

# Overview

## Overview of mineral exploration in Western Australia for 2008–09

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### Abstract

Globally, the 2008–09 year was perhaps a once-in-a-generation event, which had monumental impacts on Western Australia. Although the financial year started with ‘boom’ conditions in the mining industry, the residential housing sub-prime mortgage debt problems in the USA expanded into a global financial crisis by late 2008, and numerous major economies slipped into recession by the end of 2008 and early 2009. One of the main drivers of the world economy, China, slowed its growth rate and the world-wide demand for metals also plunged. Commodity prices plunged too, and many mining companies struggled under conditions of reduced cash flow (or being cash negative) at a time of excessive debt. Numerous mines closed, reducing mine supply, but the world-wide demand for metals was even weaker. Capital for exploration and mine development was exceedingly difficult to obtain. Even ‘letters of credit’ for shipments of iron ore were difficult to obtain at one stage. In addition, unemployment and part-time employment in the mining sector increased.

In Western Australia, numerous operating mines closed or officially went into ‘care and maintenance’ mode. The nickel sector was hit particularly hard as prices had retreated by around 45% over the previous year. Despite these conditions, the value of mineral production in the State increased by 24% to a new record of \$50.3 billion (excluding petroleum) in 2008–09. This was largely due to the dominance of the iron ore sector in Western Australia’s minerals industry, and to contract prices for iron ore that had been set in the previous year. The value of iron ore production in Western Australia rose 53% for the year! Despite one-year fixed contracts, shipments of iron ore from Western Australia were still occasionally ‘deferred’ during the year or prices renegotiated (against a backdrop of markedly lower spot prices).

As expected, attempts to preserve cash and capital meant that exploration, especially for new deposits, largely stalled. Across Australia, mineral exploration expenditure declined by 12% for the year, with drilling (metres drilled) at existing deposits falling by 11% but drilling for new deposits plunging by 30% (comparable WA-specific data for metres drilled are not available).

In Western Australia, the trend was similar but the magnitude of the falls was less — as mineral exploration expenditure in Western Australia declined during 2008–09 by only 4% (in 2008–09 dollar terms). However, the area held under granted Exploration Licences in Western Australia fell by 22% by the end of 2008–09, but the area under granted Mining Leases actually increased marginally.

By mid-2009, the global markets were more stable, showing signs that the worst of the global crisis was over. Many companies were raising capital through sale of shares and sovereign wealth funds (particularly from China) emerged strongly as providers of new capital.

**KEYWORDS:** mineral exploration, exploration expenditure, mineral production, gold, iron, nickel, base metals, copper, lead, zinc, silver, diamond, heavy mineral sands, uranium, molybdenum, rare earth elements, vanadium, lithium, coal, antimony, tungsten, manganese, exploration drilling, Exploration Incentive Scheme (EIS), tenements, Western Australia

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Significant observations for the Western Australian mineral industry during 2008–09 include:

- Mineral exploration expenditure in Western Australia decreased by 4% from \$1298 million in 2007–08 to \$1247 million\* in 2008–09 (Fig. 1, in 2008–09 dollar terms).
- Australian mineral exploration expenditure decreased by 12% from \$2536 million in 2007–08 to \$2223 million in 2008–09 (in 2008–09 dollar terms).
- Western Australia’s share of national exploration expenditure for minerals (excluding petroleum) increased from 51% in 2007–08 to 56% in 2008–09, and is returning towards the level of around 60% experienced during the late 1990s and early 2000s (Fig. 1).
- Quarterly mineral exploration data indicate that the rate of decline in exploration expenditure in Western Australia was slowing in the June 2009 quarter (Fig. 2).

\* All \$ figures in Australian dollars unless otherwise specified. All exploration expenditure figures and drilling statistics are compiled by the Australian Bureau of Statistics unless otherwise specified.

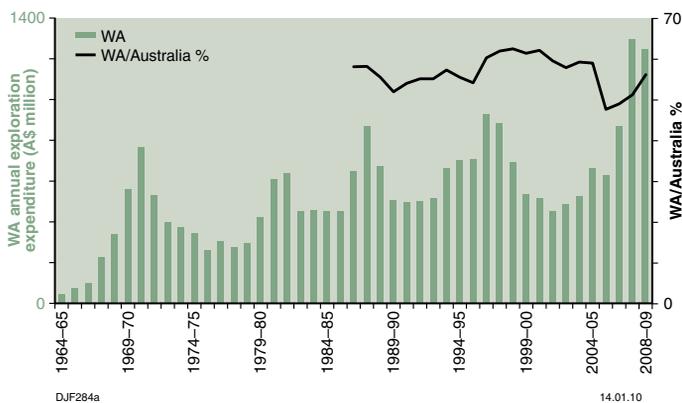


Figure 1. Mineral exploration expenditure in Western Australia, by year (2008–09 dollars)

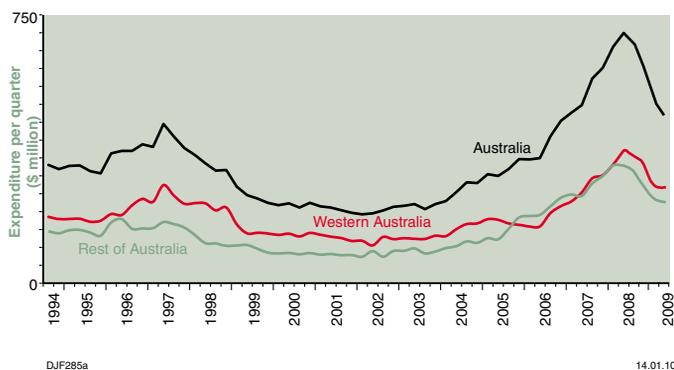


Figure 2. Mineral exploration expenditure for Australia, Western Australia, and the rest of Australia (seasonally adjusted, June 2008–9 dollars)

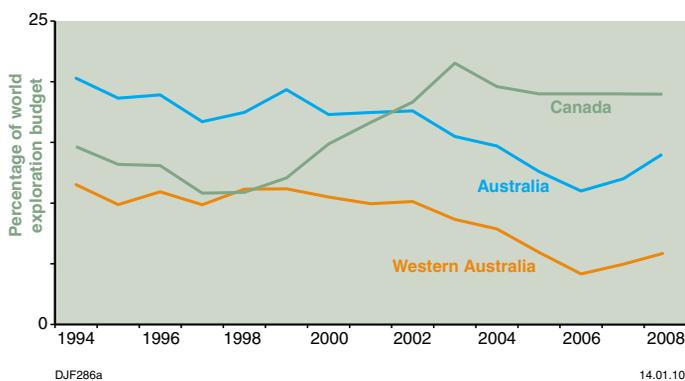


Figure 3. Non-ferrous mineral exploration expenditure — comparative market share of Canada and Western Australia since 1994 (source: Metals Economics Group (Canada), Australian Bureau of Statistics, and Department of Mines and Petroleum)

- Iron ore continued to be the key commodity for 2008–09. The value of Western Australian iron ore production increased by a remarkable 53% to \$30.6 billion and iron ore exploration expenditure increased by 29% to \$559 million.
- The world gold price reached a 25-year high (in US\$ terms), but the gold industry in Western Australia remained fairly subdued in 2008–09. The good news was the first production of gold–copper concentrate from Newmont Mining Corporation’s Boddington mine in mid-2009, and the beginning of a feasibility study of the 5 M oz Tropicana project, where commissioning is expected in 2013.
- Although the production of nickel increased by 3.5% the value of production decreased by 42%, reflecting the dramatic drop in nickel prices in late 2008 and early 2009. The fall in nickel prices has also resulted in the suspension of production from more than 10 nickel mines in Western Australia.
- The pro-uranium policy of the State Government continues to have a positive impact on the uranium sector, with numerous projects advancing, and with some being considered for mine development in the medium term. These include Yeelirrie (BHP Billiton Ltd), Lake Maitland (Mega Uranium Ltd, Itochu Corp. and Japan Australia Uranium Resources Development Co. Ltd), Lake Way (Toro Energy Ltd), Kintyre (Cameco Corp. and Mitsubishi Corp.) and Mulga Rock (Energy and Minerals Australia Ltd).
- Despite much bad news during the year, there were quite a few discoveries announced. This was to be expected, with so much spent on exploration during recent years finally coming to fruition. Discoveries include the high-profile DeGrussa massive sulfide discovery in the Proterozoic Bryah Basin, as well as Archean volcanogenic massive sulfide prospects at Bentley, Austin, and Evelyn. Gold discoveries include Musket (Higginsville), whereas iron ore discoveries include Feather Boa (Robertson Range) and Woggaginna and Jigalong (east of Newman). In addition, there were many maiden resource estimates at iron ore deposits and some also for uranium deposits.

