



The Mineralogical Society of Victoria
Incorporated
A0001471E

Newsletter No. 238

June 2019



Arsenopyrite 3mm
Rose of Denmark Mine

Print Post Approved PP100003094

The Mineralogical Society of Victoria Inc.
P.O. Box 153
Lara, Victoria, 3212

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Membership Details:

Joining Fee	\$5.00		
City Adult Member	\$25.00	Country Adult member	\$20.00
City Family membership (2 adults & children under 18)	\$35.00	Country Family Membership (2 adults & children under 18)	\$30.00
Student Member (full time)	\$15.00	Newsletter only	\$15.00

(N.B. - Country membership - more than 50 km from Melbourne G.P.O.)

Applications for membership can be obtained by writing to:-

The Secretary, Mr Fred Kapteina,
P.O. Box 153
Lara, Vic, 3212.

General meetings are held on Wednesday evenings every two months (except January and Public Holidays). Please see the Forward Diary in this Newsletter for upcoming meeting dates and locations.

Visitors are most welcome.

Newsletter of the Mineralogical Society of Victoria
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FORWARD DIARY

PLEASE NOTE - General Meetings are held approximately every second month on Wednesday evening.

June 12 ANNUAL GENERAL MEETING

Wednesday 8:00pm, at Royal Society of Victoria Building, Cnr La Trobe and Victoria Streets, Melbourne
Speaker: Alex Blount (MinSoc President), Topic – Alpine minerals, but not from the Alps.

June 16 Mineral Appreciation Group: 10:00am, Nunawading Lapidary Club, Oval Way, Nunawading.
Sunday Topic – My favourite mineral species

June 30 Micro Group Meeting: George Lysiuk's home
Sunday Topic: A study of the Min Soc's Broken Hill micro collection.
Members are also to bring along any unusual/rare Broken Hill specimens.

July 21 Mineral Appreciation Group: 11:00am, Nunawading Lapidary Club, Oval Way, Nunawading.
Sunday Topic: Evaporites.

July 28 Micro Group Meeting: George Lysiuk's home
Sunday Topic: Minerals from Central and South America.

Aug 14 GENERAL MEETING

Wednesday 8:00pm, at Royal Society of Victoria Building, Cnr La Trobe and Victoria Streets, Melbourne
Speaker: Ed Richard (Pristine Minerals), Topic – What's new

Aug 18 Mineral Appreciation Group: 10:00am, Nunawading Lapidary Club, Oval Way, Nunawading.
Sunday Topic: Tsumeb and other Namibian localities

Aug 25 Micro Group Meeting: George Lysiuk's home
Sunday Topic: Minerals in the Isometric crystal system

Sept 15 Mineral Appreciation Group: 10:00am, Nunawading Lapidary Club, Oval Way, Nunawading.
Sunday Topic: Minerals from the IMA list, coded Rn or Rd

Sept 29 Micro Group Meeting: George Lysiuk's home
Sunday Topic: Sulphate minerals

Oct 9 GENERAL MEETING

Wednesday 8:00pm, at Royal Society of Victoria Building, Cnr La Trobe and Victoria Streets, Melbourne
Speaker: Oskar Lindenmeyer (Collections Manager Melbourne Museum),
Topic – The Museum's Collections.

- Oct 27 Micro Group Meeting: George Lysiuk's home
 Sunday Topic: TBA
- Nov 17 Mineral Appreciation Group: 10:00am, Nunawading Lapidary Club, Oval Way, Nunawading.
 Sunday Topic: Minerals with special properties
- Nov 24 Micro Group Meeting: George Lysiuk's home
 Sunday Topic: TBA
- Dec 11 GENERAL MEETING
 Wednesday 8:00pm, at Royal Society of Victoria Building, Cnr La Trobe and Victoria Streets, Melbourne
 Speaker: Ian Strachan, Topic– Namibia

For any of the usual attendees to MAG meetings, if you would love a particular topic to be covered or even re-covered please let us know and hopefully it will be in time for the due newsletter.

MINERAL RELATED EVENTS

- Aug 31- Sep 1 **42st Joint Mineralogical Societies of Australasia - Annual Seminar**
 "Traps in Mineralogy, Pseudomorphs, Look-Alike and Fakes and Synthetics"
 State Library, Perth Cultural Centre, Western Australia
- Aug 31- Sep 1 Frankston and Peninsula Lapidary Club Annual Exhibition
 Peninsula Community Theatre, 90 Wilsons Road, Mornington
- Oct 19 & 20 Nunawading and District Lapidary Club Annual Exhibition
 Dorset Primary School, Rescorla Ave., Croydon
- Nov 2 & 3 Geelong Gem and Mineral Club Show
 West Geelong Town Hall, Packington Street, West Geelong
- Apr 10-132020 56th Gemboree
 Albury Show Grounds

NEXT ISSUE

PLEASE NOTE:- Material for the **September** 2019 Newsletter to be with **Fred Kapteina** by **August 25th**.

