Mineralogical Society of Western Australia Inc.

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.

NEWSLETTER 106
March 2024

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EDITORIAL

Welcome to the 106th edition newsletter to start 2024. A few activities to report on in this quarter and some other informative articles.

Since the last Newsletter, we had an interesting talk in January on silicon oxide presented by Neils Dahl.

The field trip to Greenbushes in February was booked out and everyone pleased with their fossicking.

Another successful Mineral Market was held in February.

This was followed in March by a fascinating talk by Léonard Cornuz about the Ruby deposit at Aappaluttoq in Greenland.

Planning is well underway for our next PGMS Show at the Perth Convention Centre taking place 11-13 October 2024, so save the date.

Wendy H
Newsletter Editor

JANUARY 2024 TALK

Oxide Minerals of Silicon

By Niels Dahl, photographs by the author

Figure 1. Crystalline silicon, manufactured; field of view is about 1 cm across

On Thursday, 18th January 2024, this writer presented an overview of oxides of silicon titled '*The Not So Humble SiO_2*'. Silica (SiO_2) is one of the most common compounds in the crust of the Earth as non-descript quartz and silicates. Under special conditions, it can, however, form spectacular specimens of quartz, opal and chalcedony, which can be of gemstone quality and very valuable. It also has historical value as it was extensively used amongst stone-age cultures as the material of choice for their tools.

SiO_2 is dissolved in water in the ground virtually underneath our feet and the process is accelerated several orders of magnitude by the presence of NaOH or NaCl in the solution which is always the case in a pile of rocks. When a silica–bearing fluid enters a cavity in a rock it may deposit part or all of its silica as quartz, opal, chalcedony (cryptocrystalline quartz) etc. The form of SiO_2 we find is to a large degree dependant on the temperature under which it is deposited; in general, chalcedony and opals are low temperature formats of the compound. Low-temperature quartz (α-quartz) can form together with chalcedony. SiO_2 is the most common vein material in rocks.

In Table 1, quartz, tridymite and cristobalite all have low (α) and high (β) temperature varieties. coesite was produced in laboratories before it was discovered around impact craters.

Table 1. SiO_2 Minerals - Sources: Dana (1966), Deer et al. (1967), Noe-Nygaard (1962)

Quartz, trigonal or hexagonal	Milky quartz (by far the most common), crystal, smoky quartz, sapphire quartz, amethyst, rose quartz, citrine
Coesite, monoclinic Stishovite, tetragonal	High Pressure formats
Tridymite, orthorhombic, hexagonal Cristobalite, tetragonal, cubic	High Temperature formats
Chalcedony	Chrysoprase, prase, heliotrope, agate, carnelian, onyx, sardonyx, jasper, flint, petrified wood
Opal	Gem varieties, common opal, siliceous sinter, tripolite
Still more crystalline varieties of SiO_2	e.g. Lechatelierite

SiO_2 has a framework structure of silicon-oxide tetrahedra with the oxygen atoms at the corners of the tetrahedra surrounding central silicon atoms. The oxygen atoms are shared by the neighbouring tetrahedra in the structure and the formula is therefore as stated above.

QUARTZ

Quartz grows as a prism with pyramidal end (Figure 2), on rare occasions it is bipyramidal. Its lattice reveals the presence of symmetry axes that are screw axes, i.e. axes when turned a symmetrical fraction of 360° (360° is a full turn of the symmetry axis) will move the lattice up a similar fraction of a unit along the c-axis, e.g. if low temperature quartz which is trigonal (triad axis along c-axis) is turned 120° around its symmetry axis to its first symmetrical position, the lattice is moved up one third along the c-axis. Consequently, quartz crystals have no symmetry planes and are hemiedric. The axes can rotate clockwise or anticlockwise, the difference is seen in the position of a little face of the crystal between the prism and the pyramid, see Dana (1966) for habits of quartz.

Refraction of light by quartz is nω = 1.544 and nε = 1.553 with birefringence 0.009 which is used as standard for the thickness of thin sections.

Quartz has muscly breakage with no cleavage, its hardness is 7 on Mohs' scale, its streak is colourless and it has vitreous appearance. Its density is 2.65 g/cm^3. It may grow as twins (Dauphiné law, Brazil law, Japanese law, Estérel law, Sardinian law, Breithaupt law and combined Dauphiné-Brazil law).

Figure 2. A 50 cm tall crystal of milky quartz at the TerrEstrial Visitor Centre, Georgetown, QLD

Inclusions of rutile needles (TiO_2) are common. Other inclusions are not compatible in their lattices but can be swallowed, randomly, by the growth of the quartz.