During the last decade, the proportion of the world’s non-ferrous mineral exploration expenditure in Australia has decreased from 18% to 14% (Fig. 3, based on data compiled by the

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Metals Economics Group of Halifax, Canada, (<www.metalseconomics.com>), of which, Western Australia's share has decreased from 11% to 6%. The sharp decline from 2002 levels in both Western Australia and Australia appeared to have bottomed in 2006 at 4% and 11% respectively, with a marginal rise in 2008 to 6% and 14%. Western Australia is actively working towards improving its competitiveness to attract investment by positive programs such as the Exploration Incentive Scheme (EIS).

The Exploration Incentive Scheme (EIS) is a State Government initiative to encourage exploration in Western Australia for the long-term sustainability of the State's resources sector. EIS will enhance the image of Western Australia as an attractive destination for mineral and energy exploration investment. This \$80 million initiative, funded by Royalties for Regions over five years, will stimulate increased private sector resource exploration and ultimately lead to new mineral and energy discoveries. Further details of EIS are provided in the accompanying article (Exploration Incentive Scheme, by Margaret Ellis).

## Developments and mineral exploration highlights by commodity

During 2008–09, exploration expenditure for iron ore continued its record-breaking run, but exploration for the other major commodities of gold, nickel, and base metals decreased (Figs 4 and 5).

### Gold

Trends in the gold industry in Western Australia during 2008–09 include:

- The international gold price, in A\$ terms, rose 28% — from an average of \$918/oz in 2007–08 to an average of \$1171/oz in 2008–09. In US\$ terms, the increase during the same period was 6.2% from US\$823/oz to US\$874.
- Gold production fell by 4% to 135 610 kg, but the value increased by 25% to \$5.2 billion. The top ten gold producing mines during 2008–09 were the Golden Mile Super Pit, Telfer, Kambalda – St Ives, Sunrise Dam, Jundee, Kanowna Belle, Agnew, Marvel Loch, Plutonic, and Higginsville.
- Despite the increase in gold prices, expenditure on gold exploration in Western Australia in

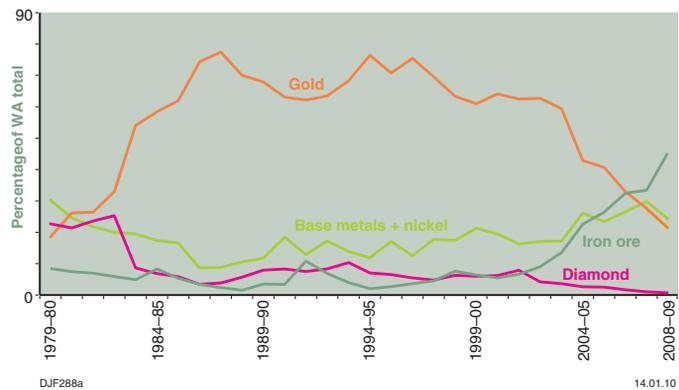


Figure 4. Exploration expenditure in Western Australia since 1979–80 (% of total, by commodity)

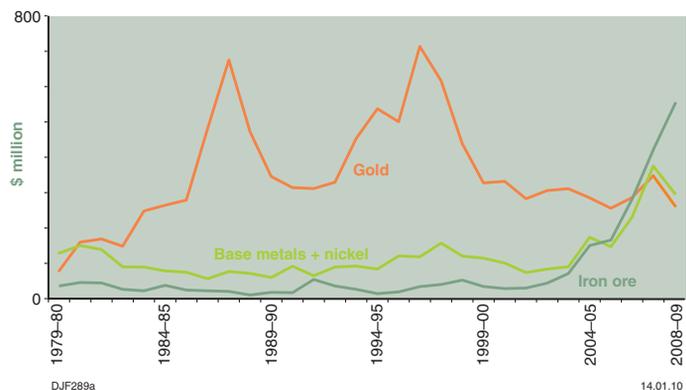


Figure 5. Gold, base metals + nickel, and iron ore exploration expenditure in Western Australia since 1979–80 (2008–09 dollars)

2008–09 decreased by 27% to \$263 million, reversing the positive trend of the previous two years (Fig. 6).

Although gold exploration has been the backbone of the mineral exploration industry in Western Australia since the early 1980s (and reached levels of around 75% of the total mineral exploration expenditure in the mid-1990s), its proportion of total exploration expenditure during 2008–09 declined to 21% (Fig. 4). As a result, exploration expenditure for gold is now less than that for iron (Fig. 5), and is also below the combined exploration expenditure for nickel and base metals. An inadequate level of greenfields mineral exploration is of ongoing concern for the future of gold mining in the State.

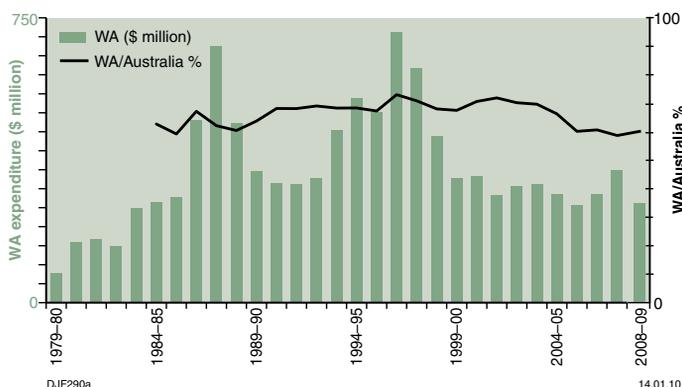


Figure 6. Gold exploration expenditure in Western Australia since 1979–80 (2008–09 dollars)

The most significant of the new mine developments for 2008–09 was the production of gold–copper concentrate from Newmont Mining’s Boddington project (100 km southeast of Perth) in mid-2009. The annual gold production from this operation in the first five years is expected to average around 1 million ounces (Moz) of gold. The deposit has estimated proven and probable reserves containing 20.1 Moz of gold, with an estimated mine life in excess of 24 years (Newmont Mining Corporation, 2009).

In mid-2009, the AngloGold Ashanti Ltd / Independence Group NL joint venture announced that it would begin a feasibility study into bringing the 5 Moz Tropicana project (340 km northeast of Kalgoorlie) into production. Construction of the remote mine and infrastructure could take around two years, with commissioning in 2013. Production is expected to be 330 000–410 000 oz of gold per annum, with a mine life of approximately 15 years (Haycock, 2009; Jacoby, 2009a).

Avoca Resources Ltd established Trident at Higginsville, about 53 km north of Norseman — the State’s third largest underground gold mine. Other planned underground mines include Chalice and Two Boys / Fairplay. New openpits include Fairplay, Mitchell, Musket, and Wills. The Higginsville plant is operating at 1.2 Mtpa. In 2008–09, the Trident mine produced 131 000 oz of contained gold, and Avoca is targeting production of more than 1 Moz contained gold over about 8 years (Avoca Resources Ltd, 2009).

Ramelius Resources Ltd expects its underground Wattle Dam mine, 25 southwest of Kambalda, to produce gold from June 2009, at an expected rate of 70 000 oz of gold up to third-quarter 2010 at

an estimated operating cost of \$385 per ounce. In addition, a diamond drillhole at Wattle Dam gold mine had an intersection of 5.5 m at 148 g/t of Au including 0.2 m at 1846 g/t Au and 0.6 m at 738 g/t Au. The results confirmed the down-plunge continuation of the high-grade zone at Wattle Dam (Ramelius Resources Ltd, 2009).

In other developments:

- Focus Minerals Ltd is mining at Coolgardie, with plans to produce 50 000 oz of gold in 2009. During the three months to December 2008, Focus increased its reserves at the Perseverance deposit of the project to 100 000 oz, giving the mine a two-year life (Focus Minerals Ltd, 2009).
- Silver Lake Resources Ltd poured its first tonne of pure gold from the Daisy Milano operation, 50 km southeast of Kalgoorlie, and processed it through its Lakewood gold processing facility, 5 km southeast of Kalgoorlie (Silver Lake Resources Ltd, 2009).
- Catalpa Resources Ltd is developing the Edna May gold project at Westonia. Edna May has reserves of 19.1 Mt at 1.2 g/t Au for 738 000 oz of contained gold (Miningnews.net, 2009).
- Integra Mining Ltd has confirmed a two-phase development of its Randalls project, 35 km east-northeast of Kambalda, with planned production totalling about 630 000 ounces of gold over 10 years (Integra Mining Ltd, 2009a).
- In late 2008, St Barbara Ltd began gold production from the Leonora operation (previously operated by Sons of Gwalia), with the first gold pour of around 1000 ounces. The deposit has more than 1.7 Moz of gold reserves grading 9 g/t Au, with an estimated mine life of more than nine years. The operation is forecast to produce 115 000 – 125 000 oz of gold in 2009 at a forecast operating cost of \$540–570 per ounce (Miningnews.net, 2008).

