June 2023, Issue No 103

Registered Society No. A1009304P

NEWSLETTER

IN THIS ISSUE

To encourage mineralogical study by amateur and professional alike and, in so doing, discover, document and preserve the Earth's and in particular Western Australia's natural history.

Mineralogical Society of Western Australia Inc.

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EDITORIAL

We hope this 103rd issue of the MinSocWA Newsletter will inspire you to get out prospecting despite this being the coldest time of year in WA.

The recent Quiz Night at Herdsman Lake Tavern on 27 June was a great way to warm up the brain cells and a successful event by all accounts. The winners were the Stone Cold Trivial! A full account will be in the Q3 Newsletter.

Thanks to Mineral Resources (MinRes) and Minjar Gold for enabling the field trip to Koolyanobbing and Marvel Loch in April and details of that exciting trip follow, along with some cozy winter reads from the library.

Stay warm!

COMMITTEE 2023

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Patron: Mark Creasy

Some of the many Fluorite facies of Fontsante, Tarneron Massif

FRANCE'S FLUORITES

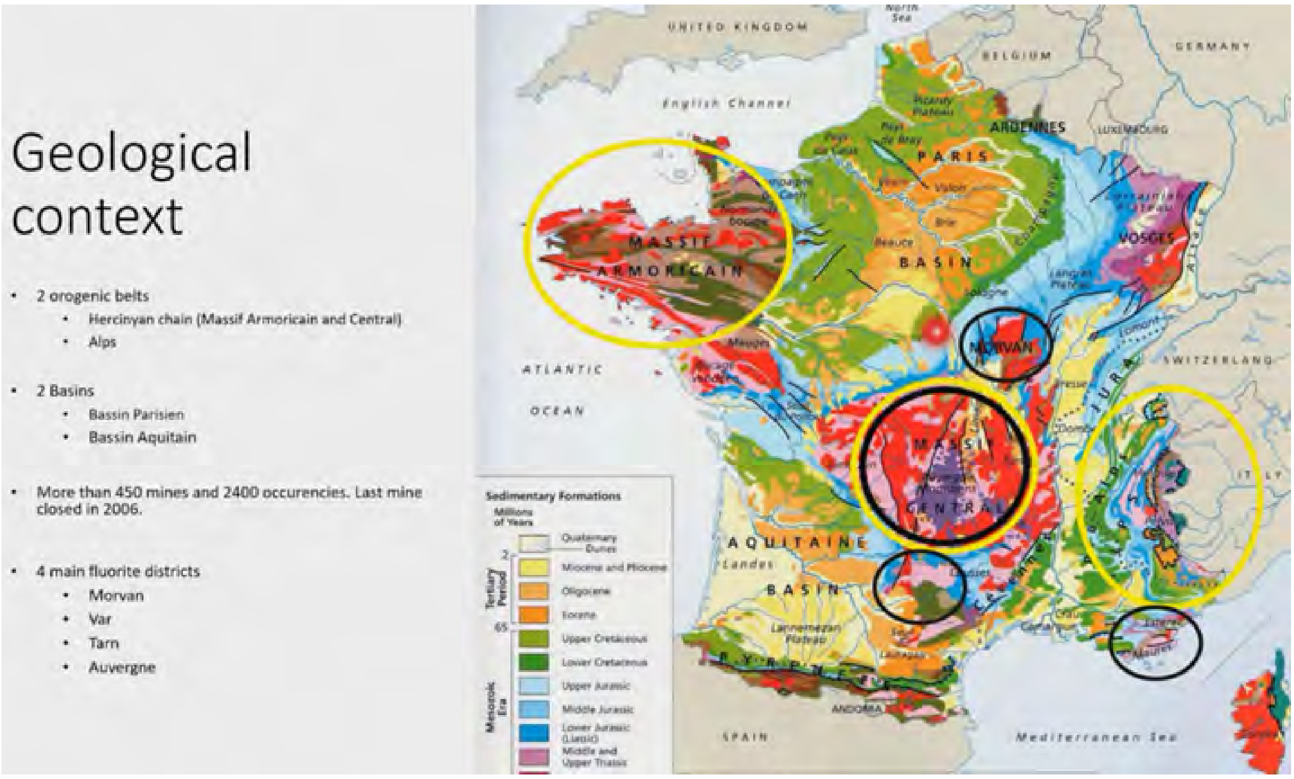
- a presentation by Aubin Cosson

Compiled by Nic Hébert

On Wednesday 12th May, **Aubin Cosson** presented a talk on the fluorites from the Puy de Dôme region, France, with a focus on the Saint Jacques d'Ambur area.