The colours of quartz vary with its contents of trace elements. Smoky quartz and purple amethyst carry iron, rose quartz carries lithium, sodium and titanium.

OPAL

Opal ($SiO_2 \cdot nH_2O$ (H_2O 6-10%/20%)) does not have framework structure. Irregular SiO_2 growth in small balls with diameters between 100-200nm and arranged jumbled (potch) or in a regular pattern (opal) are responsible for this format of SiO_2. Opal is thus amorphous with a muscly breakage. Opal has a density of 2.01 - 2.15 g/cm^3, a refractive index of 1.441 - 1.459 and a hardness of 5.5 on Mohs' scale.

The build-up of potch and opal has space for water between the SiO_2 balls, perhaps also in the balls themselves, and the amount of water determines the colour of the opal. The colours span the rainbow and incorporates also black and white.

The largest gem opal ever found in Australia is *Olympic Australis,* 28 cm long, 11.5 cm thick and 12 cm wide weighing 3.450 kg, unearthed in an abandoned shaft in the Coober Pedy Opal Field in 1956. It got its name from the Olympic Games held in Melbourne the same year. Leases at Coober Pedy are 50 m x 50 m but at Opalton in Queensland they are only 30 m x 30 m. In most towns where opal is mined, the miners often live underground in cool conditions. At Opalton this is not possible and the prospectors sometimes put a house on their tenement and dig underneath.

99.75% of opal found is common opal or potch and not valuable.

Figure 3. Opalised fish from Coober Pedy, ca. 15 cm long

CHALCEDONY

Chalcedony (Figure 4) is sub-microscopic growth of quartz and we can only study it with a Scanning Electron Microscope (SEM). It comes in many different formats and colours which have given rise to its many varieties. The origin of the silica is generally from the dissolution of rocks by water, but it can also be created by the dissolution of silica in dead organic matter in sediments and settle as concretions or bands (flint).

Dissolved SiO_2 can also settle by replacing organic matter atom by atom, e.g. petrified wood, thus preserving the original structure of the matter.

Figure 4. Unpolished chrysoprase about 8 cm across. A translucent chalcedony

OTHER VARIETIES OF SiO_2

Other varieties of SiO_2 have been found in laboratories but not yet in nature, e.g. Lechatelierite, a variety of glass.

SOURCES

Dana, ES, 1966*. A textbook of mineralogy with an extended treatise on crystallography and*

physical mineralogy, revised by Ford, WE, 851 pp., 22ND printing.

Deer, WA, Howie, RA and Zussman, J, 1967. *An introduction to the rock forming minerals.* Longmans, Green and Co. ltd, 528 pp. 2ND impression.

Noe-Nygaard, A., 1962. *Mineralogi.* Munksgaard, 184 pp. (in Danish).

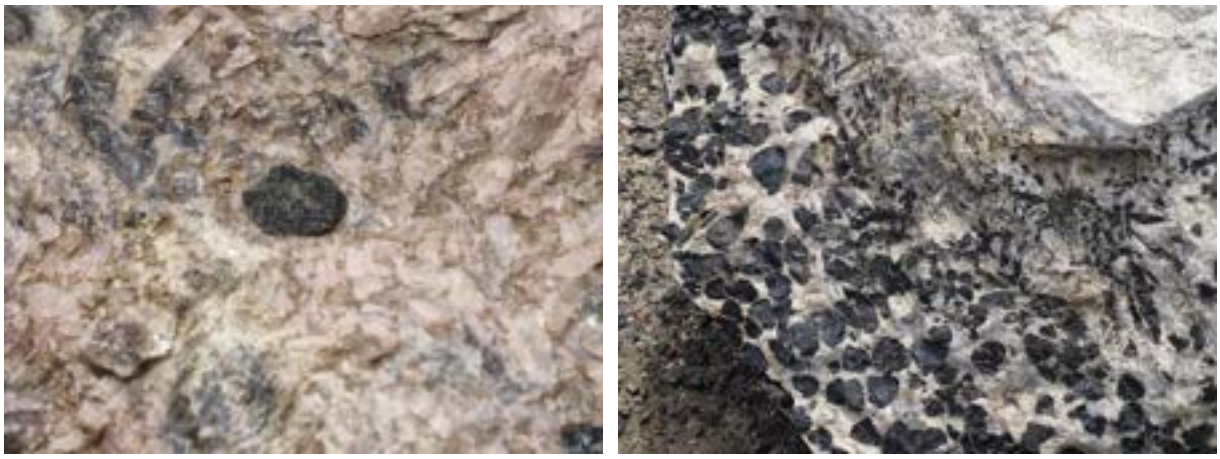
Wikipedia. https://en.wikipedia.org/wiki/Silicon_dioxide

FEBRUARY 2024 FIELD TRIP

Greenbushes

A great big thank you to Talison Lithium. Photographs by Allan Hart, approved for publication.