In the gold exploration sector, a number of companies had impressive gold intersections at various projects throughout Western Australia. These include:

- 24.1 m at 36.4 g/t Au and 17.7 m at 14.3 g/t Au at Athena lode of the Trident mine. At the Western Zone lode in the same mine there was an intersection of 48.3 m at 7.1 g/t Au and 33.4 m at 12.2 g/t Au (Avoca Resources Ltd, 2009).

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- 50 m at 5.75 g/t Au, 67 m at 2.75 g/t Au, and 49 m at 2.99 g/t Au at the Brilliant prospect of the Kurnalpi project (Carrick Gold Ltd, 2008, 2009).
- 27 m at 36.1 g/t Au (including 3 m at 114.8 g/t Au, 2 m at 121.8 g/t Au) at Barlee gold project, 140 km east of Paynes Find (Beacon Minerals Ltd, 2008).
- 42 m at 2.72 g/t Au from 32 m downhole at Blair North prospect at the East Kalgoorlie (Northern Mining Ltd, 2009).
- Drilling at Salt Creek, 35 km east-northeast of Kambalda, continued to produce good intersections including 56.45 m at 5.63 g/t Au, 40.5 m at 6.48 g/t Au, 1 m at 94.11 g/t Au, 0.6 m at 167.26 g/t Au, and 19.26 m at 10.48 g/t Au (Integra Mining Ltd, 2009b).
- Intersections of 5 m at 6.4 g/t Au from 3 m, including 1 m at 23.4 g/t Au and 15 m at 3.2 g/t Au from 34 m along strike of the Hawkeye deposit of the Hermes project in the Gascoyne Province (Alchemy Resources Ltd, 2009).
- 12 m at 6.86 g/t Au (including 4 m at 16.9 g/t Au) from 32 m, 5 m at 2.24 g/t Au from 36 m, and 3 m at 2.94 g/t Au from 34 m at Tregurtha prospect and 49 m at 1.17 g/t from 31 m, including 4 m at 4.78 g/t at Hughes prospect of the Lignum Dam gold project, 55 km north of Kalgoorlie (Pioneer Nickel Ltd, 2009a,b).
- 6.8 m at 15.73 g/t Au from 215 m, 3.4 m at 30.36 g/t Au from 216 m and 25.9 m at 16.56 g/t Au from 240 m at Two Mile Hill prospect near Sandstone (Troy Resources NL, 2009).
- 4 m at 31.2 g/t Au, 3 m at 23 g/t Au, and 1 m at 69.4 g/t Au at Paulsens mine, 105 km south of Pannawonica (Intrepid Mines Ltd, 2009).
- 8 m at 6.98 g/t Au from 12 m within a broader zone of 48 m at 1.62 g/t Au at Brierly prospect of the Turner River gold project (De Grey Mining Ltd, 2008).

## Iron

Highlights in Western Australia during 2008–09 include:

- Another year of record production quantity, production value, and exploration expenditure.
- The value of Western Australian iron ore production increased by a remarkable 53% to \$33.6 billion, although tonnage increased by only 8.5% to 316 Mt of iron ore.
- Western Australian expenditure on iron ore exploration has continued its 7-year stellar rise, climbing by 29% (to \$559 million) in 2008–09 compared to 2007–08, and more than 1133% over the last seven years (Fig. 7).
- Iron ore exploration in Western Australia now attracts the highest expenditure, and from last year surpassed gold exploration expenditure (Figs 4 and 5), accounting for 45% of the total exploration dollars spent in Western Australia. At present, over 130 companies are exploring for iron ore in Western Australia.
- Numerous mines, targeting zones of supergene enrichment, were either being developed or were at an advanced feasibility stage. The State has also moved significantly closer to developing its first iron ore mine producing a magnetite concentrate.
- Following several years of intense capital investment in expansion projects in the Pilbara, Western Australia's iron ore production is set to increase significantly over the next 5–10 years.
- Overseas companies (predominantly Chinese) continued to greatly increase their direct ownership or involvement (e.g. through

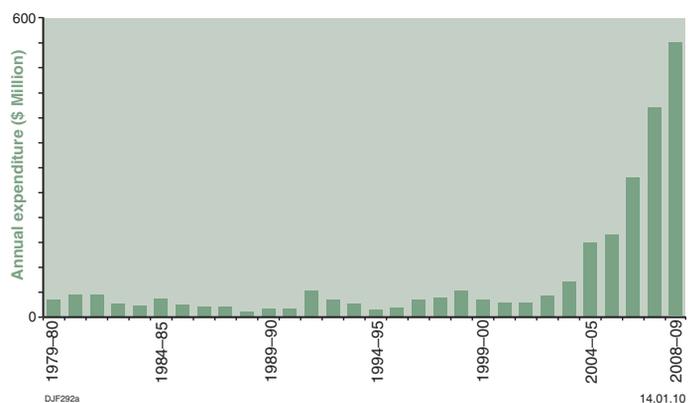


Figure 7. Western Australian iron ore exploration expenditure (2008–09 dollars)

long-term off-take agreements) in the Western Australian iron ore industry, all seeking to secure long-term supplies.

The unprecedented iron ore boom of the past three years continued, driven by extremely strong customer demand for iron ore, particularly from China, concomitant with a world-wide shortage of supply. The major producers in the Pilbara are responding rapidly by expanding their operations at existing projects and planning new ones. Also, the high iron ore prices have greatly assisted the capital-raising capabilities of junior companies. Consequently, a number of significant producers have emerged, for example Fortescue Metals Group Ltd (FMG), Atlas Iron Ltd, and foreign companies such as CITIC Pacific Ltd (potential producer), thus diminishing the historical duopoly of Rio Tinto Ltd and BHP Billiton Ltd (BHPB) in the Pilbara.

The most conspicuous corporate activity during 2008–09 involved Rio Tinto Ltd, which needed to reduce debt in the wake of the global financial crisis. Initially, BHPB launched a \$66 billion takeover bid for Rio Tinto, but this was scrapped in November 2008. Rio Tinto then sought a strategic alliance with Aluminium Corporation of China (Chinalco) in February 2009, which would have included direct investment by Chinalco in Rio Tinto, but this too was scrapped in June 2009. At that time, Rio Tinto signed a non-binding agreement with BHPB to establish a production joint venture of the two companies' Pilbara iron ore operations. The proposed 50:50 joint venture would cover all current and future production operations, but not marketing of the Pilbara product.

BHPB announced in November 2008 the approval of Rapid Growth Project 5 (RPG5), which will increase installed capacity across its Pilbara iron ore operations to 205 Mtpa by the second half of 2011. Production growth will mainly come from the Yandi and Mining Area C operations (Jacoby, 2008).

Another significant development in Western Australia's iron ore industry is the entry of Atlas Iron as an iron ore producer. In March 2009, about 150 000 wet tonnes of iron ore from the company's Bobby deposit of the Pardoo iron ore project was shipped to China, using the port facilities owned by Fortescue Metals Group in Port Hedland. The miner plans to increase capacity at Pardoo to 3 Mtpa after the Utah Point port facility is commissioned and is targeting exports of 6 Mtpa

by 2010 and 12 Mtpa by 2012. Atlas Iron also plans to develop its \$10 million Wodgina (100 km south of Port Hedland) direct shipping ore project, and expects to begin production in early 2010 at an initial rate of 2 Mtpa (Atlas Iron Ltd, 2009a,b).

On the negative side, Rio Tinto slashed its 2008 Pilbara iron ore shipment estimates by around 10% as a result of falling demand from Chinese customers. The miner has downgraded its previous 2008 estimate of 190 Mt to a revised estimate of 170 to 175 Mt (Dudley, 2008). However, iron ore production for calendar 2009 remains at around 200 Mt, with the company expecting a recovery in Chinese steel demand in the latter half of this year. Also, Rio Tinto has put the HIs melt pig iron plant at Kwinana on care and maintenance for 12 months until April 2010 due to depressed global pig iron prices and poor market outlook (Batten, 2009a,b).

In the magnetite sector, Gindalbie Metals Ltd is finalizing environmental approvals from the Western Australian Environment Minister for its Karara magnetite project in the Mid West region. Gindalbie and its Chinese joint venture partner, Anshan Iron & Steel Group, plan for construction and development of the large-scale project to begin in the latter part of 2009 (Svircas, 2009). Meanwhile, Grange Resources Ltd has increased its measured, indicated, and inferred resources at the Southdown deposit near Albany to 654.4 Mt at 36.5% magnetite (Batten, 2009c).

