

Nickel is a chemical element with the chemical symbol Ni. It was first discovered in Sweden in 1751. It is a lustrous, silvery-white metal with a melting point of 1453°C. It has relatively low thermal and electrical conductivities, high resistance to corrosion and oxidation, excellent strength and toughness at elevated temperatures and is capable of being magnetised.

Nickel is widely used in over 300,000 products for consumers, industrial, military, transport, marine and architectural applications. The most common use is as an alloying metal in the production of stainless and heat-resisting steels.

GEOLOGY

Nickel was first discovered in Australia in January 1966 as a massive nickel-copper sulphide at Kambalda near Lake Lefroy in the Eastern Goldfields of Western Australia. This marked the beginning of the nickel industry in Australia.

The sulphides at Kambalda assayed 8.3% Ni and 0.5% Cu and were hosted by ultramafic igneous rocks called komatiites (Geoscience Australia). Komatiites are rich in magnesium, iron and olivine.

Nickel sulphides found in Australia are associated with ultramafic and/or mafic igneous rocks in three main geotectonic settings: (Geoscience Australia)

- Archaean komatiites emplaced in rift zones of granite-greenstone belts
- Precambrian tholeiitic mafic-ultramafic intrusions emplaced in rift zones of Archaean cratons or Proterozoic orogens
- Hydrothermal-remobilised occurrences with no apparent age or tectonic constraints.

The largest and most economic deposits are associated with Archaean komatiitic rocks in the greenstone belts of the Yilgarn Craton of Western Australia.

ORE TYPES

Nickel ore types are generally found in two forms: magmatic sulphide or laterite. Over 60% of the world's known nickel resources are laterites found mainly in tropical areas such as Indonesia, Cuba, Columbia and New Caledonia. The magmatic sulphide deposits make up the remaining resources and are found in locations such as Canada and Russia. Australia and Brazil have both nickel ore types.

Laterite

The principal ore minerals in laterite deposits are nickeliferous limonite and garnierite. Laterites occur when nickel sulphides have transitioned to oxide ores, commonly found at or close to surface and therefore can be mined via open-cut methods. There is no simple separation technique for nickel laterites. The rock must be completely molten or dissolved to enable nickel extraction. As a result, laterite projects are higher cash cost producers and require large economies of scale to be viable.

Sulphide

The principal ore mineral in sulphide deposits is pentlandite. Sulphide ores are generally found hundreds of metres below surface and require underground mining infrastructure. The major benefit to this type of ore is that it can be concentrated using a physical flotation separation technique. Today's nickel is predominantly produced from sulphide deposits as it is easier and cheaper to mine and process than lateritic ore.

ORE PROCESSING

Laterite Ore Processing

Lateritic ores have a high percentage of free moisture and chemically bound water, which must be removed. Free moisture is removed by drying the ore whereas, chemically bound water is removed by a reduction furnace. An electric furnace is needed to obtain the high temperatures required to accommodate the high magnesia content in the ore. Some laterite smelters add sulfur to the furnace to produce a matte for processing.

Hydrometallurgical processes based on ammonia or sulfuric acid leach are also used. Ammonia leach is applied to the ore after the reduction roast step.

Sulphide Ore Processing

Sulphide ores are most commonly processed by flash smelting. Electric smelting is used for more complex raw materials and requires a roasting step to reduce sulphur content and volatiles. Dry sulphide ore containing less than 1% moisture is fed to the furnace along with preheated air and oxygen. Iron and sulphur are oxidised. The heat that results from this reaction is adequate to smelt concentrate producing a liquid matte (up to 45% pure nickel) and fluid slag. Slags are processed in an electric furnace to recover nickel.

Nickel Refining

Various processes are used to refine nickel matte. Fluid bed roasting and chlorine-hydrogen reduction produce nickel oxides containing more than 95% nickel. Vapour processes can be used to produce high-purity nickel pellets.

Nickel Pig Iron (NPI)

Nickel Pig Iron (NPI) is a low grade ferronickel composed of low grade nickel ore (mostly laterite ore), coking coal and a mixture of gravel and sand as an aggregate. The mixture is heated in either a blast furnace or electric furnace depending on the desired grade. Impurities are removed by smelting and sintering processes resulting in nickel pig iron containing 4 to 13 percent pure nickel. Chinese NPI production started to take off during 2006 and 2007 as the LME nickel price rose to record highs. NPI has been around for more than 100 years but it was the Chinese who successfully made the production commercially viable.