Aubin is currently working on the stratigraphy of the Bonaparte basin at the University of Western Australia, following on from his Masters degrees from UniLaSalle Beauvais and IUE. He is a member of the ACKAM group that was started by a team of geology students sharing a common interest in prospecting. The most recent trips the ACKAM group conducted included hunting for the elusive pink fluorite on smoky quartz combo from the Glacier d'Argentière, Mont Blanc, at more than 3,000m elevation.

The main part of the talk covered the diversity of French fluorite types, with colourful selected specimens from Morvan, Fonstande (Var), Le Burc/Mont-Roc/Moulinal and Peyrebrune (Tarn) shown.



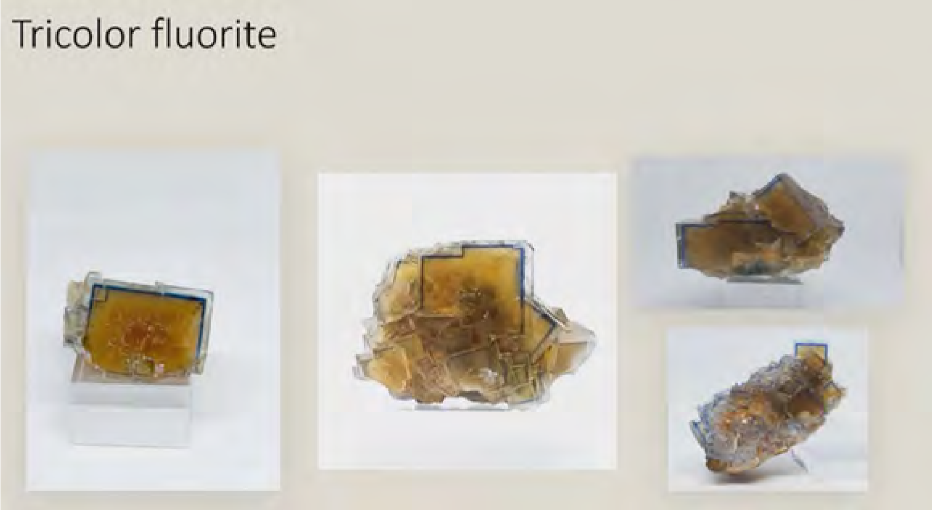
FRANCE'S FLUORITES CONT.

Photos courtesy Aubin Cosson

Underground exploration for fluorites, left. High quality French fluorites from Morvan, below, including curved octahedrons

The two main fluorite regions of Auvergne (Haute Loire) and Puy de Dôme were covered, with emphasis on the most important occurrences including Marsanges, Pratclaux, Le Beix, Puy Saint Gulmier — with a specific hue of "gitane" blue, named after the eponymous French tobacco product packaging, illustrated below.

FRANCE'S FLUORITES CONT.



The Saint Jacques d'Ambur area contains four mines, with La Barre having recently yielded the most surprising fluorite specimens, putting the area back on the international map of significant mineral discoveries. Of the original three galleries, one is still accessible.

While the mine closed in 1968, it was reopened on numerous occasions by mineralogists. The cubic blue fluorite with yellow fantoms were impressive specimens collected on in the 70s and late 90s. Pre-COVID works by the ACKAM team and other fossickers saw the discovery of greenish octahedrons covered with quartz, and the infamous tricolor phantoms, with yellow and purple core, capped with a late generation of blue. Interesting first-hand details about the process of collecting these specimens were shared with the audience and documented with in situ pictures.

Questions were then asked, which showed a strong interest in understanding the geochemistry behind the diversity of colours of the fluorite (trace rare-earth like europium and yttrium are responsible for some of the hues presented). Overall, this was a richly illustrated, very well received presentation.

Important fluorite occurrences: Marsanges and Pratclaux (examples above); and Le Beix and Puy Saint Gulmier, (examples below)

DIAMOND

Journey to the centre of the gem

Compiled by Niels Dahl and Susan Stocklmayer

On Wednesday 8th March our members were entertained by geologist, **Tim Ivanic** and physicist, **John Chapman**, who took us on a journey into the world of DIAMONDS.

Using South African examples, Tim discussed the unique physical properties and crystal forms of diamonds and their terrestrial source from their origin in the upper mantle via the kimberlite conduits that deliver these into the crust.

On Earth, diamonds are associated with intrusions and form in the upper mantle, some 150 to 200 km below surface and at temperatures of 1000 degrees Celsius and above. Diamond ages cover a huge time span with some dating back to 3.3 billion years (based on Sm–Nd radiometric age).

Diamonds are composed essentially of crystallized carbon, commonly forming as octahedral crystals as well as modified cubo-octahedra, dodecahedra and other intergrown and irregular habits.

Unusual diamond cubes with a micro-fibrous internal texture are found at some localities in West Africa. Many diamonds have surfaces features that show modifications during their rising up in the diatremes, such as rounded surfaces and etch pits.