Companies exploring for iron ore in Western Australia continue to target numerous mineralization styles including channel iron deposits (CID); supergene-enriched hematite over Archean (Marra Mamba) to Paleoproterozoic (Brockman) banded iron-formations (BIF); primary magnetite in BIF (taconite ores) of the Pilbara and Yilgarn Cratons; titanomagnetite in cumulate-layered mafic–ultramafic intrusive rocks in the Pilbara Craton at Balla Balla, magnetite in BIF within the Mesoproterozoic gneiss terrane of the Albany–Fraser Orogen; clastic hematite in Paleoproterozoic–Mesoproterozoic sedimentary rocks of the Kimberley Basin (Cockatoo Island, Koolan Island); hematite iron ore mineralization in the Mid West region, and granular iron-formation deposits in the Paleoproterozoic Earraheedy and Yerrida Basins. There was ongoing interest by numerous companies in primary magnetite mineralization within BIF horizons throughout the Yilgarn Craton.

A number of junior companies in Western Australia have either announced maiden resource

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estimates or upgraded existing resources. Some of these include:

- A maiden resource estimate of 11.7 Mt at 57.6% Fe for the Jimblebar Range iron ore project, 50 km east of Newman, where the mineralization is supergene hematite–goethite type overlying banded iron-formation (Warwick Resources Ltd, 2008).
- Wodgina, 100 km south of Port Hedland, now has an inferred resource of 42.73 Mt at 56.3% Fe of direct-shipping (DSO; does not require beneficiation) hematitic ore (Atlas Iron Ltd, 2009c).
- Mount Cauden deposit, 20 km south-southeast of Marvel Loch, has a maiden inferred resource of 19 Mt, comprising 15.5 Mt of banded iron-formation grading 57.5% Fe as well as 3.5 Mt of canga and detrital ore grading 51.5% Fe (Cazaly Resources Ltd, 2008).
- Jack Hills, 155 km west-northwest of Meekatharra, has a measured, indicated, and inferred direct shipping ore (DSO) mineral resource of 96 Mt at 58.7% Fe and a beneficiation feed resource of 991 Mt at 34.1% Fe (Murchison Metals Ltd, 2009).
- Resources at the Western Creek project, 20 km west-southwest of Newman, increased by a further 28% to a total inferred mineral resource of 52.4 Mt at 56.7% Fe (Giralia Resources NL, 2009).
- A maiden inferred resource of 72.4 Mt at 34.02% Fe is estimated for the Mount Oscar iron project, 20 km south-southeast of Roebourne (Fox Resources Ltd, 2009).
- A maiden inferred resource of 476 Mt at 55.4% Fe is estimated for Flinders Mines Ltd's Hamersley project, 80 km north-northwest of Tom Price (Flinders Mines Ltd, 2009).
- The mineral resource of the Balmoral South project, 60 km north-northwest of Pannawonica, has increased by 44% to 1.6 Bt at 22.6% magnetic iron (MagFe), whereas the probable ore reserve has increased by 26% to 859 Mt at 22.6% MagFe (Australasian Resources Ltd, 2009).
- BC Iron Ltd has increased the DSO resource at its Nullagine iron ore project (25 km southwest of Nullagine) in the Pilbara, to 50.7 Mt at 57% Fe (BC Iron Ltd, 2009).

- A maiden inferred resource of 127 Mt at 28.15% Fe at Emergent Resources Ltd's Beyondie project, 125 km northeast of Peak Hill (Emergent Resources Ltd, 2009).
- Grange Resources Ltd has increased the measured, indicated, and inferred resources at its Southdown deposit, 80 km northeast of Albany, to 654.4 Mt at 36.5% magnetite (Batten, 2009c).

Some iron ore exploration successes include:

- A new high-grade iron ore (banded iron-formation) discovery at Woggaginna, 55 km southeast of Newman (Warwick Resources Ltd, 2009).
- High-grade hematite mineralization was intersected in drilling at Jigalong, 110 km east of Newman (Hannans Reward Ltd, 2008).
- Discovery of the Feather Boa prospect, 95 km east-southeast of Newman, part of the Robertson Range iron ore project (FerrAus Ltd, 2008).
- Thick intersections of high-grade bedded iron mineralization (e.g. 117 m at 63% Fe) from 61 m at the Railway deposit, 80 km south-southeast of Wittenoom (United Minerals Corporation NL, 2008).
- A hematite-enriched zone (e.g. 70 m at 58.4% Fe) from the surface to a depth of about 80 m, at Mount Webber, 60 km southwest of Marble Bar (Haoma Mining NL, 2009).

## Nickel

Broad trends for the nickel industry in Western Australia during 2008–09 include:

- The international nickel price in 2008–09 fell dramatically (by 45%) from an average of \$31 908 per tonne in 2007–08 to an average of \$17 626 in 2008–09.
- The decrease in the nickel price led to a dramatic fall (by 42%) in the value of nickel production in 2008–09 to \$3 billion, although the production quantity increased by 3.5% to 178 kt of contained nickel.
- Nickel exploration expenditure in Western Australia decreased by 14.5% to \$247 million (Fig. 8).
- The dramatic fall of nickel prices led to the closure of a number of nickel laterite as well as nickel sulfide mining operations.

Key points in the nickel laterite sector include:

- BHPB's Ravensthorpe operation that began production in late 2007 was put on care and maintenance in January 2009.
- Norilsk's Cawse nickel laterite operation, 50 km northwest of Kalgoorlie, that began production in 1998, was also put on care and maintenance in June 2008.
- Vale Inco has decided not to proceed with the full feasibility study for the Kalgoorlie Nickel Project of Heron Resources. Heron will seek a new partner for the development of the project when the optimization study is completed (Heron Resources Ltd, 2009a).
- Heron entered into an agreement with the Chinese company, Ningbo Shanshan, for the Yerilla nickel-cobalt project (which includes the Jump-Up Dam deposit) with Shanshan able to earn a 70% interest in the project. The project will process around a million tonnes of laterite ore per annum, producing a concentrate for further processing in China (Heron Resources Ltd, 2009b).

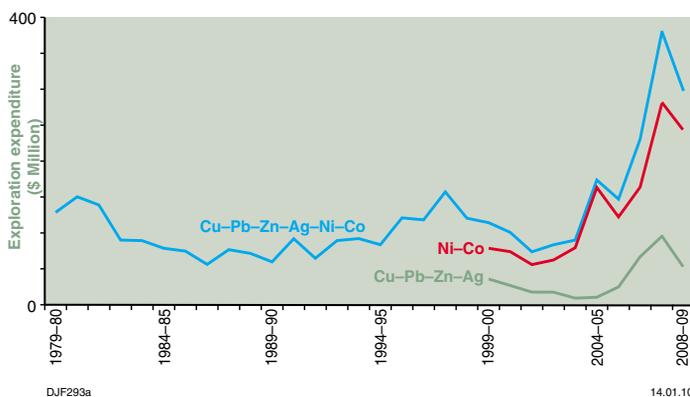


Figure 8. Western Australian nickel, cobalt, and base metal exploration expenditure (2007–08 dollars)

- GME Resources Ltd has suspended work on the feasibility study for its NiWest nickel project in the Leonora region, to be reviewed once world nickel markets have stabilized (GME Resources Ltd, 2008).

Key points in the nickel sulfide sector include:

- A significant number of operations were put on care and maintenance. These include Palmary Enterprises Ltd's Beta Hunt, Mincor Resources NL's Wannaway and Miitel, and Australian Mines NL's Blair operation, all near Kambalda;

Norilsk's Black Swan operation near Kalgoorlie, Waterloo operation near Leinster, and Lake Johnston operation (Maggie Hays and Emily Ann mines); BHPB's Rocky Reward operation near Leinster; Xstrata Plc's Sinclair operation in the Leinster region; Panoramic Resources Ltd's Copernicus operation north of Halls Creek; and Fox Resources Ltd's Radio Hill operation south of Karratha.

- Permits are being finalized for Western Areas NL's Spotted Quoll openpit mine at Forrestania. First production from Spotted Quoll should overlap production from the high-grade Lewinsky Lode at the top of the Flying Fox T5 orebody, starting in early 2010. As well, a feasibility study has commenced for an underground mine at Spotted Quoll (Western Areas NL, 2009a).
- Western Areas' Cosmic Boy nickel concentrate plant at Forrestania was officially opened and processed its first ore in early 2009. The company plans to double the capacity of the concentrator from the current 300 000 tpa ore to a nominal 550 000 tpa (Western Areas NL, 2009b).
- Work is also progressing well at Western Areas' Diggers Rocks South underground mine at Forrestania, where production is expected to commence in the latter half of 2009 (Western Areas NL, 2008).
- Western Areas announced that the company has executed an agreement with Jinchuan Group Ltd for a contract to sell up to 25 000 t of nickel in concentrate over a two-year period from the Forrestania nickel project (Western Areas NL, 2009a).
- Drilling at the Lounge Lizard deposit at Forrestania continued to produce impressive nickel intersections and (as at February 2009), the deposit was estimated to contain indicated and inferred resources of 1.149 Mt at 4.62% Ni. An agreement between Western Areas and Kagara Ltd will enable an early start to nickel production from the Lounge Lizard, by accessing it from the Flying Fox decline. The initial production rate is expected to be 50 000 tpa ore (Western Areas NL 2009c; Kagara Ltd, 2009).
- BHPB has approved the development of the US\$152 million (A\$177 million) Talc Redesign

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project at its Mount Keith nickel mine. The project, which is expected to begin in 2011, will allow the concentrator to enhance the processing of talc-bearing ore types at the Mount Keith operations (Jacoby, 2009b).