SUPPLY AND DEMAND

Nickel is the fifth most common element found on Earth. Iron, oxygen, silicon and magnesium are more abundant. Nickel resources, estimated at twice the amount of

proven land based nickel reserves are sub-economic, that is not mineable at a profit. The development of new mining technologies will result in the conversion of some of these resources into proven reserves. Extensive resources of nickel are also found in manganese crusts and nodules covering large areas of the ocean floor (USGS).

The top five producing countries are Indonesia, Philippines, Russia, Canada and Australia. World mine production of nickel totalled 1,940,000 tonnes in 2011 with an estimated 2,100,000 tonnes in 2012. World reserves are estimated to be approximately 75,000,000 tonnes. The land resource base is believed to be less than 100 years at the present mining rate.

Norilsk Nickel with its operations in Russia, Australia, Botswana and South Africa and Vale with its operations in Canada, Indonesia, New Caledonia and Brazil are the clear market leaders in nickel production.

The biggest consuming country is Asia by far, totalling 1,099,200 tonnes in 2012, up 7% on the previous year. World nickel usage totalled 1,658,300 tonnes in 2012, up 5% on the previous year.

How large are Australia's nickel resources?

Australia accounts for some of the largest nickel sulphide and laterite deposits in the world, predominately located in Western Australia. Australian nickel resources represent around 24 million tonnes, approximately 35% of the world economic resources followed by New Caledonia with 10.3%, Russia with 9.6% and Cuba with 8% (Geoscience Australia). Australia's annual nickel production is approximately 165,000 tonnes, all sourced from Western Australia, attracting export earnings of around \$3.2 billion (ABARES).

