cost is estimated at A\$10 billion (US\$6.5 billion), with some A\$700 million (US\$450 million) per year operating cost, which would add about one percent to Australian GNP.

An economic study projects total export revenues over 40 years of about A\$200 billion (US\$130 billion), with payments to governments of about A\$90 billion (US\$60 billion) in 1998 dollars before considering multiplier effects. The project envisages establishment of a shipyard and foundry for the manufacture of 70 specialised ships and some 3000 large stainless steel transport casks, as well as port and fleet maintenance facilities. Direct employment would be about 2000, indirect about 6000 people.

It remains to be seen whether this proposal will win sufficient support for it to proceed. But since Pangea does not anticipate opening for business before 2009, there will be plenty of time for the dissemination of information and measured consideration of the project among Australians, including traditional Aboriginal landowners.

Table 1. Estimated recoverable resources of uranium ( $tU_3O_8$ ). (Note: 1 tU = 1.1793  $tU_3O_8$ )

Country	Resources	% of total
Australia	894 000	25%
Kazakhstan	681 000	19%
Canada	507 000	14%
South Africa	335 000	9%
Namibia	291 000	8%
Brazil	281 000	8%
Russia	195 000	5%
USA	130 000	4%
World total	3 638 000	

Reasonably Assured Resources plus Estimated Additional Resources category 1, to US\$80/kg U (US\$31/lb  $U_3O_8$ ) from *Uranium: Resources, Production and Demand 1997*, OECD NEA and IAEA, 1998. Brazil, Kazakhstan and Russia figures above are 91% of in situ totals.

Table 2. Australian uranium production and exports.

	1990-1	1991-2	1992-3	1993-4	1994-5	1995-6	1996-7	1997-8	1998-9
Production ( $tU_3O_8$ )	4389	4349	2704	2751	2632	5105	5995	5797	6396
Exports ( $tU_3O_8$ )	6129	4729	2289	3992	4069	5286	5701	6415	5989*
Export value (A\$ million)	332	244	122	193	188	242	245	288	288*

**Notes:** Exports in 1993-4 and 1994-5 included respectively 239  $tU_3O_8$  and about 900  $tU_3O_8$  from government stockpile.

In calendar year 1995 production was 4377  $tU_3O_8$  and exports 3727  $tU_3O_8$ .

In calendar year 1996 production was 5866  $tU_3O_8$  and exports were 5424  $tU_3O_8$ .

In calendar year 1997 production was 6473  $tU_3O_8$  and exports were 6916  $tU_3O_8$ .

In calendar year 1998 production was 5799  $tU_3O_8$  and exports were 5553  $tU_3O_8$  (preliminary).

Figure 1. Australian uranium exports 1986-99 (tU<sub>3</sub>O<sub>8</sub>) (years to 30 June).

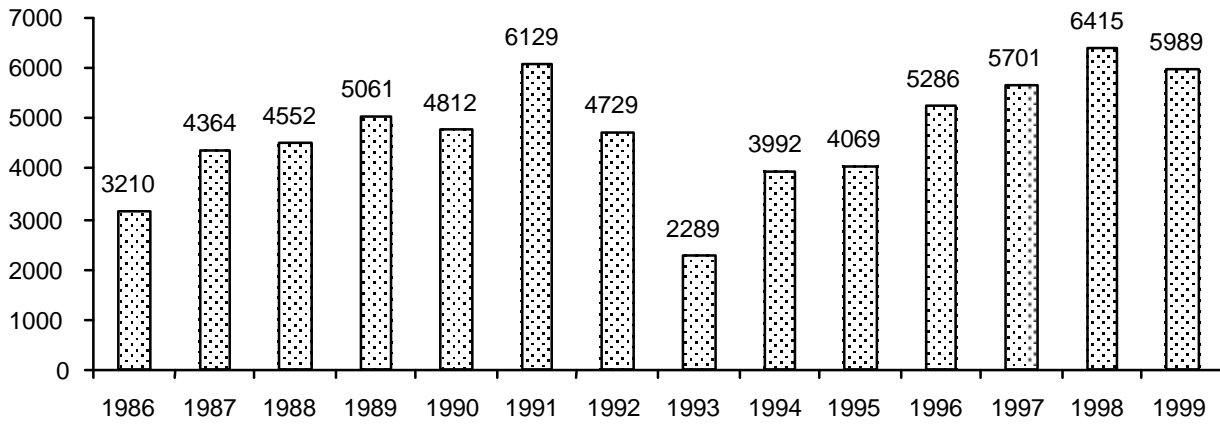


Figure 2. Cumulative production from Australia's uranium mines.