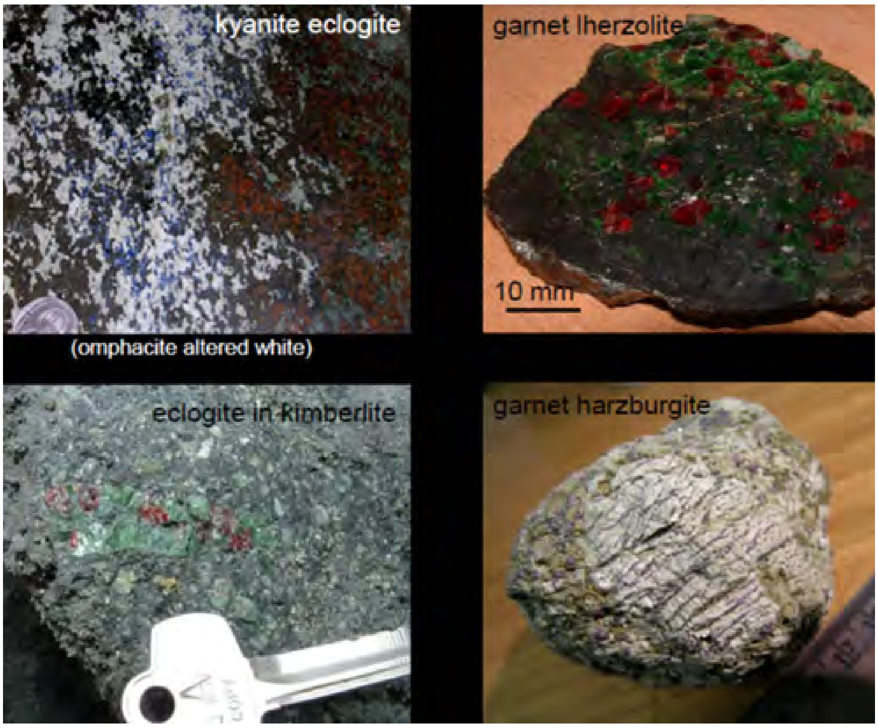
Diamond has perfect octahedral cleavage and is commonly twinned (macles). Boart, a name given to aggregated, non-gem-grade quality diamond crystals, is more usually found in diamond sources in the Democratic Republic of Congo.

Diamonds are popularly best known for their high-value, fashioned gemstones. The largest diamond ever found — weighing 3106ct (1ct = 0.2g) — was named the Cullinan and was discovered in 1905 at the Premier Mine in Transvaal (South Africa). It was fashioned into nine large and many smaller gemstones. One of the current sources of large and flawless diamonds is the diatreme Letseng-la-Terei, in Lesotho.

Some of the physical properties of diamond were compared to those of quartz: diamonds feel cold because they have high thermal conductivity (seven times that of quartz) and their tensile strength is 1050 GPa against 37 GPa for quartz. Diamond has supreme hardness of all the natural materials.

DIAMOND cont.

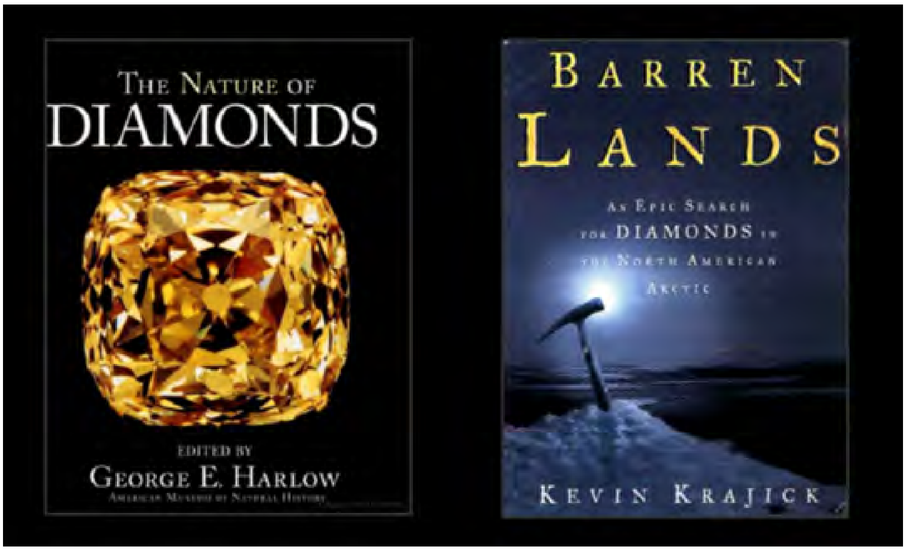
Photoluminescence (PL) has shown that the growth development of diamond crystals can be complex, with multiple growth stages showing different crystal forms from the centre to the outer crystal surface. Minerals such as coesite and omphacite can be incorporated into the developing crystals. These diamond inclusions are generally grouped by their association with either eclogites or peridotites.