- Poseidon Nickel Ltd announced a maiden resource for its newly discovered Cerberus nickel sulfide deposit, near Laverton. The inferred resources are estimated at 1.03 Mt at 2.45% Ni for 25 269 t of contained nickel (Poseidon Nickel Ltd, 2009).
- Extensional diamond drilling by Independence Group at the new Moran nickel deposit near Kambalda, located in the Long South lava channel, continued to intercept high-grade nickel sulfide leading to an estimated indicated resource of 401 000 t at 6.9% Ni and an inferred resource of 55 000 t at 8.3% Ni for the deposit. Independence Group is well advanced in planning the development and mining of this deposit, with first ore production expected to be in mid-2010 (Independence Group NL, 2009).
- Mincor Resources upgraded the potential of its operating Carnilya Hill mine, northeast of Kambalda, announcing high-grade nickel sulfide intersections some 320 m beyond the end of the current mineral resource (Mincor Resources NL, 2009).
- South Boulder Mines Ltd announced significant drilling results from The Bulge C2 nickel sulfide prospect at its Duketon project, near Laverton. Intersections include 17.82 m at 1.11% Ni (0.05% Cu, 0.08g/t Pt + Pd) from 287.18 m (South Boulder Mines Ltd, 2009).
- Drilling at the Grey Dam prospect (Kurnalpi project), 90 km east-northeast of Kalgoorlie, returned significant intersections including 43 m at 1.09% Ni and 0.055% Co and 20 m at 1.4% Ni and 0.12% Co (Condor Nickel Ltd, 2008).
- Panoramic Resources announced impressive drilling results from the resource definition drilling at the Deacon deposit, 38 km south-southeast of Kambalda. The intersections include 24.57 m at 2.87% Ni and 0.24% Cu; 14.48 m at 2.89% Ni and 0.20% Cu; 25.79 m at 3.27% Ni and 0.33% Cu, and 23.10 m at 2.73% Ni and 0.23% Cu (Panoramic Resources Ltd, 2008).

## Base metals (copper–lead–zinc–silver)

Broad trends in the base metal sector in Western Australia during 2008–09 include:

- Copper–lead–zinc–silver exploration expenditure in the State fell by a dramatic 46% — from \$98 million in 2007–08 to \$53 million in 2008–09 (Fig. 8, 2008–09 dollars).
- There was a significant fall in base metal prices in 2008–09 compared to 2007–08 with copper, lead, and zinc falling by 26% (to \$6434/t), 40% (to \$1932/t), and 36% (to \$1863/t), respectively.
- Although copper production in the State in 2008–09 increased by 11% (from 124 529 t in 2007–08 to 137 841 t in 2008–09), the value decreased by 18% to \$889 million. The increased copper production was largely due to the steady output from the Nifty mine in the Paterson Orogen and increased production from the Telfer and Golden Grove operations.
- Lead production in the State continued to decrease (36%), from 25 706 t in 2007–08 to 16 415 t in 2008–09, due to the halt in production at the Magellan lead mine in April 2007 and the closure of the Pillara mine (Teck Cominco Ltd / Xstrata joint venture; 76 km southeast of Fitzroy Crossing) in mid 2008. The only other producing lead mine was Golden Grove. The value of lead production decreased by 61% to \$32 million.
- Zinc production in the State decreased by 31% (from 197 129 t in 2007–08 to 136 011 t in 2008–09) and the value decreased by 57% to \$249 million. The production decrease was due to the closure of the Pillara mine.

Key points for base metal projects in Western Australia include:

- In late 2008, Kagara announced an initial resource estimate for their Admiral Bay deposit in the Canning Basin. This resource amounts to 2.3 Mt of contained zinc and 2.8 Mt of contained lead, respectively, the largest zinc and the second largest lead resources in a single deposit in Western Australia. Scoping studies have shown that the deposit has the potential to produce 300 000 t of zinc, 250 000 t of lead and 4.5 Moz of silver annually (Kagara Ltd, 2008).

- With the opening of the Boddington gold–copper operation by Newmont in August 2009, the production of copper in Western Australia is likely to increase by another 30 000 tpa (Boddington Gold Mine, 2008; Newmont Mining Corporation, 2009).
  - Empire Resources Ltd announced maiden indicated and inferred resources totalling 1 070 000 t grading 1.82% Cu and 0.78 g/t Au for its Just Desserts deposit of the Yuinmery project, 120 km southeast of Mount Magnet, which was discovered in late 2007 (Empire Resources Ltd, 2009).
  - The Pillara mine at Lennard Shelf, 75 km south-southeast of Fitzroy Crossing, owned by the Teck Cominco / Xstrata joint venture, was put on care and maintenance in August 2008 (Teck Cominco Ltd, 2008).
  - In January 2009, the Zn-rich Scuddles mine of the Golden Grove project was placed on care and maintenance by OZ Minerals Ltd in response to the continuing decline in the world zinc price. The expected production of zinc in 2009 is now in the range of 80 000–85 000 t of zinc concentrate, compared to 139 900 t produced in calendar 2008. Although zinc production decreases, the company has plans to increase copper-in-concentrate production by approximately 14 000 t to between 35 000–40 000 t in 2009, compared to 28 461 t produced in calendar 2008. The ownership of Golden Grove has now changed to China Minmetals Non-ferrous Metals Company Ltd (Jacoby, 2009c; OZ Minerals Ltd, 2008a,b).
  - Ivernia Inc. has begun the shipment of lead carbonate concentrate from the Magellan mine, 30 km west of Wiluna, through the Port of Fremantle. Ivernia placed the Magellan lead mine on care and maintenance in April 2007, due to environmental problems associated with transportation of lead ore through the Port of Esperance (Miningnews.Net, 2007; Jacoby, 2009d).
  - In January 2009, Aditya Birla Minerals Ltd announced that its Oxide operations at Nifty were suspended due to changed market conditions and reducing yield from the remaining copper inventory in the heaps. However, production from its underground mine is continuing (Aditya Birla Minerals Ltd, 2009).
  - The underground mining operations at Radio Hill nickel–copper mine, 25 km south of Karratha, were completed and the mine was placed in temporary suspension in late September 2008 (Fox Resources Ltd, 2008).
  - The Whim Creek mine, 90 km east of Roebourne, which commenced production of copper in June 2005, finished mining in March 2009 (Straits Resources Ltd, 2009).
  - Jabiru Metals Ltd reached an agreement with OZ Minerals to market Jabiru's concentrate (Jabiru Metals Ltd, 2009).
- A significant exploration success is the discovery of volcanogenic massive sulfides at the DeGrussa prospect of the Doolgunna project (60 km east of Peak Hill) located at the boundary zone between the Archean Marymia Inlier and the Proterozoic Bryah Basin. Drilling by Sandfire Resources NL, in May 2009, returned significant gold–copper intersections of 23 m at 2.4% Cu and 3.1 g/t Ag from 66 m. Follow-up drilling has yielded more spectacular intersections, including 50.1 m at 8.4% Cu and 2.9 g/t Au from 242.5 m, signalling a major discovery of copper–gold mineralization in Western Australia (Sandfire Resources NL, 2009a,b).
- Other highlights in the exploration sector are:
- Significant copper–zinc mineralization, in a volcanogenic massive sulfide system, was discovered by Silver Swan Group Ltd at the Austin prospect, 60 km south-southwest of Meekatharra. Drill intersections include 66 m at 1.5% Cu from 106 m in hole 08ATD007 and 49.1 m at 7.2% Zn from 118 m in hole 08ATD001. This hole also intersected 33.55 m at 1.7% Cu from 120.45 m including 7 m at 4.2% Cu from 120.45 m (Silver Swan Group Ltd, 2008).
  - Drilling by Anglo Australian Resources NL at the Sandiego deposit, part of the Koongie Park project (24 km southwest of Halls Creek), continued to produce significant copper, zinc, and silver intersections including 68 m at 6.8% Cu, 9.6% Zn, 98.7 g/t Ag, and 0.34 g/t Au from 100 m (Anglo Australian Resources NL, 2008).
  - In late 2008, Jabiru Metals Ltd announced the discovery of a new zone of volcanogenic massive sulfide mineralization at Bentley, approximately 4.5 km south of the Jaguar mine. Intersections include 20.8 m at 1.3% Cu, 11.6% Zn, 1.2% Pb, 0.8 g/t Au, and 196 g/t Ag from 459.4 m (Jabiru Metals Ltd, 2008a,b).