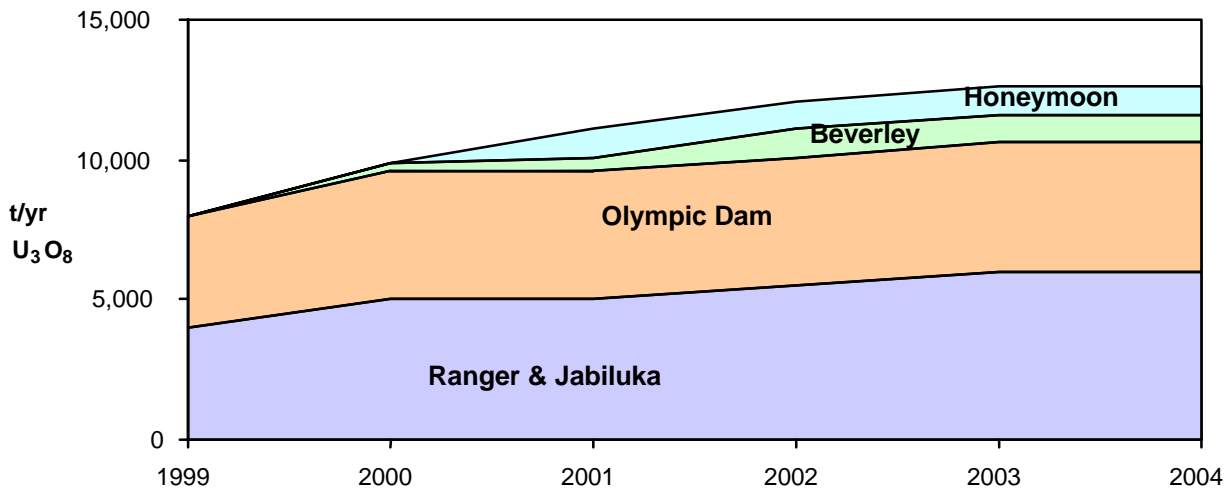


Figure 3. Uranium deposits and mines in Australia.

