Western Australia
Growing optimism in base metals

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Western Australia

- Production and exploration growth in Cu, Pb, Zn and Ni due to the buoyant market conditions
- Nickel particularly is booming with a doubling of annual exploration expenditure in 2004/05
- New mines opening and enthusiasm for new and old projects across WA (Magellan Pb, Jaguar Zn, Telfer Au Cu, Ravensthorpe Ni)
- Large area, diverse geological environments and mineralization models for base metals
Western Australia

Copper (Cu)  
Lead (Pb)  
Zinc (Zn)
Cu-Pb-Zn Production history WA

- Cu production
- Pb production
- Zn production

Lennard Shelf mines close
Telfer Au Cu
Magellan
## Cu-Pb-Zn Production 2004 or 05

### Copper (Cu)
- **Telfer**, Newcrest Mining Ltd (Au Cu) 43,173 t Cu 2005  
- **Nifty**, Aditya Birla Group 15,660 t Cu 2004  
- **Whim Creek**, Straits Resources Ltd 4,517 t Cu 2005  
  (quarters 3 and 4 2005)  
- **Golden Grove** (see below) 21,222 t Cu 2005  
- **By-product from Ni sulphide mining** Kambalda district, Cosmos, Emily Ann, Radio Hill, Sally Malay

### Lead (Pb)
- **Magellan**, Ivernia (Pb) 16,600 t Pb 2005  
  (excluding quarter 4)  
- **Golden Grove** (see below) 6,393 t Pb 2005

### Zinc (ZN)
- **Golden Grove**, Oxiana Ltd (Zn Cu Pb) 63,606 t Zn 2005  
  (21,222 t Cu; 6,393 t Pb; 24,693 oz Au; 1,829,406 oz Ag)
Cu-Pb-Zn Resources 2005

Copper (Cu)

**Telfer**, Newcrest Mining Ltd (Au Cu)
- Openpit: Measured 150 Mt at 1.3 g/t Au, 0.15% Cu; Indicated 200 Mt at 1.6 g/t Au, 0.13% Cu, and Inferred 94 Mt at 1.1 g/t Au, 0.12% Cu;
- Underground: Indicated 48 Mt at 2.9 g/t Au, 0.54% Cu and Inferred 11 Mt at 2.4 g/t Au and 0.44% Cu – Produce 640 tonnes of copper in concentrate over 20 years

**Nifty**, Aditya Birla Group
- Measured and Indicated resource of the primary and leachable ore is 41 Mt at 2.49% Cu

**Whim Creek**, Straits Resources Ltd
- Measured 7.3 Mt at 1% Cu; Indicated 7.1 Mt at 0.8% Cu, and Inferred 1.3 Mt at 0.5% Cu

**Golden Grove** (see below)

By-product from Ni sulphide mining **Kambalda district, Cosmos, Emily Ann, Radio Hill, Sally Malay**

Lead (Pb)

**Magellan**, Ivernia (Pb)
- Measured and Indicated 18.6 Mt at 5.9% Pb; Inferred 13 Mt at 4.3% Pb

Zinc (Zn)

**Golden Grove**, Oxiana Ltd (Zn Cu Au)
- Reserves and resources 6.8 Mt at 14.9% Zn, 15.69 Mt at 2% Cu and 11.34 Mt at 1.95 g/t Au
Cu-Pb-Zn
Under development or feasibility study

Copper (Cu)
- West Whundo (Cu, Zn, Ag)
  - Fox Resources Ltd
- Boddington (Au, Cu)
  - Newmont Australia Ltd, Anglo Gold Ltd
- Panorama - Sulphur Springs (Cu)
  - CBH Resources Ltd
- Phillips River (Au, Cu)
  - Tectonic Resources NL
- Spinifex Ridge (Mo, Cu)
  - Moly Mines Ltd and Kallenia Mines Pty Ltd

Zinc (Zn)
- Jaguar (Zn Cu Ag)
  - Jabiru Metals Ltd
- Lennard Shelf – Pillara
  - Teck Cominco Ltd (Zn Pb)
Cu-Pb-Zn
Exploration successes

Copper (Cu)

Maroochydore (Cu)
  ● 50:50 by Aditya Birla Group and Murchison United NL

Spinifex Ridge (Mo, Cu)
  ● Moly Mines Ltd and Kallenia Mines Pty Ltd

Mt Angelo, Koongie Park (Cu)
  ● Platquest Resources Pty Ltd

Babel (Ni, Cu)
  ● BHPB (potential resource of 1Mt Ni, 1Mt Cu)

Lead (Pb)

Abra (Pb, Cu, Ba, Fe, Au, Ag)
  ● Abra Mining Ltd

Zinc (Zn)