FROM THE COMMITTEE

Welcome to the June edition of our newsletter for 2019.

We are sure you will enjoy this latest edition of the newsletter as you will have our previous editions, but we want to remind members about the need for contributions. It is a newsletter by members for members. Don't worry about your writing skills, if that is what is holding you back. We are confident that the Editor, Michael Hirst, will be only too happy to help you with your article, so please give it a go. Alternatively, perhaps you wish to sell some minerals or mineral related items? As a member it won't cost you anything to put in a few lines in the newsletter and you will reach more than just our members.

Please check out the forward diary in this newsletter for both the Micro Group and the Mineral Appreciation Group; there are some interesting topics coming up. The topics are always challenging and sometimes even controversial, but always educational. The meetings are relaxed and social and that is always part of the fun. It will come to no surprise to those that attend regularly, but 'minerals' is usually also the topic during the social part of the meetings.

Re fieldtrips, there has been no feedback from members on possible future fieldtrips and destinations. How about another trip to Flinders or Jindivick for zeolites? What about a trip to collect vivianite nodules at Anglesea. Another suggestion is an extended weekend trip to Broken Hill (no access to main lode mines)? Please let the Committee know to what locations you would like to have a field trip, or send your ideas to the

Secretary to pass onto the Committee.

The Committee is currently trying to push the Society's publicity. To that end there will be new flyers designed and printed with the intention that members distribute them to friends or, if they belong to a Lapidary Club, hand them out to members there. We will also give batches to dealers to have at their stalls at shows and we will also hand them out at shows that we officially attend. We are also in the process of developing a new web site that is easier to maintain and a better and more modern platform that will offer a lot more to entice new members. In the meantime the current web site, www.minsocvic.org.au will provide an up to date forward diary reflecting any changes from that posted in the newsletter.

Also, if you are on Facebook, you will have noticed regular postings on our site "Mineralogical Society of Victoria". Feel free to "guest" post things of interest on our page that have a mineralogical or related theme.

This is the month for our Annual General Meeting (AGM) of the Society. On June 12 all Committee positions become vacant and elections aim to see some new blood either join or replace current retiring members. So if this newsletter reaches you before the AGM, please have someone nominate you for a position for the year 2019/20, or put up your hand on the day. Nomination forms will have been sent out with the notice advising you of the AGM.

Finally, if you are unable to attend meetings in Melbourne but have some suggestions, send us an email via the Secretary. The Committee will be only too happy to consider all suggestions.

Fred Kapteina
Secretary

SHORT TALKS

As always, it is a struggle to find speakers for the Short Talks. Aside from a few regular contributors and some generous offers, it is left to the Committee to nominate people from those who we expect might be attending the General Meetings. Given the smaller numbers of attendees at General Meetings, it is also becoming nearly impossible to 'volunteer' people for short talks – as we are never quite sure who will be present! Whilst we have seen some exceptional presentations in the past year, we are regularly left without a short talk for the meeting.

We are happy to entertain ANY suggestions for alternative activities, ways to encourage more people to attend and present something... anything at all. These are your meetings so please let the Committee know what you would like to see or hear?

MUSEUM FUND

Donations to the Museum Fund are always appreciated and can be made through your annual membership renewal form, through buying or donating specimens for sale, or by contacting a Committee member at any time.

EDITORIAL

Due to travel commitments, I am calling for an assistant to help me with completion of the September 2019 issue of the Newsletter. Please send offers of help to **The Secretary** or myself (mike7354@hotmail.com) before the start of August.

PLEASE don't leave it to "The Committee" to do all the work on this next issue!

Michael Hirst
Editor

PUBLICITY

Micro Group Report

By Jo Price. Photographs by John Haupt

Meeting held on 28th April 2019

The topic was minerals from their Type Localities. With 5,484 species listed in MINDAT, it was not surprising to find that many different minerals were brought along to study at the meeting.

Australian localities were Broken Hill, N.S.W., with specimens of kintoreite, kolitschite, marshite, mawbyite, miersite, plimerite, raspite, and segnitite.

From Tasmania: hellyerite & hazlewoodite, Lord Brassey mine; dundasite, Adelaide mine and stichtite, Dundas.

From Queensland: Cloncurryite, Great Australia mine and sieleckiite, Mt. Oxide mine.

From South Australia: Francisite, and kleemanite, Iron Monarch; kapundaite, Tom's quarry; aldermanite, Moculta; sulvanite, Edelweiss mine, Burra; cobaltaustinite, Dome Rock; pale blue paratooite, and decrespignyite, Paratoo.