Searching through the waste piles.



Rocks at the macro scale several centimetres across

Specimens of holmquistite several centimetres to tens of centimetres across

Microscope Corner – Mineral Notes from Greenbushes WA

By Susan Stocklmayer (images by author)

A group of twenty MinSocWA members visited the lithium mine at Greenbushes in the WA southwest, on Saturday, 17th February. After time spent collecting minerals from a designated boulder dump zone above the main pit excavations, and with a conducted tour through the crushing plant, two minerals of particular significance were spodumene and holmquistite.

Spodumene (lithium aluminium silicate, [Li Al Si_2O_8]) is a monoclinic pyroxene group mineral and holmquistite is an orthorhombic mineral, [$Li_2(Mg_3Al_2)$ Si_8 $O_{22}(OH)_2$] of the amphibole supergroup. Spodumene (Figures A and B), the main lithium ore mineral, is the important

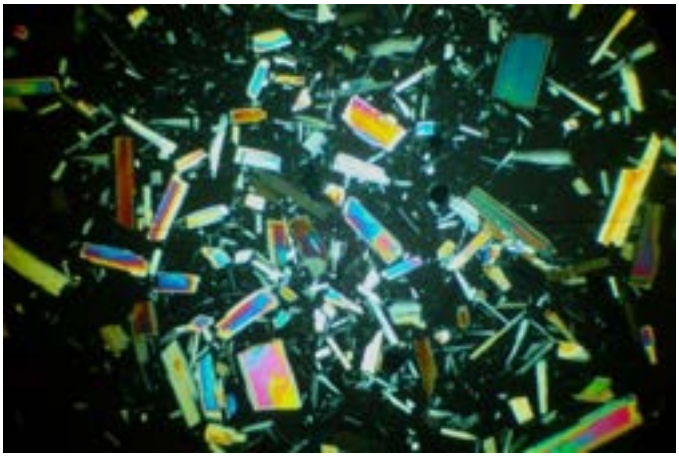
economic mineral and is evident in the ore rock as white glistening lath-shaped crystals, the ore being overall fine-grained. Holmquistite is a relatively rare lithium amphibole occurring in the pegmatite contact zone where lithium has caused a reaction with the host amphibolite.

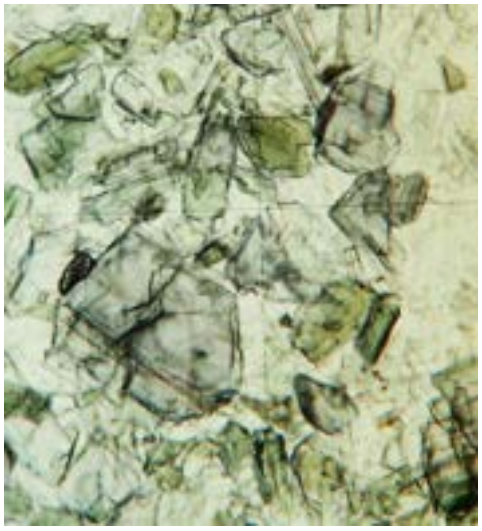
Holmquistite (Figure C) was found developed in some coarse prismatic crystals a few centimetres in length, some in radiating groups in the dark coloured amphibolite host rock. It is typically violet-coloured when seen as small grains (Figure D). Some zones of host rock in contact with pegmatite also show a bright glistening narrow zone of a metallic grey colour. These zones appear deceptively micaceous but are composed of fine-grained holmquistite and green amphibole.

NB Greenbushes is the type locality of ferro-holmquistite but it would not be possible to name the mineral samples as such because the chemistry cannot be established from optical mineralogical methods. Both holmquistite and ferro-holmquistite minerals form an isomorphous series and are found within the metasomatic alteration zone.