Admiral Bay (Zn, Pb, Ag)
  ● Kagara Zinc Ltd

Teutonic Bore (Zn, Cu)
  ● Jabiru Metals Ltd

Exploration expenditure $9.5M 2004/05
Top ten copper, lead, and zinc projects in Western Australia

**Copper**
- Nifty
- Telfer
- Boddington
- Maroochydore
- Golden Grove
- Spinifex Ridge
- Whim Creek
- Panorama
- Mt Angelo
- Koongie Park

**Lead**
- Magellan
- Sorby Hills
- Trilogy
- Abra
- Koongie Park
- Lennard Shelf
- Napier Range
- Lennons Find
- Northampton
- Salt Creek

**Zinc**
- Golden Grove
- Panorama
- Lennard Shelf
- Koongie Park
- Lamboo
- Teutonic Bore
- Sorby Hills
- Lennons Find
- Freddie Well
- Trilogy
Cu-Pb-Zn Mineralization styles

Archean VMS deposits
- e.g. Golden Grove and Jaguar in the Yilgarn Craton

Mississippi Valley Type sediment-(carbonate) hosted
- Canning Basin (e.g. Admiral Bay)
- Lennard Shelf (e.g. Pillara)

Vein and hydrothermal deposits
- e.g. Telfer

Orthomagmatic mafic and ultramafic deposits
- e.g. Kambalda

Deposits associated with porphyry systems
- e.g. Mt Angelo

Deposits in regolith, Nickel laterite deposits
- e.g. Siberia
Copper, lead, and zinc deposits in Western Australia

Legend

- Orthomagmatic mafic and ultramafic deposit
- Volcanic-hosted massive sulfide deposit
- Sediment-hosted deposit (includes MVT deposits)
- Vein and hydrothermal deposit
- Deposit associated with a porphyry system
- Deposit in regolith
- Deposit: mineralization style not defined

- Phanerozoic rocks
- Proterozoic rocks
- Archean rocks
Western Australia

Nickel (Ni)
Ni Production history W A

2005 - partially estimated
2006 and 2007 - estimated

With projected production from Ravensthorpe
Kambalda-Kalgoorlie region

- **Nickel Sulfide:**
  - Miitel, Wannaway, and Redross, Mincor Resources NL (Ni Cu)
  - Carnilya Hill, View Resources Ltd (Ni Cu)
  - Silver Swan, LionOre Mining International Ltd (Ni)
  - Beta Hunt, Consolidated Minerals Ltd (Ni Cu)
  - Redross and Mariners, Mincor Resources NL (Ni)
  - Blair, Australian Mines Ltd (Ni, Cu)
  - Zone 29, View Resources Ltd (Ni, Cu)
  - Lanfranchi, Sally Malay Mining Ltd (Ni)

- **Nickel Laterite:**
  - Cawse, OMG (Ni Co)
Recent Production, **New Mines**

- **Northern Eastern Goldfields**
  - Nickel Sulfide: **Cosmos**, Jubilee Mines NL (Ni Cu)
    - Mt Keith and Leinster, BHPB (Ni)
  - Nickel Laterite: **Murrin Murrin**, Minara Resources Ltd (Ni Co)

- **Lake Johnston region**
  - Nickel Sulfide: **Emily Ann**, LionOre Mining International (Ni Cu)
    - **Maggie Hays**, LionOre Mining (Ni, Cu)

- **Halls Creek region**
  - Nickel Sulfide: **Sally Malay**, Sally Malay Mining Ltd (Ni, Cu, Co)

- **Pilbara region**
  - Nickel Sulfide: **Radio Hill**, Fox Resources Ltd (Ni Cu Co)
<table>
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<tr>
<th>Project</th>
<th>Operator</th>
<th>Contained Ni (t)</th>
<th>Mineralization style</th>
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<td>Minara Resources Ltd</td>
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<td>Cawse (estimated)</td>
<td>OMG Cawse Pty Ltd</td>
<td>5 181</td>
<td>Laterite</td>
</tr>
</tbody>
</table>

| Total                        |                                     | 141 917 t        | 33 699 t             |
Under development or feasibility study

- **Kambalda region**
  - Helmut South, Sally Malay Mining Ltd

- **Northern Eastern Goldfields**
  - Prospero near Cosmos, Jubilee Mines NL
  - Cliffs and Yakabindi, BHPB
  - Honeymoon Well, LionOre Mining International Ltd

- **Forrestania region**
  - Flying Fox, Western Areas NL

- **Halls Creek region**
  - Copernicus, Sally Malay Mining Ltd

- **Pilbara region**
  - Sherlock Bay, Sherlock Bay Nickel Corporation Ltd
Recent exploration success

- **Kambalda district** - Junior companies exploring and developing nickel sulfide deposits
  - **McLeay** (0.344 Mt at 6.9% Ni), near Victor South, Independence Group NL
  - **BSA prospect, Anomaly 11 prospect, Area 57**, near Blair, Australian Mines