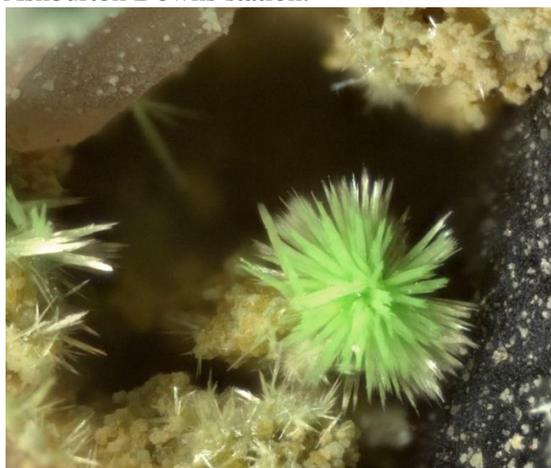
From Victoria: Lakebogaite and ulrichite, Lake Boga; newberyite, Skipton Caves; and wycheproofite from the town of that name.

From Western Australia: Widgiemoolthalite, hydrohonessite and gillardite, from the 132 North mine, Widgiemooltha; putnisite from the Armstrong mine; and ashburtonite from Ashburton Downs station.



Above: Mawbyite from the Kintore opencut, Broken Hill, NSW. 5mm FOV.

Below: A group of 0.5mm crystals of miersite from the Proprietary mine, Broken Hill, NSW.

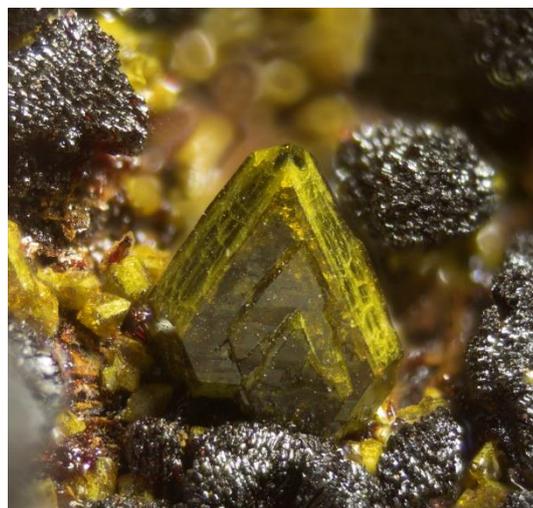


Above: A 1mm spray of ulrichite crystals from Lake Boga, Vic.

Below: Gillardite, 132 North mine, Widgiemooltha, W.A. 2mm FOV.



Below: Segnitite and carminite from the Kintore opencut, Broken Hill, NSW. 2mm FOV.



From the U.K.: Cornish minerals included arthurite, Hingston Downs Consoles, Gunnislake; botallackite, Botallack mine, St Just; chalcophyllite, Wheal Pollard, St Clear; bayldonite, Penberthy Croft mine, St Hilary; and liroconite, Wheal Gorland, St Day. Anglesite from Parys Mountain, Anglesea, Wales.

From Germany: agardite-(Ce) bariopharmacosiderite, and rankachite, Clara mine; erythrite, and pucherite, Schneeberg; manganite, Harz; strunzite and laueite, Hagendorf.

Other European minerals were lengenbachite, Valais, Switzerland; ardennite, Belgium; mrazekite and euchroite, Lubietova, Slovakia; ludwigite, Banat, Romania; and from Russia, shuiskite, Urals; rimkorolite, Kovdor deposit, Kola Peninsula; uvarovite, Saransk.

From Chile: leverettite, Torrecillas mine, Salar Grande; herbertsmithite, San Francisco mine, Caracoles; atacamite, La Farola mine, Cerro Pintado; natrochalcite with leightonite, Chuquicamata mine, Calama; and metavauxite from Llallagua, Potosi, Bolivia.

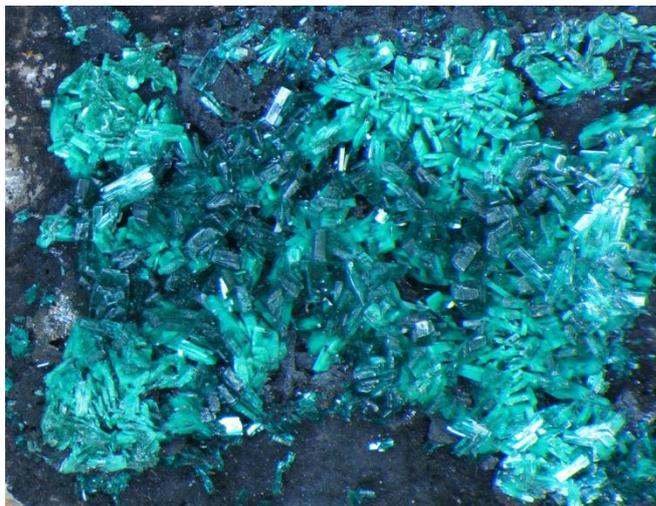
From Africa: windhoekite and ellingsenite, Aris quarry; germanite, arsentsumebite and duftite from Tsumeb, Namibia; and kolwezite, Katanga, Zaire.