Kimberlites were also described to us as "schizophrenic". In an example from the Monastery Mine, South Africa, the thin section contained extremes from the igneous rock world – a matrix of 50:50 carbonatite and ultramafic, ultrapotassic lamprophyre contaminated with ultra-depleted and primitive mantle components, and a jumble of marble (baked limestone country rock), garnet lherzolite xenoliths with reaction rims, and garnet and ilmenite megacrysts with exsolution textures. A petrographic nightmare!

Xenoliths in diamond-bearing rocks vary greatly; examples shown to us included garnet lherzolite, garnet harzburgite, kyanite eclogite, eclogitic kimberlite. Kimberlite magmas are more volatile than other magmas and show associations with mantle metasomatism resulting in examples such as garnet websterite (+SiO_2), phlogopite–edenite lherzolite (+K, -OH) and ilmenite dunite (+Ti).

Tim recommended two books for those interested in diamonds: The Nature of Diamonds by George E. Harlow, and Barren Lands by Kevin Krajick – on the Canadian diamond exploration.



All images above courtesy of Tim Ivanic

DIAMOND cont.

Image courtesy of John Chapman

John's talk concentrated on the natural and artificially induced colours of diamonds, as well as the test results from various instruments used to distinguish natural from synthesized and treated diamonds.

A proportion of natural diamonds are naturally colourless, and a range of colours including yellow, brown, green, pink, red and blue are also found naturally. Generally, colours are caused by the presence of trace elements, notably nitrogen but also boron, hydrogen and iron. Boron and nitrogen are neighbours of carbon in the periodic table and can replace carbon atoms in the diamond lattice.

Diamonds are classified into two types, based on whether nitrogen is significantly present or not in its crystal structure: type I diamonds contain nitrogen atoms as a major impurity (up to 0.2%) and type II diamonds do not contain nitrogen as a significant impurity. Type II diamonds may contain significant boron impurities.

Colour in diamonds is also affected by other parameters: point defects in the atomic configuration are created by inclusions of foreign atoms (type I -nitrogen and type II -boron) replacement of carbon atoms in lattice positions, presence of vacant positions in the atomic lattice, and the relative positions and groupings of both foreign elements and vacancies. Irradiation, both natural and induced, also causes vacancies. All these mechanisms affect the electronic transitions within the lattice, absorbing different parts of the visible spectrum resulting in different colours.

A summary of what seems to be the dominant mechanisms to affect colour in diamonds was provided: colourless- No N/2N and 4N; yellow- single N/3N; blue- B/Ni/irradiation; green-irradiation; pink/red- plastic deformation and vacancies; brown- vacancy clusters and plastic deformation.

Treatment of diamonds may involve high pressure, high temperature (HPHT) methods – with temperatures over 2000 degrees C; irradiation (2 MeV - million electron volts) and moderate temperature; annealing (~1000 degrees C). These processes cause nitrogen atoms to disaggregate, causing vacancies and vacancies to migrate. All cause changes in colour.

DIAMOND cont.

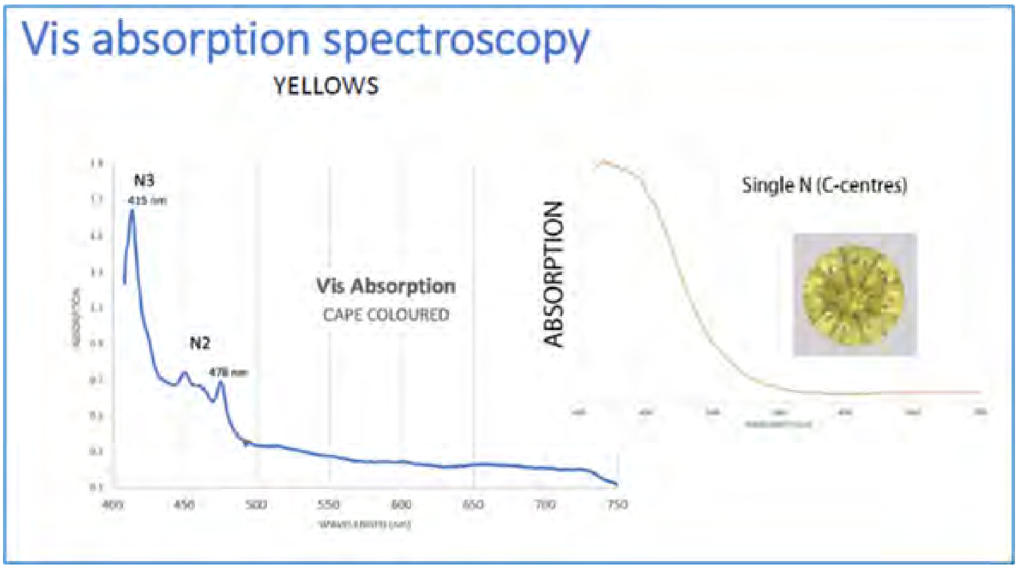


Image courtesy of John Chapman

Diamonds are synthesized by two principal technologies: HTHP (high temperature – high-pressure methods) and CVD (chemical vapour deposition). These respectively produce type II- with no N and colourless diamonds, type I with single N atoms- yellow colour and type II with B – blue colour.