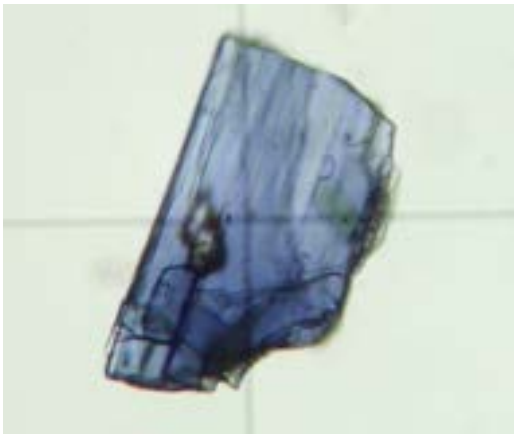
(A) *Image shows a sample of coarse grains from the ball mill in a 3 cm diameter petri-dish. Spodumene is the dominant mineral, typically white or colourless and transparent the cleavages result in prismatic shaped grains. Dark fragments of almost-opaque green amphibole and rare grains of white mica, feldspar and quartz are all present in the sample.*

(B) *Image of a grain crush of spodumene at 200x magnification and XPL displaying the well-cleaved typically prismatic form of the grains*





(C) *Grain crush of the country rock amphibolite: grey/violet coloured grains are holmquistite with green amphiboles (not specified) largest grain ~ 0.5 mm. PPL view*



(D) *A grain of holmquistite conspicuously grey violet coloured. Many tiny inclusions of zircon, some with a halo of discolouration caused by U-decay, are common. Grain size - 0.3 mm long. PPL view*

Nannup Exploring

Following the Greenbushes fossicking, some members moved on to Nannup for half a day exploring with Mike Freeman leading. Photographs all by Allan Hart.

Inspecting the columnar basalt at HWT Tablot's grave, a well-known geologist of WA (and GSWA)

MINERAL MARKET - Sunday 25 February 2024

The public Mineral Market Day was held at the premises of the WA Lapidary & Rockhunting Club in Rivervale.

A well-attended event with about 140 adults and some children circulating around the 25 tables present. Photographs by Allan Hart

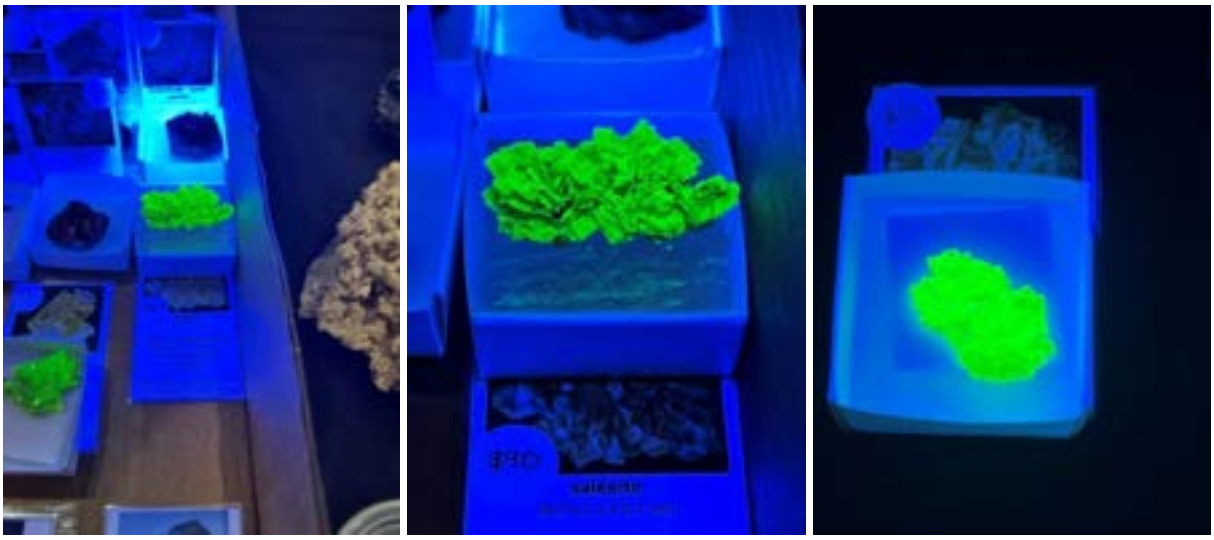
The room is full of wonderful items

Some specimens from Murray Thompson's stand:

Last minute preparation and browsing before opening time

Unusual pyrite forming along joint surfaces in yellowish marl from John Mill's table, and crocoite in goethitic matrix

Saleeite, from Steve Turner's table, under normal light



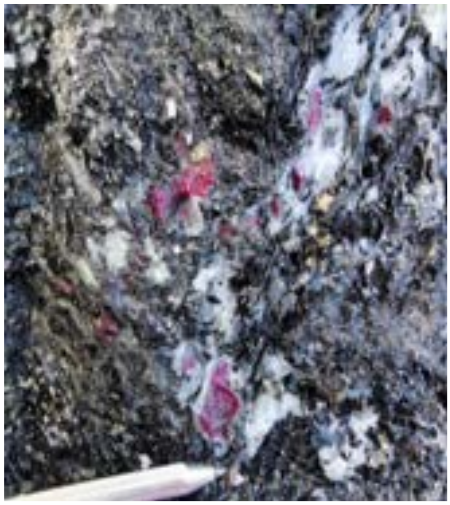
The same Saleeite under UV light. No need for a light room here!