From Mont Saint-Hilaire, Canada, were donnayite-(Y), hilairite, lemoyneite, monteregianite-(Y), normandite thomasclarkite-(Y) and yofortierite.

From the USA we saw mcguinnessite, Red Mountain, California; ruizite, Christmas mine, Arizona; kingmountite and switzerite, Foote mine, Kings Mt, Nth Carolina and callaghanite, Gibbs District, Nevada.

Other minerals were tualite, Mayor Island, New Zealand; hubeite, Daye copper mine, Hubei, China; diopside from Altyn-Tyube, Kazakhstan; thomsenolite, and cryolite, Ivigtut, Greenland; and bentorite, Negev Desert, Israel.

Below: Arsentsumebite from the Tsumeb mine, Namibia. 4mm FOV.



Above: Botallackite from the Levant mine, Cornwall. 6mm FOV.

Below: Balydonite from Penburthy Croft mine, St Hilary, Cornwall. 12mm FOV.



Below: Herbertsmithite from San Francisco mine, Caracoles, Chile. 4mm FOV.



Micro Group Meeting May, 2019

The topic for this meeting was sulphide and sulphosalt minerals. Many of these were metallic and mostly silver to grey in colour. Specimens in the sulphide group are relatively common ore minerals (e.g. pyrite, galena, sphalerite). Minerals in the sulphosalt group are much rarer. Some form as wires, (e.g. boulangerite, jamesonite, bismuthinite, stibnite, owyheeite & millerite), and a few are more colourful (e.g. cinnabar, greenockite, orpiment & realgar).

Some of the specimens from noted localities were:

From the Lengenbach quarry, Switzerland (where over 30 sulphosalt species are recorded): dufrenoyite, jordanite, lengenbachite, sartorite and sphalerite.

From the Cattle grid pit at Mount Gunson, South Australia: chalcocite, emplectite, sphalerite, tennantite and wittichenite.

From the Broken Hill mines: millerite, sphalerite, perrouditite, proustite, pyragyrite, pyrite.

Some interesting species and localities were:

Sphalerite with crystals in various colours: black (South Comet mine, Dundas, Tasmania); orange (Maestries mine, Dundas, Tasmania); yellow (Golden Grove mine, W. Aust.); and red (Kagara zinc mine, Mungana, Qld.).

Stibnite: In curved, striated form from Hillgrove, NSW; Fine sprays from Costerfield, Vic; and as wires from the Magword mine, (Fishington)/Wongwibinda, NSW.

The characteristic cog wheel crystals of bournonite from Quiruvilca & Casapalca, Peru; Yaogangxian mine, Hunan prov. China and the Tolwong mine, NSW.

Arsenopyrite crystals with axinite from Colebrook Hill and from Mt Bischoff, Tasmania; & associated with other sulphides from Tolwong, NSW.

Red cinnabar from the Nikitovka Hg deposit, Ukraine; from Tongren, China & from Kilkivan, Qld.

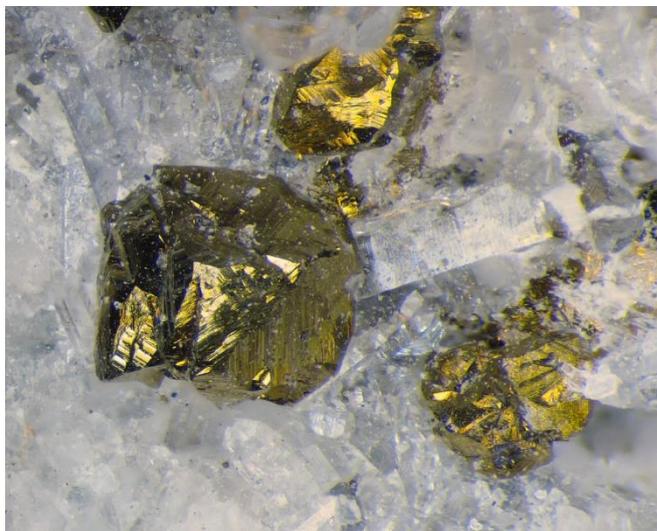
Brass coloured wires of millerite from USA and the Agnew mine, Leinster, WA.

Deep red sprays of Kermesite from Tuscany Italy.

Sharp crystals of chalcocite from the Levant and Geevor mines in Cornwall; and Mount Gunson, S. Aust.

There were pyrite crystals from many localities, including Linton, Deddick and Flinders in Victoria.