- **Kalgoorlie laterite project** advances by Heron Resources / Inco

- **Northern Eastern Goldfields**
  - Nickel sulfide at Collurabbie, BHPB
  - **Tapinos and Alec Mairs** near Cosmos, Jubilee Mines NL
  - **Waterloo-Amorac**, LionOre International Ltd

- **Forrestania** – Nickel sulfides at Western Areas **T5 deposit**

- **Musgrave** – Potential resource at **Babel** – 1 Mt contained Ni and 1 Mt Cu

- Use of **deep penetrating EM** effectively explores depths of 150–500 m

**Exploration expenditure $148.7M 2004/05, up 106%**
Nickel projects ranked by contained nickel (resources and reserves combined)

- Contained Metal in Sulfide deposits (kt)
- Contained Metal in Laterite deposits (kt)

Contained Ni (kt)

Nickel resources of Western Australia, by mineralization style

- **Laterite**
  - (probable + proved + measured + indicated + inferred)
- **Sulfide**
  - (probable + proved + measured + indicated + inferred)

With Babel resource
**Ni Exploration Targets**

**Sulfide komatiite deposits**
- Kambalda district (Ni, Cu)
- Northeastern Goldfields - Collurabbie (Ni, Cu, PGM)
- Forrestania district
Western Australian nickel sulfide mines, deposits, and exploration sites

LEGEND
- Nickel sulfide mine or deposit
- Nickel exploration site
- Town
Ni Exploration Targets

Sulfide komatiite deposits
- Kambalda district (Ni, Cu)
- Northeastern Goldfields - Collurabbie (Ni, Cu, PGM)
- Forrestania district

Sulfide layered mafic and ultramafic intrusions
- Kimberley
- Musgrave
- Pilbara
- Large Igneous Provinces
  - Kimberley (Kalkarinji LIP 510 Ma)
  - Earareedy Basin (Warakuna LIP 1070 Ma)
1465 Ma and 1070 Ma dolerite sills of the Western Bangemall Supergroup

1070 Ma sills of the Warakurna large igneous province in the Glenayle area of the eastern Bangemall Supergroup
Ni Exploration Targets

**Sulfide komatiite deposits**
- Kambalda district (Ni, Cu)
- Northeastern Goldfields - Collurabbie (Ni, Cu, PGM)
- Forrestania district

**Sulfide layered mafic and ultramafic intrusions**
- Kimberley
- Musgrave
- Pilbara
- Large Igneous Provinces
  - Kimberley
  - Earaheedy Basin

**Laterite deposits**
- Murrin Murrin (Ni, Co)
- Ravensthorpe (Ni, Co)
- Kalgoorlie region (Ni) (Goongarrie, Bulong, Highway, Kalpini, etc)
- Wingellina (Ni, Co)
Western Australian nickel laterite mines and deposits

LEGEND

- Nickel laterite mine or deposit
- Town
Cu-Pb-Zn Conclusions

- World demand for Cu-Pb-Zn continues to increase
- Increased base metal activities in Western Australia with opening of Whim Creek, Jaguar, and Magellan mines
  - Work continues on Lennard Shelf and expansions planned in Nifty
- Telfer (Au–Cu) reopened, Boddington (Au–Cu) to start production
- Cu–Pb–Zn exploration recovering - unrealistically low considering potential
- potential for Cu-Pb-Zn discoveries– size of WA, geological diversity
  - Yilgarn Craton
  - Pilbara Craton
  - Albany–Fraser Orogen
  - King Leopold and Halls Creek Orogens
  - Earaheedy, Edmund Basins (Caricorn Orogen)
  - Canning Basin
North Paterson Orogen
Conclusions

- Western Australia - third largest producer of nickel in the world
- Large resource base attracting major players - INCO and BHPB
- Great success stories for small explorers
- Small miners becoming mid-tier companies
- New greenfield provinces
  - Babel in Musgrave Complex
  - Collurabbie in Gerry Well greenstone belt
- Outlook - additional nickel production from nickel laterite - BHPB’s Ravensthorpe and INCO/Heron’s Kalgoorlie Project
- Enormous large igneous provinces (LIPs) in Kimberley, Capricorn Orogen under explored
Mineral occurrences in the Kimberley

- Precious metal
- Base metal
- Speciality metal
- Diamond, semi-precious stone
- Energy mineral
- Industrial mineral
- Iron
- Construction material

Sally Malay

Lennard Shelf

Lamboo Complex
Western Australia

- Geological diversity and large size of WA provides opportunities in base metals exploration and mining
- On-going programs to collect new data
- Wide ranging opportunities
  - join fledgling, mid size or mature projects
  - initiate new projects