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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. 2000

Mineralogical Society of Western Australia Inc.

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EDITORIAL

The **2023 Perth Gem and Mineral Show** was held at the Perth Convention and Exhibition Centre and proved to be even more popular than last year.

Spectacular mineral specimens were on display at the sponsors' and collectors' stands. An extensive array of stalls offered mineral specimens, gems, jewellery and gold, as well as the tools of the trade, for sale to experienced collectors and novices alike.

MinSocWA was thrilled at the turnout and would like to thank all who attended, especially the sponsors, presenters and volunteers, for making the PGMS 2023 event a great success.

(Photos courtesy Wendy Beets and Susan Stocklmayer)

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Patron: Mark Creasy

Perth Gem and Mineral Show 2023

Held at Perth Convention and Exhibition Centre on 27th-29th October 2023

Following the welcome address by Tony Rovira of Azure Minerals, the show was declared open.

Several seminars ran during the event on the topic of “All about granite related minerals”, with presentations including. “An appetite for apatite”, by Anthony Clarke and “The giant Pilgangoora lithium deposit”, by John Grigson. Nicolas Hebert enlightened us on “Mineralogy of alpine clefts: from France to Pakistan” and Niels Dahl on “SiO2 minerals”. Well done to all seminar presenters for the interesting and informative presentations!

The theme of PGMS 2023 was Mega Minerals and the displays did not disappoint! Some photos from the event follow, courtesy of *Natasha Issler of Cheeky Dingo Photography, and our own John Mill and Alan Hart.*

Perth Gem and Mineral Show 2023 cont.

Thanks to the PGMS Committee for organising another fantastic event. With over 6,000 attendees, the show gets bigger and better every year. Special thanks to our patron, Mark Creasy, and to our sponsors for their support, without which the PGMS would not be possible.

Diamond Sponsors

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Technical changes in mineral identification methods and field geochemistry – then and now

by Vernon and Susan Stocklmayer

Field geochemistry - then : blowpipe analysis kits from the late 18th century

Methods of mineral identification in the 18th century were generally based on a study of their physical and chemical properties. Blowpipe analysis of minerals and metal ores, originally pioneered by Swedish scientists and mineralogists in the late 18th century, was continually refined throughout the 1800s until it was replaced by the Bunsen burner and spectral analysis towards the end of the 19th century. Portable blowpipe kits became important in the last half of the 19th century and many companies, particularly in Germany, manufactured compact kits for use in the field by geologists and mineralogists.

The first geologist appointed by the Department of the Southern Rhodesian Geological Survey commenced work in 1910 but staff numbers remained small until the end of WW1 in 1918. The portable kit illustrated in Figures 1 and 2, below, would have been used by the field geologists in Southern Rhodesia and elsewhere in the early 1920s. It is of unknown origin but most likely manufactured in Germany as the chemical containers are labelled in German and the white porcelain dishes are marked with the symbol of the Dresden factory.

Almost all the field kits had a similar layout, with two or more layers of instruments within a wooden box. In the example below, the wooden case is lockable and has two hook clasps; the dimensions are 280 mm width, 180 mm depth and 100 mm height and there are two layers. The top section lid and tool kit compartments are lined with suede leather; the sections of the bottom are wooden.

Figure 1: Top layer with equipment

Field Geochemistry - then and now cont.

Figure 2: Bottom layer with chemicals

The example shown above has an upper section that contains an agate mortar and pestle, well-made wooden-handled hammer, files and gougers and a blowpipe. The magnifying hand lens is cased in horn and the small black box contains platinum wire, foil and litmus papers.

The lower section contains six pots of powdered chemicals* (three appear to be missing), parts of the retort stand and attachments, small brass pot burner, fuel container, several small porcelain dishes and an additional small agate mortar and pestle. Below the wadding are numerous bulb-shaped small glass tubes and lengths of open-ended glassware tubes.

Compressed charcoal, as a standard block, is not included as part of these kits although several of the wooden handled items would have been used in grinding fine charcoal powder.

Many chemical tests were conducted using these kits. Sublimation tests were done in closed tubes using mineral grains and often some powdered charcoal; open tube tests in which changes to the solid and the nature of the condensates or sublimates were observed — odours were sniffed (heated arsenic smells of garlic)! Blowpipe tests were done on charcoal and on plaster using fluxes. Simple flame and bead tests could also be carried out. The blowpipe was used for intensifying the heat of a flame by blowing a constant stream of air through the hottest part of a flame.

The Munich mineralogist Franz von Kobell (1803–1882) devised a six-step fusibility scale from which some minerals could be differentiated by their fusing reactions in a regular flame, or by the use of a blowpipe.

Blowpipe analysis was an important method for the determination of the metallic elements and used by mineralogists and metallurgists for quick qualitative tests of ores and smelter products.

**various fluxes and reagents– containers with borax, soda, saltpeter, bone ash and a calcium compound.*

Reference

Burchard U, 1994. The history and apparatus of blowpipe analysis: The Mineralogical Record v. 25, July–August. p. 251–277.

Field Geochemistry - then and now cont.