Several of the ruby silvers (pyragyrite & proustite) from Peru, Morocco & Saxony, Germany.



Above: Chalcopyrite, Henty Gold mine, Zeehan, Tas. 2mm FOV.

Below: Galena, 0.5mm crystal. From the Maestries mine, Dundas, Tas.



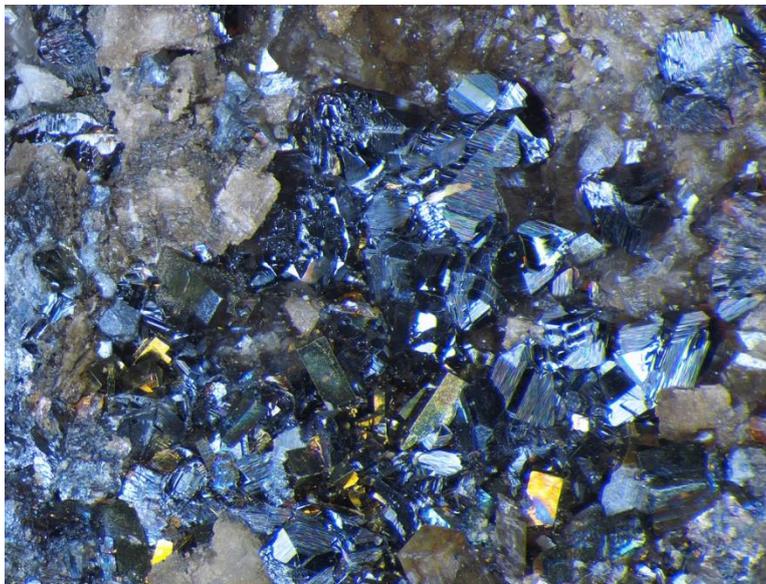
Right: Bournonite & arsenopyrite from the Tolwong mine, NSW. 2mm FOV.

Below: Stibnite wires and coil from the Magword mine, Wongwibinda, NSW. 1mm FOV.



As members can see from our reports, the micro group meetings always have many interesting specimens to look at and discuss.

We welcome new attendees, the main requirement is to let the host know if you wish to attend and ideally, a microscope. The Society owns a microscope, which, if prearranged, may be borrowed for the meetings.



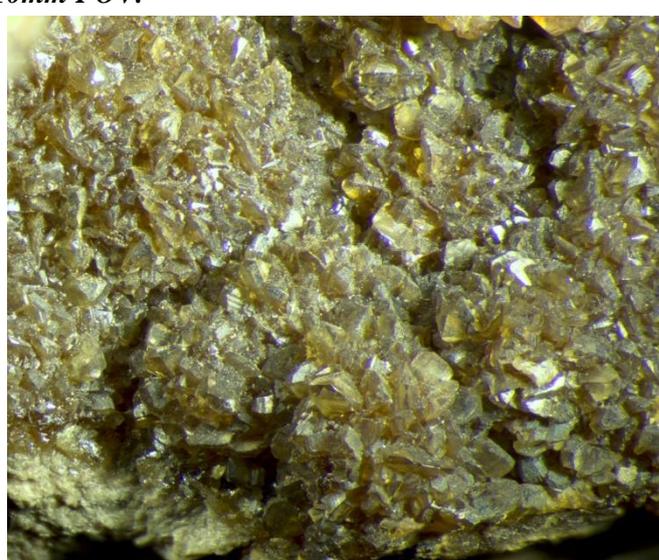
Above: Sphalerite and pyrite, South Comet mine, Dundas, Tas. 7mm FOV.

Below: Yellow sphalerite, Golden Grove mine, W.A. 10mm FOV.

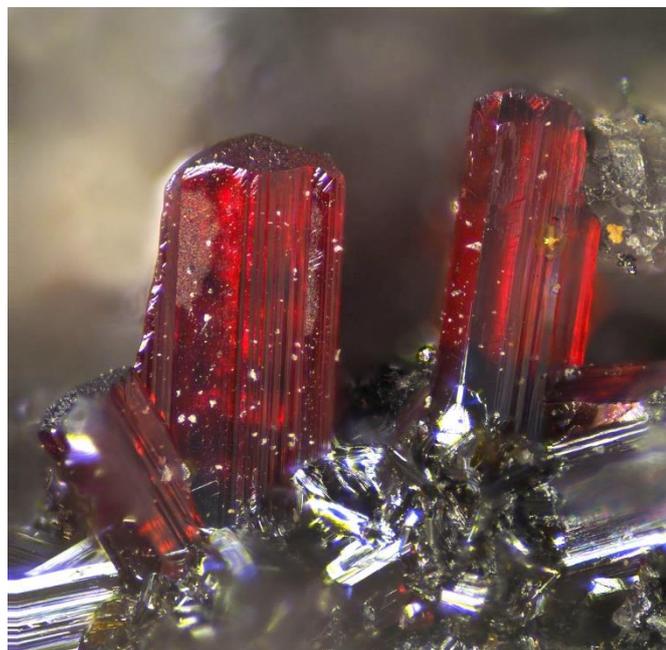


Above: Complex growth faces on a 1mm sphalerite crystal from the Maestries mine, Dundas, Tas.