# Overview

- Drilling has confirmed the presence of significant massive sulfide mineralization at the Evelyn prospect of the Libertee–Indee project, 30 km south of Whim Creek. Intersections include 20 m at 5.6% Cu, including 3 m at 29.8% Cu from 16 m and 18 m at 3% Cu, 9% Zn, 0.7% Pb, 55 g/t Ag, and 1.5 g/t Au from 72 m (Venturex Resources Ltd, 2009).
- Drilling at the Erayinia project, 150 km east-southeast of Kalgoorlie, continues to produce significant zinc intersections including 5 m grading 10.5% Zn and 4 m at 11.5% Zn (ABM Resources NL, 2008).
- Drilling at Mount Angelo North, 30 km southwest of Halls Creek, returned a significant intersection of 69 m at 3.84% Cu and 0.89% Zn (3D Resources Ltd, 2008).
- Ashburton Minerals Ltd announced significant copper, gold, bismuth, and platinum group element (PGE) assays from a number of prospects in the Pokali area within 3.5 km of the Mount Webb project, about 400 km north-northeast of Warburton. Assays from a number of samples from the Pokali South prospect include 13.30% Cu (sample A0151), 19.08 g/t Au (sample A0148), and 78.05 g/t Ag, and 2.63 g/t Pd in sample A0152 (Ashburton Minerals Ltd, 2008).

## Diamond

Diamond production (strictly sales production rather than mine production) in Western Australia in 2008–09 fell to 9 million carats (Mct), which is a significant fall of 67% compared to the 2007–08 production of 28 Mct. The fall in production led to a 57% fall in the value of diamond sales to \$262 million.

Expenditure on diamond exploration in Western Australia for 2008–09 was \$5 million, which is a disappointing fall of 62% from the estimated \$13.2 million spent in 2007–08 (Fig. 9, in 2008–09 dollars). Diamond exploration expenditure is now less than 1% (Fig. 4) of the total Western Australian mineral exploration expenditure. This is the seventh year in a row that diamond expenditure in Western Australia has declined (now at its lowest level in 30 years), reflecting the general lack of exploration success and hence investor interest.

Rio Tinto owns and operates the Argyle diamond mine in Western Australia. Diamond production for 2008–09 decreased to 14.274 Mct from

16.024 Mct in 2007–08. Production from Argyle’s AK1 openpit mine is expected to continue through to 2011. When production from the southern end of the pit is completed in 2009, mining is expected to move to the Northern Bowl and continue until further ore becomes available from the underground mine. In January 2009, Rio Tinto announced that the Argyle underground mining project will be slowed to critical development activities only. Full production from the openpit is now expected to start in 2013, with the underground operations enabling the life of the mine to be extended till about 2018 (Rio Tinto Ltd, 2009).

In December 2007, Gem Diamonds Ltd, a global diamond company, acquired the Australian-listed Kimberley Diamonds that owns the Ellendale mine (135 km east-southeast of Derby). The production of diamond from Ellendale in 2008–09 decreased by 45% to 266 868 carats compared to the 2007–08 production of 487 416 carats.

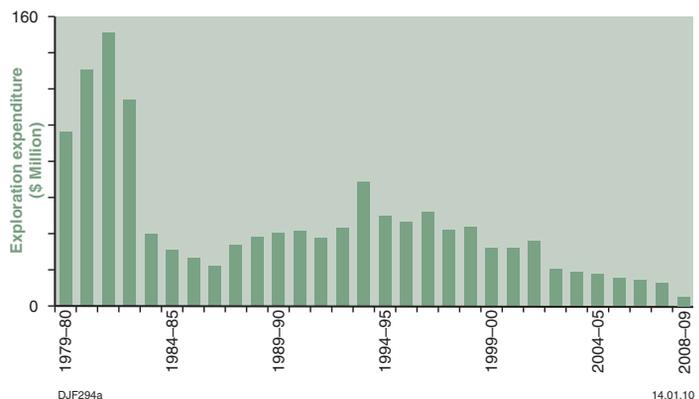


Figure 9. Western Australian diamond exploration expenditure (2008–09 dollars)

Mining operations ceased at the Ellendale 4 pipe and the mine was placed on care and maintenance. The company shifted its focus to the Ellendale 9 pipe to maximize cash flow (Gem Diamonds Ltd, 2009).

Blina Diamonds NL recommenced exploration in June 2008 at its Ellendale 9 North alluvial project at Ellendale, and by the end of 2008 a total of 37 970 t had been excavated and processed, returning 4813 stones for 2117.27 ct, with an average grade of 5.58 cpht (carats per hundred tonnes). An alluvial channel was also discovered over the eastern end of the Ellendale 9 lamproite pipe (Blina Diamonds NL, 2009).

## Heavy minerals (Ti–Zr and garnet)

Production of heavy mineral sands (garnet, ilmenite, leucoxene, rutile, and zircon) in Western Australia in 2008–09 decreased by 29% to 990 496 t, with the value decreasing marginally (<1%) to \$697 million.

In 2008–09, expenditure in Western Australia on heavy mineral sands exploration decreased by 14% to \$13 million (Fig. 10). With the switch in exploration focus to the eastern Eucla Basin and the Murray Basin in Australia's eastern states in the mid-1990s, Western Australia's share of Australian exploration expenditure for heavy minerals fell from nearly 70% of the total in the mid-1990s to only 29% in 2002–03. It has recovered in recent years and was 43% in 2008–09, a slight increase from last year's figure of 40%.

In late 2008, Iluka Resources Ltd, the market leader in this industry in Western Australia, announced its intention to stop production indefinitely from its synthetic rutile kiln 4, located at Narngulu in the Mid West. The kiln is one of four synthetic rutile kilns in Western Australia and will be idled effective from mid-2009. During 2008, mining operations at its Cloverdale operation also ceased. In January 2009, Iluka also announced the closure of its Wagerup mine, south of Perth. Iluka also plans to complete its mining operations at Waroona in late 2009, following the exhaustion of higher value synthetic rutile feedstock ilmenite. During mid-2009, the Gingin mining and processing operations were closed as a result of exhaustion of ilmenite suitable for the higher value synthetic rutile feedstock. Eneabba remains the principal mining operation in the Mid West. Iluka hopes to secure final regulatory

approvals to commence mining at Tutunup South in the South West in late 2009. In addition, the approval process for Tutunup is underway with the aim to commence mining in the second half of 2011. Iluka is continuing to explore in the Perth Basin to delineate resources for near-mine extensions in the South West (Tutunup) and Mid West (North Mine remnants) regions. Also, stratigraphic drill testing commenced west of Eneabba where Iluka completed an aeromagnetic survey that identified anomalies (Iluka Resources Ltd, 2008; 2009a,b,c).

Other highlights in the heavy minerals sector for 2008–09 include:

- The Gwindinup mine, 15 km south of Bunbury, successfully ramped up to full production after plant commissioning in early 2008 (Bemax Resources Ltd, 2008).
- The environmental approvals process is almost complete for Matilda Zircon Ltd's Keysbrook mineral sands project, 50 km south of Perth (Matilda Zircon Ltd, 2009).
- Image Resources NL has estimated, indicated, and inferred resources totalling 261 Mt containing 6.4 Mt of heavy minerals at its deposits in the North Perth Basin, which include Helene, Hyperion, Bidaminna, and Titan. In addition the company has identified a 1.4 km-long high-grade zone at Cooljarloo averaging more than 20% heavy minerals, with mineralization up to 100 m wide and 6 m thick (Image Resources NL, 2009a,b).
- Diatreme Resources Ltd continued to explore the Western Australian portion of the Eucla Basin. The company announced a 50% increase in the resource estimate for the Cyclone deposit at Wanna Lakes, boosting the potential for a new world-class zircon province in the Western Australian portion of the Eucla Basin. The new measured, indicated, and inferred resources total 98.4 Mt at 2.88% heavy minerals, containing 2.8 Mt of heavy minerals. Exploration is continuing at Hurricane and Jubilee Lakes prospects in the Eucla region (Diatreme Resources Ltd, 2009a,b).
- Strong interest has been shown in Gunson Resources Ltd's Coburn zircon project (230 km north of Geraldton) from potential investors and end users in China, including two large companies introduced by The Balloch Group. Gunson has made a decision not to proceed with China Triumph International Engineering

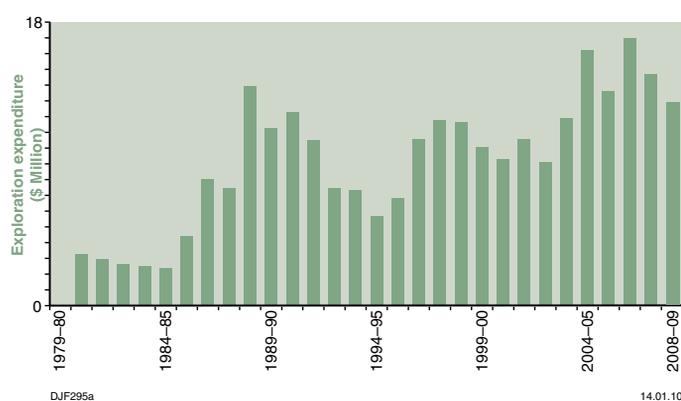


Figure 10. Western Australian heavy mineral sand (Ti–Zr) exploration expenditure (2008–09 dollars)

# Overview



(CTIEC) as the general engineering contractor for Coburn construction, instead choosing Sedgman Ltd as the preferred engineering contractor for project construction (Gunson Resources Ltd, 2009a,b,c).