Field geochemistry - now: Portable XRF Analysers

With the rapid development and commercialization of relatively inexpensive and quick analytical techniques such as Atomic Absorption Spectrometry (AAS) X-ray Fluorescence (XRF) and Inductive Coupled Plasma Spectrometry (ICPS), the need for geologists to carry and use portable equipment for field chemical analysis rapidly diminished. Field blowpipe kits were assigned to dusty cupboards (from where the one above was rescued) or appreciated as collectors' items.

However, these sophisticated analytical techniques required large and expensive instruments that needed to be housed in permanent locations. There still remained the need for a suitable portable analytical instrument that could be used in the field.

XRF analysers (XRF), using a radioactive source, became first commercially available at the end of the 1940s, the first portable XRF by the late 1960s and the first handheld XRF by the early 1980s. Towards the end of the 20th century these had progressed to X-ray tube instruments which, with developments in detection methods, resulted in the production of the handheld XRF analyser (Figures 3 and 4) that is familiar to most of us.

Figure 3: Thermo Scientific Portable XRF Analyzers for research, exploration and mining

Figure 4: Elemental content from a rock (in ppm) recorded by a portable XRF instrument

Field Geochemistry - then and now cont.

While these instruments have great application for the field geologist, they do have limitations, the exact details of which depend on which particular make is used. In general, calibration of the instrument based on the type of sample under consideration (e.g. drillcore versus powder) is critical, and comparison of analyses from different instruments can be tricky.

Detection of light elements (including Li, Be, Bo, C, Na) need to be tested by other instruments such as laser-induced breakdown spectrometry (LIBS) or secondary ion mass spectrometry (SIMS).

It must also be remembered that all these instruments provide a chemical composition of the spot/area analysed and not a mineralogical determination; this limits their use to a mineral collector.

More recently, portable Raman spectrometers that use a wide spectrum of light (from ultraviolet to infrared) have been developed (Figure 5) that allow for rapid mineralogical determinations in the field. Infrared spectroscopy has also advanced and allows for identification of most minerals using handheld instruments, some with laser beams for microscopic samples (https://www.microspectra.com/solutions/applications).

Figure 5: Bruker Bravo handheld Raman spectrometer as exhibited at the Perth Gem and Mineral Show (PGMS) in October 2021

Web references

https://www.azom.com/article.aspx?ArticleID=6366 (viewed September 2023).

https://www.microspectra.com/solutions/applications (viewed September 2023).

https://www.portaspecs.com/why-light-elements-are-difficult-to-measure-with-portable-xrf/ (viewed September 2023).

Minerals from around the world

Compiled by Niels Dahl with contributions from Sarah Gain and Susan Stocklmayer

At our July meeting, members were treated to three short presentations about minerals from around the world: **Zircon from Mud Tank Well**, Alcoota Station, Northern Territory, by Sarah Gain; **Emerald from Zimbabwe**, by Susan Stocklmayer; and **Tugtupite from Greenland**, by Niels Dahl.

Sarah, mineralogist and analytical geochemist with Fortescue Metals Group, Perth, entertained us by presenting 732 Ma zircons ($ZrSiO_4$) from Mud Tank Well at Strangways Range northeast of Adelaide along Plenty Highway. Zircon, a tetragonal orthosilicate, is generally prismatic with pyramidal termination. The zircons are accompanied by cm-large, yellow, clear apatite, magnetite, martite, rhodochrosite and vermiculite created by carbonatite fluids in a shear zone.

The zircons at Mud Tank Well are hunted by gemstone fossickers all year 'round sometimes with great success. Visible by the eye, they vary from mm-size to cm-large crystals (up to 8cm large crystals observed by the author), beautifully prismatic and at times with pyramidal double termination.

The colours of the crystals range from orange, pale brown, pink, purplish, yellow to colourless. Colours vary as a result of changes in chemistry, Al can replace Si in the SiO_4 tetrahedra, Zr is generally replaced slightly by Hf (< 3%), Fe, Nb, REE and impurities of U, Th are also present. Radioactive elements usually cause some destruction of the lattice (metamictisation) in their host, but the crystals from Mud Tank Well do not seem to have much of this problem, i.e. the content of radioactive elements in the crystals is low to nil. Fe usually makes its host brown and the iron content in the zircon from Mud Tank Well is also low to nil. The darkness of the zircons from Mud Tank Well depends on the variety of trace elements (Fe, Nb, U and Th). Like the apatite at this locality, the interior of the zircons is invariably cracked and impurities can penetrate along the cracks such as water, phosphorous. The zircons from Mud Tank Well are often zoned.

Most zircons at Mud Tank Well are found in situ or close to their site of origin in soil creep on a low rise in the landscape, some have been found transported a very short distance from the hill on the surrounding flats and may have then suffered slight damage and incipient rounding.

Zircons from Mud Tank Well (courtesy Sarah Gain)

Minerals cont.

Zircons from Mud Tank Well (Photo by Sarah Gain)

Following Sarah's zircons, Susan introduced us to highly valuable emeralds from Mweza Greenstone Belt in southern Zimbabwe, the Sandawana Emeralds. They are found in a series of deposits arranged like pearls on a string and were discovered in 1956.