Below: Lustrous crystals of Proustite from the Imiter mine, Morocco. 2mm FOV.



Below: Orange-red sphalerite from the Que River mine, Waratah, Tas. 8mm FOV.



Common Elements And Their Uses - Nickel

By John Haupt (All photographs: J. Haupt)

A talk given at the Mineralogical Society meeting on 13th February 2019, based on information compiled by the late Val Hannah.

Introduction:

Nickel, Atomic Number 28, is a silvery, shiny, metallic element with a high melting point of 1453°C. It has an Oxidation State (valence) of +2 (-1, +1, +3, +4). It is malleable and can be hammered into thin sheets. Nickel, with its adjacent elements iron (No 26) and cobalt (No 28) are the only three elements known to be ferro-magnetic.

Nickel is the 5th most common element on earth. In combination with iron it comprises the earth's inner core. It is 24th most abundant in the in the earth's crust. The presence of the element nickel in iron-nickel meteorites distinguishes them from rocks or minerals on the earth. The amount of nickel in these meteorites ranges from 5% to almost 20%.



Smelted nickel, 3cm across.

Ni

Periodic Table of Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H Hydrogen 1.00794	2 He Helium 4.002602																
3 Li Lithium 6.941	4 Be Beryllium 9.012182																
5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984332	10 Ne Neon 20.1797												
11 Na Sodium 22.98976928	12 Mg Magnesium 24.3050																
13 Al Aluminum 26.9815386	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948												
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.887	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938045	26 Fe Iron 55.845	27 Co Cobalt 58.933195	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.96	43 Tc Technetium (97.9072)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.9054519	56 Ba Barium 137.327	57-71 Lanthanoids	72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89-103 Actinoids	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (282)	117 Uus Ununseptium (284)	118 Uuo Ununoctium (294)

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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57 La Lanthanum 138.9047	58 Ce Cerium 140.9076	59 Pr Praseodymium 140.9076	60 Nd Neodymium 144.242	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92535	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93032	68 Er Erbium 167.259	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.9668
89 Ac Actinium (227)	90 Th Thorium 232.0376	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

Discovery:

In medieval Germany, a red mineral was found in the Erzgebirge that resembled copper ore. However, when the miners were unable to extract any copper from it, they blamed a mischievous sprite of German mythology, Nickel (similar to Old Nick) for besetting the copper. They called this ore Kupfernickel from the German Kupfer for copper. In 1751, Axel Fredrik Cronstedt of Sweden attempted to extract copper from the mineral niccolite (nickeline) and to his surprise got a silvery-white metal, instead of copper. He named the new metal nickel after the name kupfernickel.

Uses:

The major use of nickel is in stainless steel. In 1913, Harry Brearly, an English scientist, first produced stainless steel when he accidentally discovered that the addition of chromium to steel makes the steel resistant to staining. Today, stainless steel also contains some molybdenum, titanium and nickel, to increase its resistance to corrosion.

Nickel is commonly used in nonferrous alloys (or mixed with metals other than steel) and superalloys (metal mixtures designed to withstand extremely high temperatures and/or pressures, or to have high electrical conductivity). (e.g. Jet engine turbine blades).

Nickel is used as a coating on other metals to slow down corrosion, accounting for 14% of nickel use.

With its ferromagnetic properties it is used in permanent magnets, such as in combination with cobalt and aluminium (ALNICO).

Nickel is used in the production of coins, nickel-cadmium and nickel-metal hydride batteries; as a catalyst for certain chemical reactions; and as a colourant - nickel is added to glass to give it a green colour.

Trace amounts of nickel are important to a number of species of animals and is also important to the proper function of some enzymes in both plants and animals. (Challonder, 2015).

Resources:

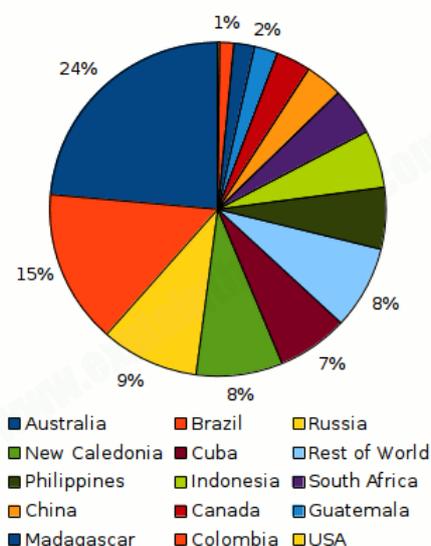
It is estimated that there is about 140 million tons of nickel available in identified deposits. Around 70 per cent of reserves are found in the form of laterites, which are soils rich in mineral ores. It occurs as nickeliferous limonite $(\text{Fe,Ni})\text{O}(\text{OH})$ and garnierite - a hydrous nickel silicate $(\text{Ni,Mg})_3\text{Si}_2\text{O}_5(\text{OH})_4$. Many of these reserves remain untapped due to the complexities of extracting nickel from these laterites. Nickel sulphide deposits (Pyrrhotite-pentlandite ore) contain the remaining 30% of the reserves.