## Uranium

The pro-uranium policy of the State Government continues to have a positive effect on exploration expenditure for uranium in the State. Expenditure — that had been negligible in the previous decade — increased by a further 6% to \$28.3 million in 2008–09 (Fig. 11).

Several companies are now planning to produce uranium in the near future:

- BHPB has flagged a 2011 construction start for its Yeelirrie uranium project (70 km south of Wiluna), which is estimated to contain an indicated resource of 35 Mt at 1.5 kg/t of  $U_3O_8$  for 52 500 t of  $U_3O_8$  (Jacoby, 2009e).
- Mega Uranium Ltd announced a new indicated resource of 27.6 Mt at 378 ppm  $U_3O_8$  (23 Mlb (million pounds) of contained  $U_3O_8$ ) and an inferred resource of 3.6 Mt at 274 ppm  $U_3O_8$  (2.2 Mlb of contained  $U_3O_8$ ) for their Lake Maitland deposit, 105 km southeast of Wiluna. The company plans to commence uranium production in late 2011 with an annual output of 1.65 Mlb  $U_3O_8$  (Mega Uranium Ltd, 2009).
- Toro Energy Ltd plans to sell uranium by 2013 from its Lake Way mine near Wiluna and is in

discussions over project funding. The project has estimated measured, indicated, and inferred resources totalling 20.21 Mt at 548 ppm  $U_3O_8$  for 11 070 t of contained  $U_3O_8$  (Toro Energy Ltd, 2009).

- Energy and Minerals Australia Ltd announced an initial inferred resource of 44.36 Mt at 550 ppm  $U_3O_8$  for 24 520 t of contained  $U_3O_8$  for the Mulga Rocks deposits, 225 km northeast of Kalgoorlie (Energy and Minerals Australia Ltd, 2009).
- Cameco Corporation is exploring the Kintyre uranium deposit, 72 km south-southwest of Telfer. The deposit was acquired (70%) from Rio Tinto in August 2008. The remaining 30% is owned by Mitsubishi Corporation (Cameco Corporation, 2009).

## Other commodities

Expenditure on exploration for other mineral commodities in Western Australia in 2008–09 has increased by 31% to \$80 million. ‘Other commodities’ includes all industrial minerals, alumina, construction materials, PGE, molybdenum, tantalum, manganese, chromium, vanadium, rare earth elements (REE), and coal–lignite. Of these, exploration during 2008–09 was focused on molybdenum, vanadium, spodumene, and manganese.

In the molybdenum sector, the fall in the world price of molybdenum oxide (to approximately US\$10/lb) in late 2008, forced Moly Mines Ltd to change focus at its proposed Spinifex Ridge porphyry Mo–Cu mine in the Pilbara to a smaller scale mine and plant, with a capacity in the order of 8–10 Mtpa, producing 11 to 13 Mlb molybdenum per annum (Moly Mines Ltd, 2009).

In the REE sector, Lynas Corporation Ltd announced in early 2009 the suspension of work at its Mount Weld rare earths project, 30 km south-southeast of Laverton, due to shortage of funding. Lynas had already completed the first mining campaign and had stockpiles of ore at Mount Weld. The deposit is estimated to contain measured, indicated, and inferred resources of 12.24 Mt at 9.7% REO for 1184 kt of REO (Lynas Corporation Ltd, 2009).

In the vanadium sector, developments were deeply affected by the global financial crisis:

- In early 2009, Windimurra Vanadium Ltd, owner of the Windimurra Vanadium project,

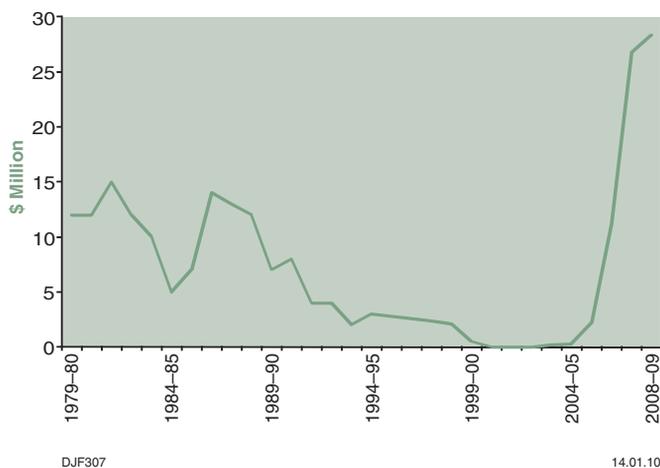


Figure 11. Uranium exploration expenditure in Western Australia since 1979–80 (2008–09 dollars)

75 km east-southeast of Mount Magnet, has called in the administrators, as the company was unable to raise the funds needed to keep it afloat. The Windimurra deposit is estimated to contain measured, indicated, and inferred resources totalling 177 Mt at 0.46%  $V_2O_5$  (Dudley, 2009; Windimurra Vanadium Ltd, 2009).

- Reed Resources Ltd has completed a definitive feasibility study aimed at establishing a vanadium mine at Barrambie, 65 km north of Sandstone. The study indicated the processing plant and associated infrastructure will target a throughput of 3.2 Mtpa of vanadium-bearing magnetite mineralization at a grade of 0.82%  $V_2O_5$  and produce either about 11 200 t of vanadium pentoxide per annum or 7700 t of ferro-vanadium per annum, for a minimum 12-year period. The deposit is estimated to contain indicated and inferred resources totalling 65.2 Mt at 0.82%  $V_2O_5$  (Reed Resources Ltd, 2009a,b).
- On a brighter note, Aurox Resources Ltd is still planning to develop Western Australia's largest vanadium resource at Balla Balla, 10 km northwest of Whim Creek, but predominantly as an iron ore mine instead. It is proposed to process the vanadiferous titanomagnetite to produce an iron ore concentrate with around 0.85%  $V_2O_5$ , along with about 7000 tpa of ferrovanadium ( $Fe_{80}V$ ), and a titanium concentrate of about 43%–46%  $TiO_2$  (Aurox Resources Ltd, 2009).

In the lithium sector, Galaxy Resources Ltd plans to develop its Mount Cattlin hard-rock spodumene project, at Ravensthorpe, as the world's second-largest hard-rock lithium operation. Galaxy Resources was successful in raising capital (about \$65 million) during the worst phase of the economic downturn. Galaxy hopes the project will produce 137 000 tpa of spodumene concentrate containing 6% lithium. Plans are also underway to establish a lithium carbonate chemical facility in Jiangsu Province in China, producing 17 000 tpa of lithium carbonate. The company is targeting the rechargeable-battery sector in China and plans to produce a 100% battery-grade product, which attracts a premium price of 10–15% over technical-grade lithium (Galaxy Resources Ltd, 2009).

In the coal sector, Rey Resources Ltd announced initial measured, indicated, and inferred resources totalling 511 Mt of sub-bituminous coal for the Duchess–Paradise project, 135 km southeast of

Derby, in the Canning Basin. Rey Resources is investigating the potential of the deposit to support an initial 2 Mtpa thermal coal export operation (Rey Resources Ltd, 2009a,b).

In the antimony sector, Northwest Resources Ltd announced indicated and inferred resources totalling 1.33 Mt at 8.3 g/t Au (353 000 oz) and 1.02% Sb (7300 t) at its Nullagine gold project (Northwest Resources Ltd, 2009).

In the tungsten sector, Hazelwood Resources Ltd announced measured, indicated, and inferred resources totalling 10.07 Mt at 0.18%  $WO_3$  (cut-off grade of 0.1%  $WO_3$ ) in its Big Hill deposit, 45 km northeast of Nullagine. More than 70% of the resource is in the measured and indicated categories (Hazelwood Resources Ltd, 2009).