MARCH 2024 TALK

Paragenesis of Greenland Rubies

Our guest speaker, Léonard Cornuz, expertly delivered his talk live from Switzerland, without any technical problems! He focused on the Aappaluttoq ruby deposit in Greenland.

A full report will appear in the next Newsletter.



MEMBERSHIP

Celebrating Over 100 Members

The Mineralogical Society of WA celebrates the passing of 100 members, with **106** members as of April 2024.

We welcomed the following new members since December:

Lily Grace	Finlay (Fin) Rea
Sheila McFerran	Margaret Hawke
David Ryan	Janice Oliver
Simone Pfuetzner	Vinodaarshini Vigneswaran
Hugh Morrison	Joanne Antoun

We welcome the return of Mike Freeman, Kylie Matonia, and Martin Rosser

All members are asked to ensure that their contact details are up to date with the Membership Secretary/Secretary. If you change your email address or phone number, please let us know so that you continue to receive all MinSocWA communications – membership@minsocwa.org.au

ADVERTISING

Hunting for a new Treasurer

The Mineralogical Society of WA is calling for nominations for the role of treasurer to commence at the next AGM. Put your name forward now, so you can be introduced to the ins and outs of the tasks by our Honorary Treasurer John Mill.

UPCOMING EVENTS

Cystal Universe – Mineral Gallery Night
Friday May 3rd 6 pm-10 pm
For MinSoc WA members only

Crystal Universe Perth Showroom
205 Hay St, Subiaco
Drinks and canapes will be served

The Perth Gem and Mineral Show (PGMS)
11 & 13 October 2024

https://www.perthgemmineralshow.com/

PGMS
Perth Gem & Mineral Show
Proudly presented by the Mineralogical Society of Western Australia

The Perth Gem and Mineral Show (PGMS) sub-committee is pleased to report that planning of the inaugural show is going ahead smoothly. The event will showcase many of the wonders that the mineral, gem, fossil and geoscience communities have to offer, with a special focus on Western Australia's mineral heritage.

LIBRARY NEWS

The MinSocWA Library holds Rocks and Minerals Vol. 99, No.2. Reviewed here by John Mill.

The lead article is on '*The New Cornelia Mine (Ajo), Pima County, Arizona*' by Les Presmyk. It was first discovered in 1856 by US Army soldiers/prospectors who were attracted by the vivid blues and greens of secondary copper carbonates against the iron-rich country rock. Because it did not have gold-silver credits, mining did not start until 1916 and finished in 1984.

The mineralization is hosted in joints and fractures in a monzonite porphyry which is capped by andesite and rhyolite. Species collected from the mine include malachite, azurite, ajoite, calcite, native copper, cuprite and gypsum. Rarer shattuckite, and papagoite also occur.

Other articles include '*The Brown Derby No. 1 Pegmatite, Gunnison County, Colorado*' by Phillip M. Persson and Mark Ivan Jacobson, '*Aragonite Part 4: Morocco*' by Bruce Cairncross and Jingnan 'Tom' Zhang's mineral collection which includes many beautiful specimens.

All in all, a worthwhile read.

Some of the extraordinary native copper specimens recovered from the New Cornelia (Ajo) Mine

COMMITTEE MEMBERS FOR 2023/2024

President	Peter Willems	president@minsocwa.org.au
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Committee Member	Nicolas Hébert	aminenh3@gmail.com
PGMS Secretary	Peter Willems	pgms_secretary@minsocwa.org.au

Patron - *Mark Creasy*

Meetings

Meetings of the Mineralogical Society of Western Australia Incorporated are usually held at **7.30pm on the second Wednesday of every odd month** at the WA Lapidary & Rockhunting Club rooms at 31 Gladstone Road, Rivervale (corner of Newey Street). The venue will be open from 7pm for refreshments and socialising.

MinSoc WA LINKS

Web: http://www.minsocwa.org.au

Facebook Group: https://www.facebook.com/groups/minsocwa

Facebook Page: https://www.facebook.com/MINSOCWA

Instagram: https://www.instagram.com/MINSOCWA

YouTube Channel: https://www.youtube.com/channel/UC0S2TFVFIBLU-2zlEzE5VNA

Mineralogical Society of WA, Inc.
Meetings held at the WA Lapidary & Rockhunting Club rooms
31 Gladstone Road, Rivervale (corner of Newey Street)
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