REVIEW OF THE AUSTRALIAN NICKEL INDUSTRY MARCH 2014

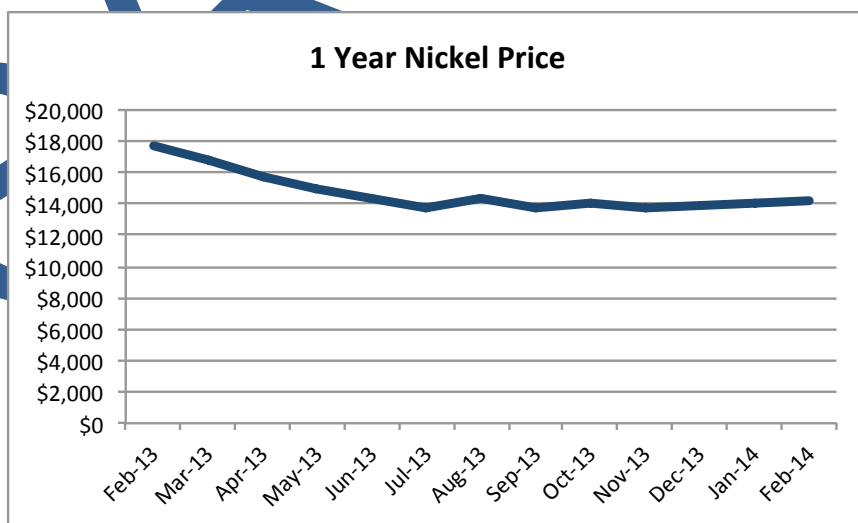
ASX Listed Nickel Companies

ASX Listed Nickel Companies													
Name	Code	Status	Share Price (\$)	Shares (m)	Mkt Cap (\$m)	52 Week		Tonnes	Total Reserves			Total Resources	
						High (\$)	Low (\$)		Grade Ni%	Ni Tonnes	Tonnes	Grade Ni%	Ni Tonnes
Ausquest Ltd	AQD	Explorer	0.014	260.5	3.600	0.042	0.009						
Australasian Resources Ltd	ARH	Explorer	0.034	489.1	16.600	0.160	0.021						
Axiom Mining Ltd	AVQ	Explorer	0.012	2,500.0	30.500	0.025	0.010						
Cazaly Resources Ltd	CAZ	Explorer	0.085	130.5	11.100	0.190	0.071						
Cougar Metals NL	CGM	Explorer	0.004	665.3	2.700	0.012	0.003				10,090,000		0.98
Cullen Resources Ltd	CUL	Explorer	0.009	818.4	7.400	0.030	0.006						
Discovery Metals Ltd	DML	Producer	0.041	560.0	23.000	0.790	0.035					4,100,000	0.70
Falcon Minerals Ltd	FCN	Explorer	0.012	169.0	2.000	0.027	0.009						
Focus Minerals Ltd	FML	Explorer	0.015	9,100.0	137.100	0.028	0.011					591,300	2.20 13,250
GME Resources Ltd	GME	Explorer	0.029	384.7	11.200	0.037	0.018					108,460,000	0.93 1,007,573
Gondwana Resources Ltd	GDA	Explorer	0.047	17.2	0.810	0.095	0.044						
Hazelwood Resources Ltd	HAZ	Explorer	0.035	1,200.0	40.500	0.055	0.017						
Heron Resources Ltd	HRR	Development	0.140	253.0	35.400	0.175	0.110						
Highlands Pacific Ltd	HIG	Explorer	0.068	854.3	58.100	0.145	0.050	75,700,000	0.91	na		795,600,000	0.70
Impact Minerals Ltd	IPT	Explorer	0.030	487.1	14.600	0.105	0.015					143,200,000	1.01
Independence Group	IGO	Producer	4.250	233.3	991.600	4.840	2.180	881,000	3.8	33,900	1,381,000		5.40 74,100
Jervois Mining Ltd	JRV	Explorer	0.026	65.7	1.700	0.070	0.020						
Jindalee Resources Ltd	JRL	Explorer	0.175	34.8	6.100	0.270	0.165						
Lincoln Minerals Ltd	LML	Explorer	0.061	201.3	12.300	0.104	0.041						
Mamba Minerals Ltd	MAB	Explorer	0.540	70.6	38.100	0.980	0.270						
Metallica Minerals Ltd	MLM	Development	0.048	160.6	7.700	0.169	0.046					59,500,000	0.51 305,100
Mincor Resources	MCR	Producer	0.635	188.2	119.500	0.970	0.445					3,172,000	3.70 117,000
Mirabela Nickel Ltd	MBN	Producer	0.016	876.8	14.000	0.008	0.465					159,300,000	0.52 569,800
Northern Mining Ltd	NMI	Explorer	0.055	938.4	51.600	0.065	0.003					16,800,000	0.60 94,000
Panoramic Resources Ltd	PAN	Producer	0.400	322.3	128.900	0.495	0.200	2,928,000	1.29	37,750		4,740,000	1.48 70,300
Pepinini Minerals Ltd	PNN	Explorer	0.016	120.4	1.900	0.054	0.014						
Poseidon Nickel Ltd	POS	Development	0.105	411.1	43.200	0.275	0.069	1,719,000	1.44	24,750		10,093,000	1.55 156,300
Redstone Resources Ltd	RDS	Explorer	0.064	152.0	9.700	0.145	0.032						
Resource Mining Corporation L	RMI	Explorer	0.001	2,700.0	2.700	0.002	0.001					125,000,000	1.06
Rox Resources Ltd	RXL	Explorer	0.037	665.5	24.600	0.097	0.025						
Sipa Resources Ltd	SRI	Explorer	0.055	481.6	26.500	0.099	0.050						
Sirius Resources	SIR	Feasibility	2.500	261.9	654.800	5.600	1.560					14,600,000	2.20 325,000
St George Mining Ltd	SGQ	Explorer	0.120	79.5	9.500	0.200	0.080						
Traka Resources Ltd	TKL	Explorer	0.046	111.8	5.200	0.120	0.030						
Variscan Mines Ltd	VAR	Explorer	0.045	175.7	7.900	0.065	0.037						
Western Areas Ltd	WSA	Producer	3.280	196.9	645.700	4.750	1.940	6,614,436	3.3	218,160	22,946,542		2.00 461,694