In the manganese sector, Mesa Minerals Ltd announced its inaugural shipment of manganese lump ore (24 000 t) to China from its Ant Hill mine, 55 km east-southeast of Nullagine. The shipment was the first from trial production and the company anticipates larger scale mining of manganese at Ant Hill deposit as well as at the nearby Sunday Hill deposit (Mesa Minerals Ltd, 2009). In addition, several companies reported high-grade manganese intersections from exploration drilling:

- Aurora Minerals Ltd reported high-grade manganese up to 55.1% Mn from its Capricorn Southeast project in central Western Australia (Aurora Minerals Ltd, 2009).
- Shaw River Resources Ltd is focused on preparations for initial drilling at its Baramine project, 80 km northwest of the Woodie Woodie manganese mine, where preliminary exploration has identified wide zones of manganese mineralization, including 24 m at 38.7% Mn and 10 m at 50.3% Mn (Shaw River Resources Ltd, 2009).
- Exploration with encouraging results is continuing at the Mount Minnie project, 95 km southeast of Onslow, and at the 701 Mile project, 75 km south of Newman (Shaw River Resources Ltd, 2009).
- Exploration drilling by AusQuest Ltd at the Table Hill manganese project, 200 km east-southeast of Newman, is continuing, with encouraging intersections. Intersections include 3.9 m at 47.5% Mn from 286.8 m, and 1.3 m at 47.7% Mn from 326.1 m (AusQuest Ltd, 2008, 2009).

# Overview

## Drilling activity

The upward trend in exploration drilling activity throughout Australia between 2002–03 and 2007–08 reversed sharply in 2008–09 and, as expected, the sharpest falls were experienced in exploration drilling for new deposits. The fall in exploration drilling around existing deposits was not as severe. The details are as follows:

- Metres drilled during 2008–09 in Australia decreased by 19% (by 1.869 million metres) to a total of 7.887 million metres (Fig. 12).
- The estimated drilling for mineral exploration in Western Australia followed a similar trend with metres drilled during 2008–09 decreasing by 11% (0.57 million metres) to a total of 4.42 million metres (based on Western Australia's proportion of total Australian exploration expenditure for each year as the ABS does not release WA-specific data).
- Mineral exploration drilling for new deposits in Australia decreased sharply (30%), from 3.92 million metres in 2007–08 to 2.72 million metres in 2008–09.
- By contrast, mineral exploration drilling at existing deposits in Australia decreased more modestly (11%), from 5.83 million metres in 2007–08 to 5.17 million metres in 2008–09.

## Mining tenement activity

Tenement statistics also demonstrate the end of the boom phase and a rapid response to the changing global economic conditions, with an immediate and sharp drop in Exploration Licences and in new applications for tenements, but with the number of Mining Leases staying relatively constant (Fig. 13). The details are:

- The number of granted tenements (in force) in Western Australia during 2008–09 decreased by 2.5% (521), from a total of 20 910 in force at 30 June 2008 to 20 389 at 30 June 2009.
- The area under granted tenure decreased by 11.1 million hectares (Mha) or 19%, from a total of 58.2 Mha at 30 June 2008 to 47.1 Mha at 30 June 2009.
- The big reduction was in Exploration Licences (ELs), where the number of granted ELs in force at 30 June 2009 dropped by 11.8% (636) and the area under tenure of granted



Figure 12. Mineral exploration drilling in Australia and Western Australia

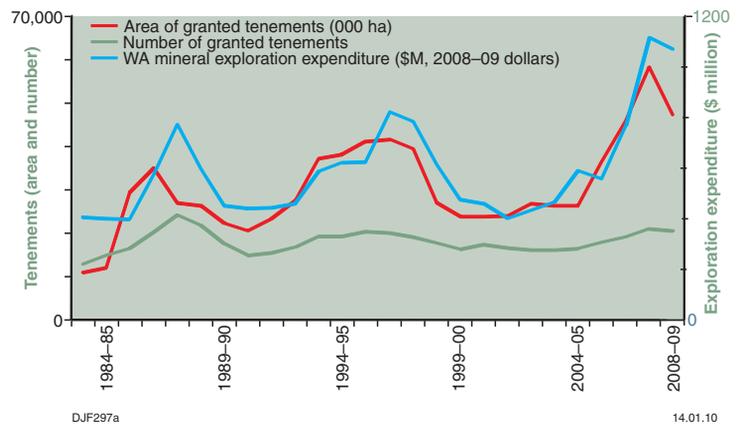
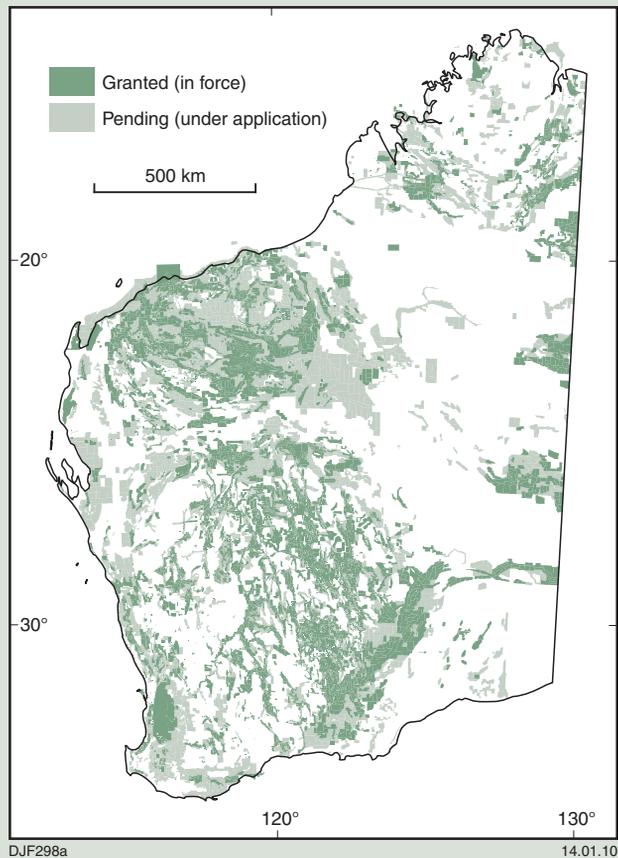


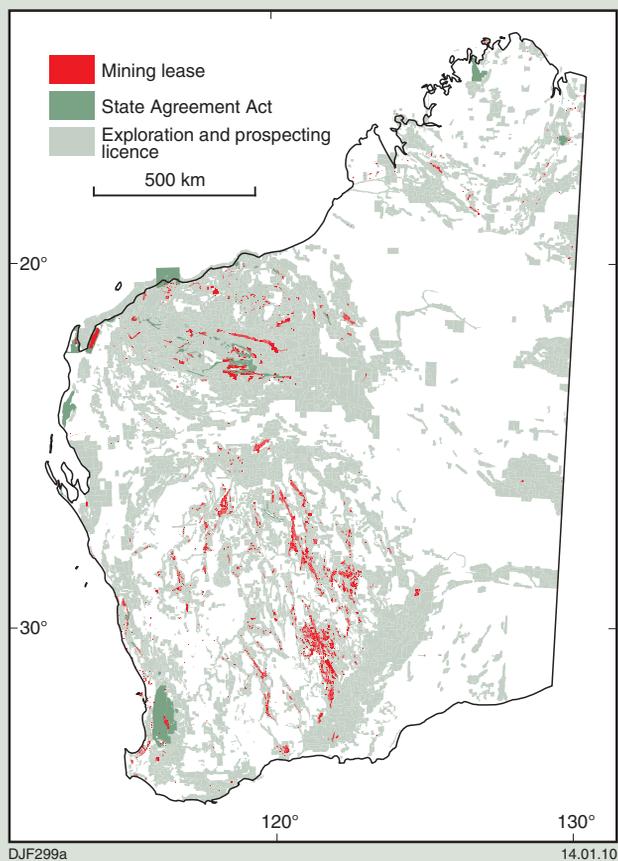
Figure 13. Trends in exploration expenditure and tenement activity (1904 and 1978 Mining Acts) since 1983–84 (source: Department of Mines and Petroleum)

ELs dropped by 22% (11.3 Mha). Hence the number and area held under all *other* tenement types actually rose slightly over the year!

- Statistics for Mining Leases show an increase from 2007–08 to 2008–09, rising in number from 5 474 to 5 613 and in area under granted tenure from 2.03 to 2.06 Mha.
- As expected, the number of applications received by the Department during the year for new tenements also decreased, from 4 154 in 2007–08 to 3 882 in 2008–09.
- These statistics are despite a big improvement in the speed of processing tenement applications within the Department, where the backlog of tenement applications (for tenements of all types) dropped by 5 764, from a total of 14 703 at 30 June 2008 to 8 939 at 30 June 2009.



The distribution of tenements, both granted and under application at 30 June 2009, is shown in Figure 14. The distribution of mining leases, exploration and prospecting licences (granted and under applications) and State Agreement Act areas is shown in Figure 15.



*Figure 14 (top left). Distribution of mining and exploration tenements, granted and pending, in Western Australia as at 30 June 2009*

*Figure 15 (bottom left). Distribution of Mining leases, Exploration and Prospecting licences (granted and pending), and State Agreement Act areas in Western Australia as at 30 June 2009*

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