John provided examples of the type of data obtained from several instruments that are used to distinguish synthesized from natural diamonds. Infrared spectroscopy produces different graphical absorption results and is used to identify natural from synthesized diamonds.

Visible spectroscopy (within the visible light range) may produce absorption peaks for yellow type I and blue diamonds. Ultraviolet (UV) and UV laser excitation (between 400 and 800 nm) produces different absorption peak patterns for natural, CVD and HPHT diamonds and UV imaging at 234nm results in different fluorescent colours between natural, HTHP and CVD diamonds.

Crossed polarized light microscopy can be used to demonstrate anomalous interference patterns from strain in natural and CVD diamonds. Long- and short-wave ultraviolet light will produce a range of fluorescent colour responses (stronger in LWUV) and some phosphorescence in diamonds. Differentiation between natural, synthesized, and treated diamonds requires a range of results using some of these specialized instruments.

We thank our speakers for their in-depth talks about an important and interesting mineral, the diamond.

Field Trip to Koolynobbing and Marvel Loch

21 to 23rd April 2023

Compiled by Frank Doedens - Field Trip Coordinator
Photos courtesy Frank Doedens unless otherwise stated.

Marvel Loch

Thirteen enthusiastic MinSocWA members departed from Hazelmere to Marvel Loch at about midday on 21st April. On arrival, we were allocated very comfortable accommodation for the next two nights in one of Minjar Gold's camps. We all enjoyed high quality food in the mess.

The next morning after being inducted into the site, we spread out over the large dump of the Marvel Loch mine immediately behind the Geology offices. Specimens of actinolite, opaline, hyaline as well as mica were found.

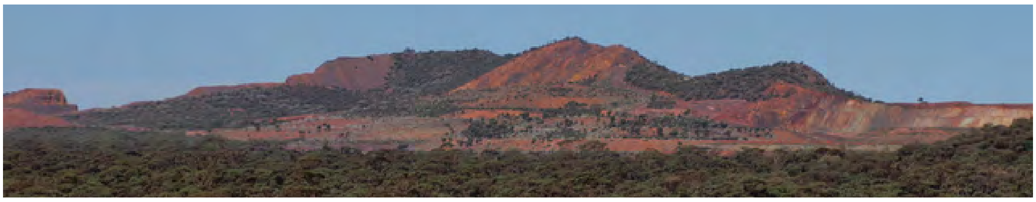
Next stop was the abandoned Great Victoria mine. Here we examined the pits and the dumps where sulphides such as massive arsenopyrite and pyrite occurred. In addition, specimens of chalcedony and hematite were collected. The remains of the processing plant could be seen at the top of the pit.

Lunch was north of Marvel Loch at the Axe Handle deposit, next to a beautiful green lake. Some intrepid collectors scanned the dumps where there were minor sulphides such as chalcopyrite and someone even found small specs of gold!

The final pit stop was at the Sunbeam mine dump, and this really raised the level of excitement! Here the dump had been overlain with material from the nearby Mercury pit. Excited fossicking kicked off with plentiful carbonaceous shales covered with gemmy almandine(?) garnets, mostly up to about 3–4 mm, but some up to 8 mm or more. Some also had pyrite associated with the garnet.

Finding unweathered samples with better cemented garnets was the prize for a few of our members. Unfortunately, the larger garnets were generally translucent to opaque. In addition, there were some plates of shale with large lathes (12 cm and more in length) of altering andalusite. These were generally a bit fragile but came in many interesting patterns.

Marvel Loch Open Pit



Koolyanobbing

We departed from Marvel Loch early on Sunday morning with packed lunches for Koolyanobbing. On arrival we were welcomed with a nice spread of morning tea and extra lunches. We were then inducted into the site regulations and given an overview of its history and the structural alignment of ore bodies from well north and east of our location to well south in the Parker Ranges, west of Marvel Loch.

Our first stop was at the lookout of pit K1. Here we had a good overview of the main ore source of the project over the past 20/30 years. Our recently deceased member Mr Desmond Lascelles along with his daughter, was instrumental in identifying satellite deposits that had suitable material for blending with the high phosphate ore from K Pit. His daughter, who now lives in Queensland, had requested that Des' ashes be scattered at the Lookout. We held a brief but poignant ceremony led by his long-time friend and fossicking partner, Mr Manfred Mertinat during which his ashes were scattered.