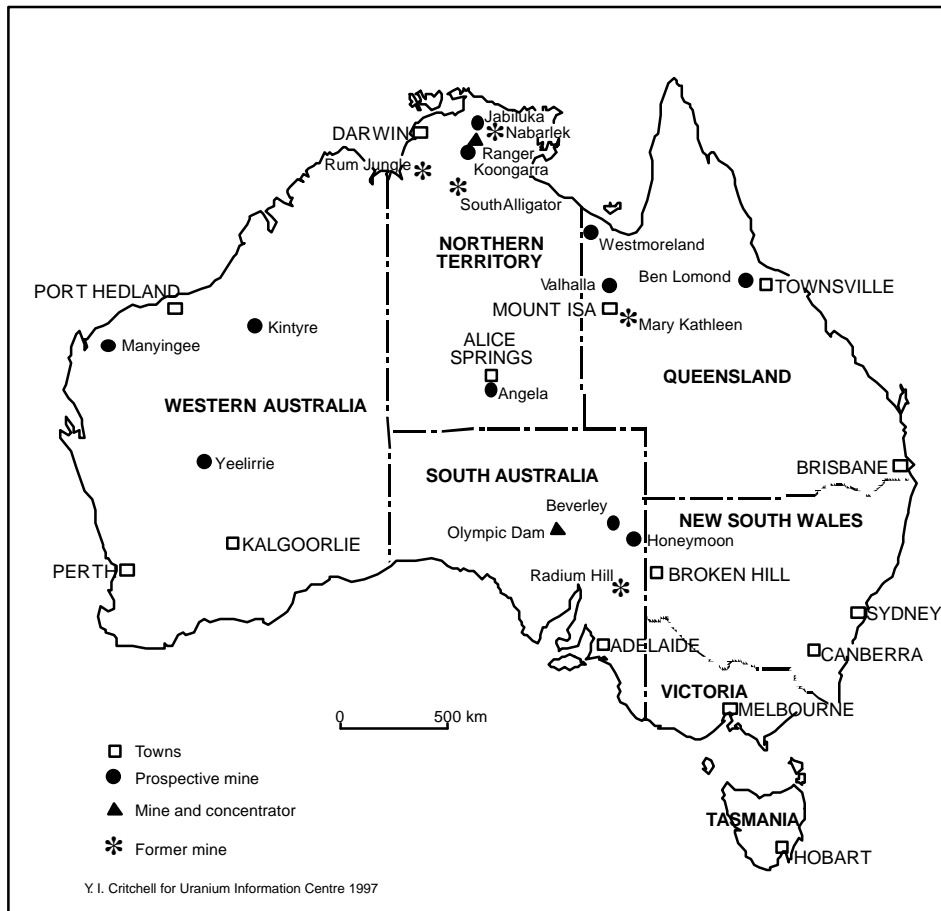
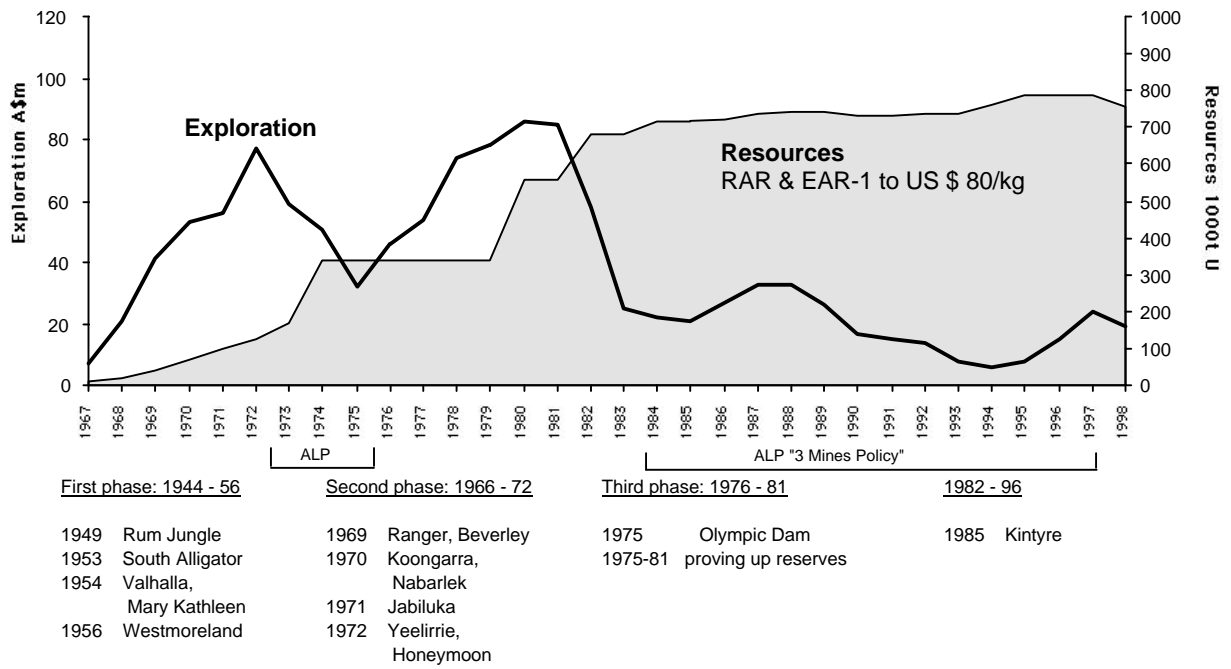


Figure 4. Exploration expenditure and known uranium resources in Australia.



Appendix

The following companies are the main ones involved in uranium exploration in Australia, or are holding assets pending their development as mines.

<b>Company</b>	<b>Management base for U</b>	<b>Main Australian uranium interests</b>
Acclaim Uranium NL ♦	Perth	Wide portfolio of WA deposits
AFMEX P/L (COGEMA Australia P/L)	Perth	Arnhem Land, NT, Ben Lomond*, Qld
Black Range Minerals NL ♦ (was Uranium Australia NL)	Perth	Angela*, near Alice Springs, NT Arnhem Land, NT; Frome Basin, SA
Cameco Australia P/L	Darwin	Arnhem Land, NT
Heathgate Resources P/L	Adelaide	Beverley*, Frome Basin, SA
Koongarra Mines P/L (COGEMA Australia P/L)	Darwin	Koongarra*, Alligator Rivers, NT
Paladin Resources NL ♦	Perth	Manyingee*, WA, also Frome Basin, SA, Yilgarn, WA (with Brightstar, JV)
PNC Exploration (Aust) P/L	Sydney	Arnhem Land, NT
Rio Tinto Ltd ♦	Perth	Kintyre*, WA Westmoreland*, NW Qld
Sedimentary Holdings NL ♦	Melbourne	35% interest in Southern Cross Resources
Southern Cross Resources Inc	Brisbane	Honeymoon*, Frome Basin, SA
Summit Resources NL ♦	Perth	Valhalla*, near Mount Isa, Qld
Uranium Australia NL ♦	Perth	Angela*, near Alice Springs, NT Arnhem Land, NT; Frome Basin, SA
WMC Resources Ltd ♦	Adelaide	Yeelirrie*, WA

♦ Listed on Australian Stock Exchange

\* Identified deposit.