Australia has abundant nickel laterite reserves but the extraction of nickel from these laterites has been challenging, and expensive. Traditional processing techniques use large quantities of sulphuric acid at high temperatures and pressures, resulting in expensive waste treatment and disposal of the toxic chemicals used in the extraction process.

Nickel laterites are becoming a priority for mining companies as traditional nickel sulphide reserves are depleted. In 2010, global nickel production from laterites exceeded nickel sulphide-based production for the first time.

Australia has the largest reserves followed by Brazil & Russia. Western Australia has the largest nickel resource with 95.3% of total Australia's economic deposits. Queensland is the second largest with 4.5%, followed by Tasmania with 0.2%. The WA deposits comprises both sulphide & laterite deposits. Qld has laterite deposits.

World nickel reserves by country:



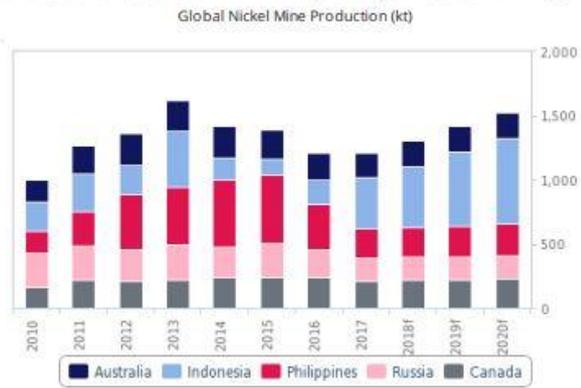
www.explainthatstuff.com

Production:

The leading producers of nickel in 2018 were (in Tonne):

Indonesia	400,000
Philippines	250,000
Canada	210,000
Australia	190,000
Russia	180,000
Brazil	140,000
China	98,000

Indonesia To Lead Growth And Quantity Ahead Of Philippines



Source: BMI, USGS

Nickel price:

The nickel price has fluctuated wildly as shown in the chart below, with many Australian mines being closed due to the relatively low current price. With Chinese investment in Indonesian nickel operations have made them a major producer with, which has kept prices low.



Australian Deposits:

Western Australia

The Nickel boom: In the late 1960s, nickel was in high demand due to the Vietnam War and a shortage of supply from industrial action against the major Canadian supplier Inco. These factors pushed the price of nickel to record levels, peaking at around £7,000/ton in November 1969. In September 1969, the mining company Poseidon NL made a major nickel discovery at Windarra in WA. Their shares had been trading at \$0.80, but as information about the discovery was released, the price rose until it was trading at \$12.30 on October 1. After this, very little further information came to light, but the price continued to climb due to speculation, reaching a high of \$280 in February 1970. By the time Poseidon actually started producing nickel, the price of nickel had fallen. Also, the nickel ore was of a lower grade than originally thought and extraction costs were higher. Profits from the mine were not sufficient to keep Poseidon afloat, and in 1974 it went into receivership. Western Mining then took over management of the mine, operating it until 1991. Mount Windarra produced 5.3 million tonnes of ore grading 1.5% nickel during its minelife (Wikipedia).

The Kambalda Nickel District in Western Australia is one of the world's great nickel provinces. Since its discovery by WMC Resources Ltd in 1966, it has produced over 47 million tonnes of ore, containing more than 1.4 million tonnes of nickel metal. The district has consistently generated more than 35,000 tonnes of nickel metal per annum, apart from a brief period in the late 1990s when the nickel mines were partly shut down. Mincor has played a leading role in the post-2001 revival of the Kambalda Nickel District. Production commenced at its Miitel Nickel mine in March 2001. To the end of June 2013, Mincor's attributable production had reached 153,000 tonnes of nickel metal. Over the same period Mincor increased its ore reserves by more than seven times, consistently

replacing mined ore reserves with new deposits through exploration and, more rarely, acquisitions. The Company suspended mining operations in January 2016 due to exceptionally low nickel prices.