K Pit is claimed by 'Google' to have the best specular hematite specimens. The enthusiasm shown by the group in acquiring some for themselves when we returned later in the morning justified its reputation! However, we next visited Pit A which was a good example of a banded iron-formation orebody. Nice, banded chert/jasper/iron oxide samples were plentiful on the dumps.

At 1pm we returned to the main office and had lunch before departing to return to Perth. A big thank you to the drivers, particularly Murray who drove the Hi-Ace van for the entire trip!

The trip went smoothly mainly due to the great support from Mineral Resouces and the Minjar Gold Geology teams on site as well as Daniel Prokop, Josh Thurlow and James Shapcott in the Mineral Resources' Perth office. Jonathan Streeter and his team from Minjar Gold were especially supportive and arranged the accommodation and food for our stay.

Left: Nic Hebert with his Koolyanobbing find.

Impressive iron ore display sample at Koolyanobbing. Photo courtesy Stuart Jeffries.

Koolyanobbing pit wall hematite mineralisation.

Koolyanobbing open pit

Koolyanobbing iron ore find on the dumps

Members keen for an early start

Millerite

a representative mineral for Western Australia

Compiled by Frank Doedens

Millerite is a nickel sulphide with the formula NiS. It is the highest-grade nickel ore. In Western Australia, an occurrence of millerite with mammillary and stalactite-like growth was reported in large, open fissure pockets of the Agnew mine, near the large Perseverance mine in the Leinster nickel district.

Western Australia is currently the sole producer of nickel in Australia and accounts for 7% of the world's production. The state's nickel resources consist of both sulphide and lateritic deposits, with most production derived from nickel sulphide mines.

Nickel sulphide deposits in Western Australia are mainly hosted in high-temperature ultramafic Archean flood basalts known as komatiites.

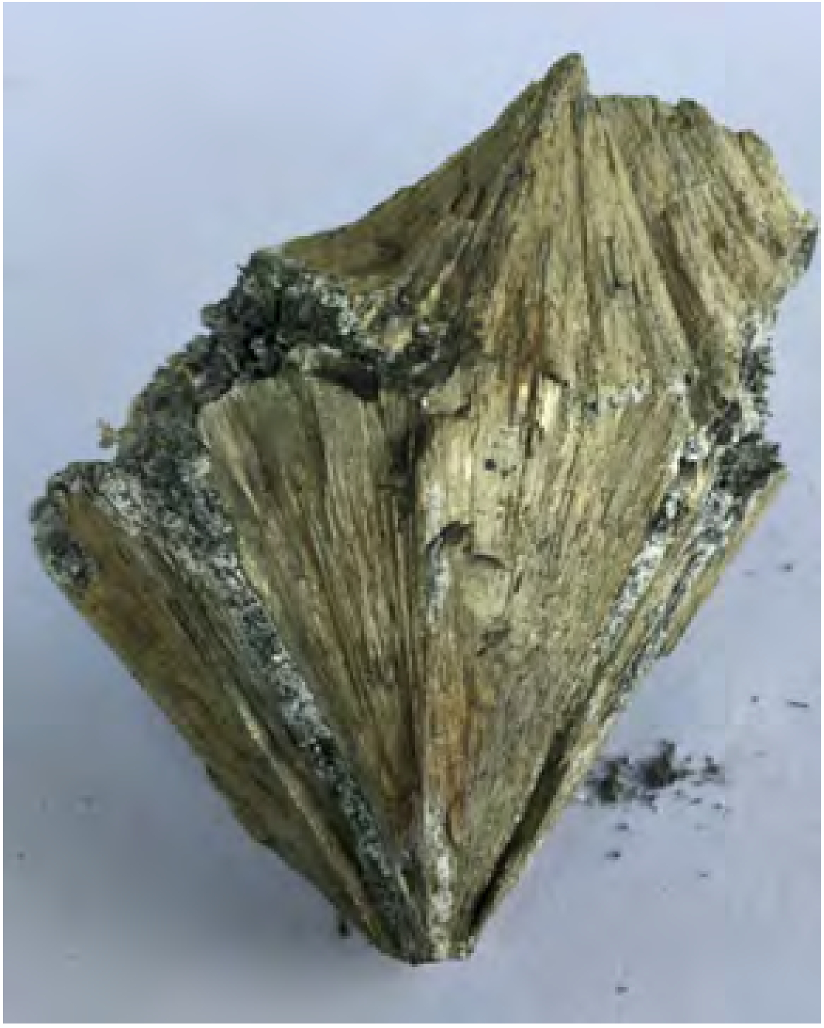
Komatiite-hosted nickel sulphide deposits represent some of the world's largest nickel deposits, and are commonly higher grade than intrusion-related or lateritic nickel deposits (Hoatson et al., 2006).