* Empty fields means data is unavailable

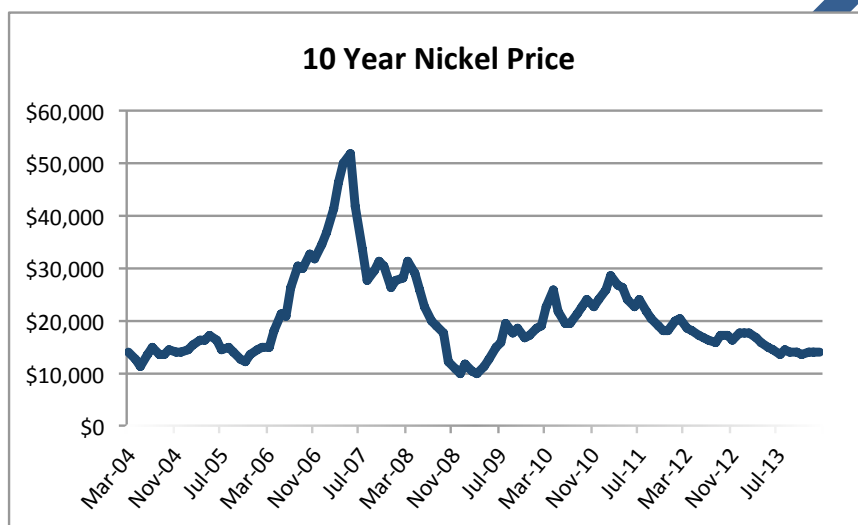
1 Year Nickel Price (London Metal Exchange)

The graph that follows shows the price of nickel over the past year. During February 2013, nickel peaked at \$17,597 per tonne and then commenced its decline to hit a four year low of \$13,725 per tonne in November 2013.



10 Year Nickel Price (London Metal Exchange)

The graph below shows the price of nickel over the past ten years. Nickel peaked to a record high of \$52,179 per tonne in May 2007 and then prices declined until the end of 2008 with a low of \$9,678 per tonne in December.



SUMMARY

Western Australia accounts for some of the largest nickel laterite and sulphide deposits in the world, representing 35% of the world economic resources. Australia produces approximately 165,000 tonnes annually.

Lateritic ores are commonly found at or close to surface and therefore can be mined via open-cut methods. However, there are no simple separation techniques for nickel laterites and therefore require higher cash costs to process and larger economies of scale to be viable.

Sulphide ores are generally found hundreds of metres below surface and require underground mining infrastructure. The major benefit to this type of ore is that it is easier and cheaper to mine and process than lateritic ore.

World mine production of nickel in 2012 was estimated to be 2,100,000 tonnes (up 8% on 2011) and world nickel usage totalled 1,658,300 tonnes in 2012 (up 5% on 2011). In 2012, there was an estimated nickel surplus of 441,700 tonnes, equivalent to just over 3 months supply. Figures for 2013 are currently not available.

On 12 January 2014, Indonesia placed a ban on all mineral ore exports to promote domestic processing. This ban changes the dynamics of the nickel industry from a situation of oversupply during the next few years because of the increase in NPI production to a potential shortfall.

There are over thirty companies listed on the Australian Securities Exchange (ASX). Discovery Metals, Independence Group, Mincor Resources, Mirabela Nickel and Western Areas are all producers of nickel. The remaining companies are in development or exploration phase.

SOURCES

Geoscience Australia

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

International Nickel Study Group (INSG)

London Metal Exchange (LME)

TERMS AND CONDITIONS

The following Terms and Conditions relate to material presented in this document published by Resources Stocks to Watch, ABN 95 574 112 603 and should be read before making any investment decision.

Analyst Certification

The analyst(s) certify that the views expressed in this document accurately reflect their personal and professional opinion about the financial product(s) to which this document refers. The analyst(s) may have an interest in shares referred to in this report.

Warnings

Nothing in this document is advice by or opinion of the author. Past performance is not a reliable indicator of future performance. The information in this document is based solely on consideration of the investment and/or trading merits of the financial product(s) alone without taking into account the investment objectives, financial situation and particular needs of any person. Before making an investment decision, the reader must consider whether it is personally appropriate for them in light of his or her financial circumstances and should seek further advice.

Disclaimer

This document is for the exclusive use of the person to whom it is provided by Resources Stocks to Watch and must not be used or relied upon by any other person. No representation, warranty or undertaking is given or made in relation to the accuracy or completeness of the information presented in this document, which is compiled from public information that has not been verified by Resources Stocks to Watch. The information in this document is subject to change without notice and Resources Stocks to Watch assumes no obligation to update this document following publication. Resources Stocks to Watch disclaim all liability for any error or inaccuracy in or omission from the information contained in this document or any loss or damage suffered directly or indirectly by the reader or any other person as a consequence of relying upon the information.