Nickel is an important commodity that is used in the manufacture of stainless steel, super-alloys, rechargeable batteries and in other high-tech industries. When alloyed with other elements nickel imparts toughness, strength, resistance to corrosion, and various electrical, magnetic and heat resistant properties. Current global demand for nickel is mainly from China, other north Asian economies, north America and the European Union.

Australia holds the world’s largest economic resources of nickel, with approximately 25% of resources (based on latest data from United States Geological Survey, 2012). The state of Western Australia holds the majority of known resources of nickel with 90.7% of the total Australian Economic Demonstrated Resources (EDR).

The bulk of Australia’s nickel resources occur in laterite deposits (69%). However, most (82%) of Australia’s nickel production is from sulfide deposits hosted by ultramafic volcanic and intrusive rocks (komatites), within the Archean Yilgarn Craton of Western Australia (Figure 1). Australia ranks fourth in nickel production behind Russia, Indonesia and Philippines, accounting for 11.8% of estimated world mine production in 2012. In 2012 Australia’s nickel production was 244,000 tonnes.

### Table 1.1: Australia’s resources of nickel with world figures as at December 2012.

<table>
<thead>
<tr>
<th>Units</th>
<th>JORC Reserves (% of EDR)</th>
<th>Economic Demonstrated Resources (EDR)</th>
<th>Inferred Resources</th>
<th>Accessible EDR</th>
<th>Mine production in 2012</th>
<th>World economic resources</th>
<th>World mine production in 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt</td>
<td>7.5 (42%)</td>
<td>17.7</td>
<td>17.8</td>
<td>17.7</td>
<td>0.244</td>
<td>72.6</td>
<td>2.14</td>
</tr>
</tbody>
</table>

Note: JORC Reserves are those complying with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code)
Source: Geoscience Australia, the Bureau of Resources and Energy Economics and the United States Geological Survey.

Mt = million tonnes of nickel metal

Although komatiite-hosted deposits dominate Australian production, this deposit type ranks only fourth in global nickel production (18%), after deposits hosted by large igneous provinces (LIPs) (30%, e.g., Noril’sk, Russia), astrobleme (20%, Sudbury, Canada) and tholeiitic intrusion-hosted or ‘basal sulfide’ deposits (20%, e.g., Voisey’s Bay, Canada and Jinchuan, China).

In the Yilgarn Craton of Western Australia, potential for new greenfields discoveries exists where known mineralised nickel provinces extend under cover to the north and east of the exposed parts of the craton (see map overleaf, region A).

Tholeiitic intrusion-hosted nickel sulfide deposits are highly sought exploration targets due to their potential size and co-products of platinum-group elements (PGE) and copper. Relatively small deposits of this type have been discovered in Australia, in the Musgrave Province (Nebo-Babel or West Musgrave deposits; see map area C, overleaf), Lamboo Province (e.g., Sally Malay deposit; see map area F, overleaf), and in the Albany-Fraser Province (recently discovered Nova deposit; see map area B, overleaf). Ongoing studies of nickel mineral systems by Geoscience Australia and other groups indicate the high potential of several other provinces, including LIPs, to host major undiscovered intrusion-hosted nickel deposits. Some of these regions are shown in the map overleaf.
Australia’s nickel provinces, resources and host-rock geology:
Opportunities for discoveries under cover

Figure 1: Australia’s major nickel deposits (light purple circles) and geological provinces containing nickel resources (shades of yellow). Also shown are the outcrop and/or interpreted sub-surface distributions of mafic and ultramafic igneous rocks (green areas), which are the principal hosts of nickel sulfide deposits. The extent of major sedimentary basins of variable age covering older basement rocks are shown as a stippled pattern with coloured outlines.

Selected regions with nickel potential
A Under-cover extensions of provinces in the Archean Yilgarn Craton containing komatite-hosted nickel deposits
B Extension of the Proterozoic Fraser Zone, containing the Nova nickel-copper-PGE deposit
C Extension of the Proterozoic Musgrave Province in the region of the Nebo-Babel nickel-PGE deposits
D Eastward extension undercounr of the Proterozoic Musgrave Province and Gales Event intrusions
E Proterozoic to early Paleozoic mafic-ultramafic intrusions in the Aileron, Warumpi and Irindina Provinces
F Southern and northern extensions of the Proterozoic Lachlan Orogen with its intrusion-hosted nickel-PGE deposits
G Potential for large laticite and sulfic nickel deposits related to mafic-ultramafic rocks in the Paleozoic Lachlan Orogen

References
The new dataset highlights the presence of numerous high-volume mafic and ultramafic igneous events across Australia, from the Archean to the Phanerozoic. This geology is favourable for major tholeiitic mafic-ultramafic intrusion-hosted Ni-PGE-Cu deposits such as the Noril’sk (Russian Federation) and Voisey’s Bay (Canada) deposits.

**Geoscience Australia’s nickel products and data**

Selected products and data (below) are available to assist nickel mineral explorers, investors and others interested in Australia’s nickel resources and potential.

- **Geoscience Australia’s nickel webpage:** http://www.ga.gov.au/scientific-topics/minerals/mineral-resources/aimr/nickel
- **Mafic-Ultramafic Events resource packages including .pdf maps and User Guides:**

**For further information:**

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Cover image: Nickel mine in Western Australia, courtesy of BHP Billiton.