Western Australia hosts several world-class examples of komatiite-hosted nickel sulphide deposits, including Kambalda, Mt Keith and Perseverance (Hoatson et al., 2006). The first major nickel sulphide deposit was discovered at Kambalda, with other deposits around Mount Keith, Perseverance and Yakabindie following. Major lateritic nickel mines that produce a nickel–cobalt concentrate include Murrin Murrin and Ravensthorpe.

In 2020–21, nickel was Western Australia's fourth most valuable mineral sector, worth $3.5 billion.

Nickel is used on more than 300 000 products including consumer, industrial, military, aerospace and architectural applications, but the major use of nickel is in the manufacture of stainless steel.

The growing need for high-grade nickel in batteries for electric vehicles has created a huge demand for Western Australian nickel products.



A typical example of the radiating form of the millerite from the Agnew Mine is shown here. This habit of millerite is very unusual for the species, and these specimens are highly sought after as attractive mineral display items.

Photo courtesy Frank Doedens.

Reference: *Hoatson, DM, Subhash, J and Jaques, AL 2006, Nickel sulfide deposits in Australia: Characteristics, resources and potential: Ore Geology Reviews, v. 29, p. 177–241.*

From the Library

Compiled by John Mill

The Mineralogical Record

Volume 54, Number 2

The lead article in this issue is: Altyn-Tyube, Karaganda Region, Kazakhstan: The Type Locality for Dioptase by W. E. Wilson.

Altyn-Tyube is a very small mine located in the vast grassland steppes of Kazakhstan. The mine has been worked for nearly 10,000 years. Dioptase, probably mined from Altyn-Tyube, is found in the eye pigmentation of Neolithic plaster statues which are dated from 7,200 B.C.

The article describes the intricate history of collecting dioptase from the Altyn-Tyube mine which commenced in 1781. Today, the deposit is mined intermittently by Sergey Golomolzin in partnership with Collector's Edge Minerals.

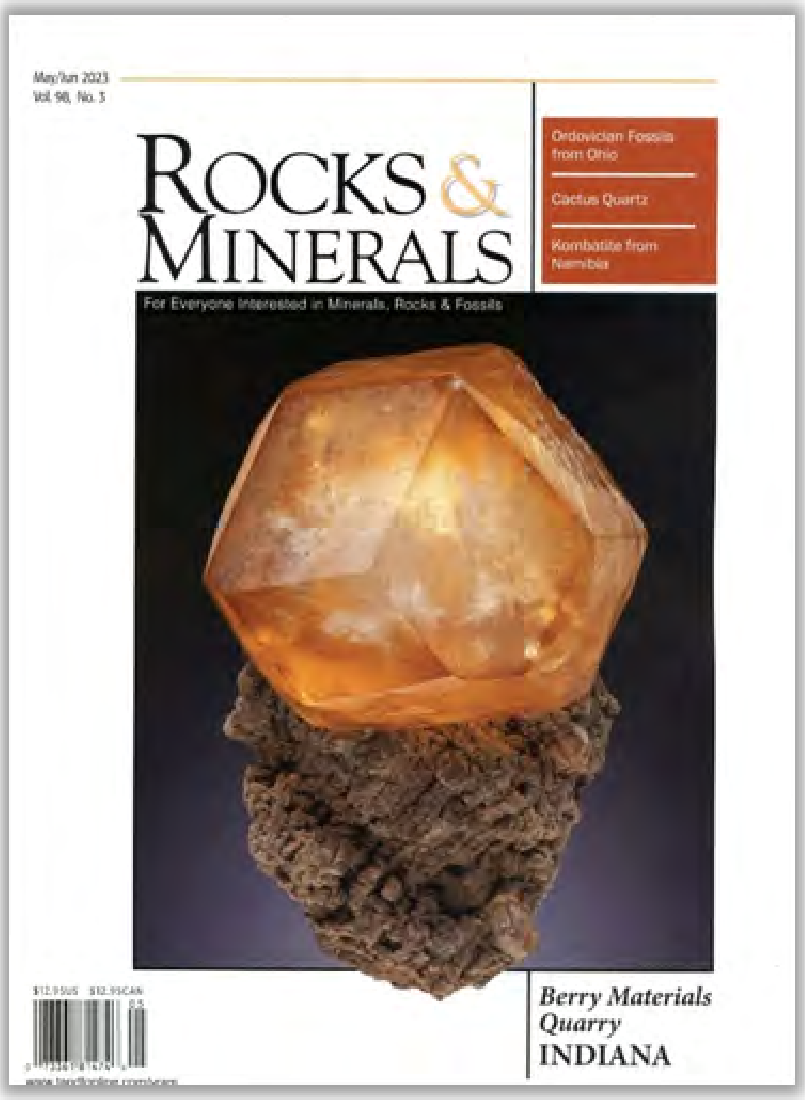
The deposit occurs in clay-rich limestones of Late Devonian age which discordantly overly Middle Devonian andesite. Copper mineralisation is genetically associated with a nearby andesitic porphyry intrusion. Primary copper mineralisation consists of chalcopyrite, bornite, pyrite and chalcocite, with rare galena and sphalerite. Oxidation extends to a depth of 240 m below surface.
Secondary mineralisation consists mainly of dioptase in cavities in hard, silicified limestone. Other secondary minerals include chrysocolla, azurite, tenorite, pseudomalachite, cuprite and native copper. The article is enriched by images of beautiful dioptase specimens sourced from the mine.