Ravensthorpe is one of two nickel laterite mines operating in WA, the other being Glencore's Murrin Murrin mine near Laverton. In 2008, BHP spent \$2.1 billion building the nickel laterite mine at Ravensthorpe but it was closed in 2009, just months after opening, at a cost of 1800 jobs as the nickel price plunged. Canadian company, First Quantum Minerals bought the mine from BHP for \$US340 million in 2010 and restarted operations in 2011. Ravensthorpe produced 11,512 tonnes of nickel at a cost of \$US5.70 per pound for the six months to the 30th June 2016. (~\$US12,000 per tonne). In August 2017, First Quantum revealed Ravensthorpe - at current metal prices - is making a loss of more than a dollar on every pound of nickel it produces. (McKinnon, 2019)

Queensland

In 1974 Greenvale nickel opened a laterite nickel deposit at Greenvale, constructing a town, railway and a nickel refinery at Yabulu (Townsville). In 1988, laterite ore was obtained from Indonesia and New Caledonia. In 1989, ammoniac AL solvent extraction technology was introduced to the refining process to significantly improve the separation of nickel and cobalt. Mining ceased at Greenvale in 1992. From 1993 to 1995 laterite ore was mined at Brolga, near Rockhampton. In 1995, an ore handling system was built at Townsville and all ore for the refinery was imported from overseas. In 1997, the refinery was purchased by South African owned Billiton and in 2001 became a wholly owned BHP Billiton asset. In 2007, the Yabulu refinery was expanded and ore was shipped from BHP Billiton's Ravensthorpe mine in Western Australia for processing. In 2009, Clive Palmer purchased Queensland Nickel Pty Ltd and the Yabulu refinery. In 2016 Queensland Nickel was closed. (Mudd & Jowitt, 2016)

Tasmania

In 2008, the Avery mine, west of Zeehan, was commissioned by Ozminerals. It closed in 2009 and placed on care & maintenance. In 2009, Ozminerals assets at Avebury and Rosebery were acquired by China Minmetals and owned by their Hong Kong listed subsidiary, MMG. MMG sold the mine to Dundas Mining in 2017 for \$25 Million. The mine is yet to reopen. (Zwartz, 2019)

Nickel minerals:

MINDAT lists 151 species as containing nickel in the following groupings:

- 18 Elements (most species are from meteorites)
- 66 Sulphides
- 3 Halides
- 12 Oxides
- 14 Carbonates
- 13 Sulphates & borates
- 16 Phosphates/Arsenates
- 8 Silicates

Below: Gersdorffite from Ait Ahmine, Bou Azzer, Morocco, 3cm across.

Below left: Annabergite, KM-3 mine, Lavrion, Greece. 10mm FOV.



There are 15 species with Australian type localities.

From Western Australia:

Carrboydite - Carr Boyd Rocks Ni mine, Menzies Shire

Erni nickelite - SM7 pit, Siberia Goldfield, Kalgoorlie Shire

Gillardite - 132 North Mine, Widgiemooltha

Glaukosphaerite - Hampton East Location 48, Kambalda Nickel mines, Kambalda

Hydrohonnellite - Otter Shoot Nickel mine, Kambalda
 Kambaldaite - Otter Shoot Nickel mine, Kambalda
 Nickelblödite - Durkin shaft, Kambalda & Carr Boyd Rocks Ni mine, Menzies Shire
 Nullagineite - Otway Ni deposit, Nullagine
 Otwayite - Otway Ni deposit, Nullagine
 Paraotwayite - Otway Ni deposit, Nullagine
 Paratacamite-(Ni) - Carr Boyd Rocks Ni mine
 Widgiemoolthalite - 132 North Mine, Widgiemooltha
 Cassidyite - Wolfe Creek meteorite crater, Carranya Station
 Pectoraite - Wolfe Creek meteorite crater, Carranya Station
 Reevesite - Wolfe Creek meteorite crater, Carranya Station
 Roaldite - Youndegin meteorite, Quairading Shire
 Tučekite - Kanowna Goldfield, Kalgoorlie Shire
 UM1981-20-S:NiSbSnTe - Mount Clifford Ni deposit, Ten Mile Outcamp, Leonora Shire

From Tasmania:

Heazlewoodite - Lord Brassey Mine, Heazlewood, Waratah
 Hellyerite – Lord Brassey Mine, Heazlewood, Waratah
 Shandite - Nickel Reward Mine, Trial Harbour



Above: Glaukosphaerite from the 132 North mine, Widgiemooltha, W.A. 2mm FOV



Above: A 2mm group of gillardite crystals from the 132 North mine, Widgiemooltha, W.A.



Left: Hydrohonnellite from the 132 North mine, Widgiemooltha, W.A. 2mm FOV.



Left: Gaspeite from the 132 North mine, Widgiemooltha, W.A. 3cm across.

Below: Hellyerite from the Lord Brassey mine, Heazlewood, Waratah, Tasmania. 2mm FOV.



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