Another article, The Crystal Cave, South Bass Island, Ottawa County, Ohio, describes a large cave system lined with celestine crystals. The crystals in the cave are up to 46 cm long and 15 cm thick, which make them the largest known in the world. The 'walk-in' cave is one of 30 in the region but is the only one to be lined with celestine crystals. Other common minerals include barite and calcite.

A third article by Alfredo Petrov explores the mechanisms by which the mineral vivianite darkens when exposed to sunlight. An interesting, but not scientifically proven, is the belief by some that darkening occurs when the mineral absorbs "evil energies". The real reason, however, is that when a photon (particle of light energy) strikes a vivianite crystal, it converts one water molecule into a hydroxyl molecule and converts one $Fe2+$ into $Fe3+$. The liberated hydrogen atom escapes the system. This process leads to the progressive colour change.
Finally, the issue has a series of beautiful images of minerals collected by Tennessee collector Steve Neely.

DIGITAL ACCESS to The Mineralogical Record is available to members. Please contact the Secretary for details.

From the Library cont.



Rocks & Minerals May/June 2023 Vol. 98 No. 3

The lead article is about 'cactus quartz' which refers to a specific growth form, where a larger hexagonal, prismatic quartz crystal is encrusted by a secondary overgrowth of smaller crystals oriented at right angles to the prism faces thereby producing a spiky surface, resembling the spines of a cactus. One common variant of this type is known as 'spirit quartz'.

The deposits are located at Boekenhouthoek, roughly 70 km northeast of Pretoria, Republic of South Africa. They occur in a complex granite environment and are mined by artisans from the oxidized zone. The quartz occurs in a wide variety of colours and shapes as shown below, but the best specimens are deep purple in colour and are classified as amethyst.

Two other articles, one about unique calcite crystals from the Berry Materials Quarry of Indiana (specimen shown on the cover) and the other about Faden Quartz from Baluchistan, Pakistan, will also be of interest to MinSocWA members.

Finally, an article about the origins of the mineral name kombatite, $Pb_{14}(VO_4)_2O_9Cl_4$, by Malcolm Southwood. The mineralisation of the Kombat copper–lead–silver deposit in Namibia is considered epigenetic and syntectonic in nature, formed from hydrothermal fluids as metasomatic replacement and fracture-fill deposits in dolostones and shales of the Huttenberg Formation. However many of the exotic minerals at Kombat, including kombatite, are hosted by lens-shaped, layered assemblages of iron-manganese oxides which may be exhalative in nature.

What's New in the Mineral World?

Report #66
April 15, 2023

by **Thomas P. Moore**
The Mineralogical Record
TPMoore1@cox.net

Tom Moore's popular online column about mineral news is available here: **mineralogicalrecord.com/whats-new**

UPCOMING MINSOCWA EVENTS
2023

12 July - talk @ 6.30 pm for 7pm
AGM - 13 September @ 6:30pm

SAVE THE DATES!

27th to 29th October 2023 - Perth Gem and Mineral Show (PGMS)
at Perth Conference and Exhibition Centre
This year's theme is **mega minerals** (a.k.a. pegmatites)
Please consider volunteering!

November 2023 - 45th Annual Seminar of the Mineralogical Societies of Australasia in Tasmania. Talks welcome.

MEMBERSHIP & MEETINGS

The Mineralogical Society of WA would like to welcome the following new members:
Samuel Spinks
J.Lynn Sutherland
Jeffrey Haworth
Adam Thomson
Amanda Elphick
Rahul Pillai

All members are asked to ensure that your contact details are up to date. If you change your email address or phone number, please let the Secretary know so that you continue to receive all MinSocWA communications. Membership forms can be downloaded from the MinSocWA web page **www.minsocwa.org.au/membership**.

Please also note that receipts for membership subscriptions are available at the door at each meeting.

Meetings of the Mineralogical Society of Western Australia Inc. are usually held from 6.30pm on the second Wednesday of every odd month
at
WA Lapidary & Rockhunting Club
31 Gladstone Road, Rivervale (corner of Newey Street)
A Show & Tell, refreshment and socializing are followed by a talk starting at 7.30pm.

The Society's microscopes, UV lamp and refractometer are available for use by members.