The emeralds, a variety of beryl, a hexagonal and prismatic cyclosilicate, formed in Mweza Greenstone Belt by the introduction of Be-rich pegmatitic fluids that came in contact with ultramafic rock. The emeralds are predominantly located in the phlogopite reaction zone of the ultramafic rock, some are found in the pegmatites themselves.

Beryl, $Al_2Be_3Si_6O_{18}$, can carry a range of other elements, Al in Be positions in the lattice, Cr, Cs, Li, Fe, K, Na and Sc have been mentioned in literature. The larger elements and water are present in the channels created by the ring structure. The colours of beryl are, therefore, many from colourless to blue, green, pink, white and yellow. The Sandawana emeralds are dark green, they are known for their attractive and intense green colour and liveliness, and good stones command a high price in the gem market.

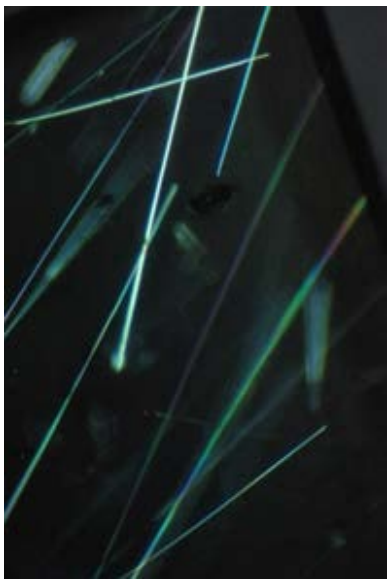
As is usual with emeralds, the Sandawana crystals are crowded with inclusions. Here they are dominantly of common actinolite, cummingtonite, apatite and albite with rarer holmquistite and phlogopite.

In Zimbabwe the Sandawana emerald occurrences, after a series of faceting and evaluation tests, were first mined by Rio Tinto Zinc (RTZ) and subsequently by Sandawana Mines Ltd. The Zeus deposit was the most significant.

In the last few years uncontrolled mining for Li minerals by illegal artisan miners has caused tremendous damage to the countryside around the Sandawana deposits. Little has been done to try to control this.

Example of an uncut Sandawana emerald (courtesy Susan Stocklmayer)

Minerals cont.



Microscopic inclusions in a Sandawana emerald (courtesy Susan Stocklmayer)

Next, Niels went north to arctic Greenland in search of gemstones, in particular, tugtupite. The name means 'Reindeer Blood' in Inuit language, and it is the national mineral of Greenland.

Be-rich tugtupite is a tetragonal tectosilicate with the formula $Na_4BeAlSi_4O_{12}Cl$. It is considered by some to be part of the helvite group of minerals, X_4SiO_4S, but others consider it part of the sodalite family, Na-Ca-tectosilicates of $AlSiO_4$ tetrahedra with one or more of Cl, SO_4, and S. I think the jury is still out on this one. It has bisphenoidal and pyramidal habit, crystals are rare and small. As the name implies, it is red, other colours are white and pink, extremely rarely also blue and green. It fluoresces.

Tugtupite was recognised at Ilimaussaq superalkaline, layered intrusion in the Gardar Province, southwest Greenland. The intrusion is believed to lie in a paleo-rift zone, dating from 1100Ma to 1300Ma. Tugtupite was first recognised in the 1950s and publicised in 1962 and has now been recognised in many places around the world.

Tugtupite from Ilimaussaq (Photo by Niels Dahl)

Whim Creek Copper Mine –
Historical Prospecting and Modern Exploration

Compiled by Niels Dahl

On the 13th September 2023, members of Mineralogical Society WA Inc. and some guests listened to presentations on the Whim Creek Copper Mine in the West Pilbara, presented by Wendy Beets and Manfred Martinet.

Wendy is the Exploration Manager for Anax Metals, which is currently operating the project and Manfred informed us of his prospecting experiences at Whim Creek in the 1970s.

Some of our society members visited the Whim Creek mine site in November last year and found interesting oxidation minerals, in particular well-developed malachite pseudomorphs of azurite crystals. The historical underground operations Manfred had entered in the 1970s were largely mined out by open pit method during Straits Resources operations from 2004 to 2009.

The Whim Creek Greenstone Belt wraps around the Malina Basin controlled by the northeast trending regional Scholl Shear. The greenstones hosting the Whim Creek copper-zinc deposits also have potential to host gold, nickel-cobalt and lithium deposits, the latter being the current focus of exploration.

The greenstones have undergone multiple stages of deformation. Granitoid intrusions, such as the Caines Well Batholith, c. 3100Ma, caused folding perpendicular to the intrusion. These folds overlap the dominant NE-SW fold direction, creating domes in the stratigraphy. These domes have been modelled in 3D, in relation to known mineralisation, to assist with making new discoveries.

The known copper-zinc deposits are widely interpreted to be volcanogenic massive sulphide (VMS) style, though they can clearly be seen to be structurally controlled, creating E-W striking S-shaped lodes between the northeast trending Marten and Jaffrey Faults.

Copper mineralisation at Whim Creek was first reported on the 5th June 1889 in the West Australian Newspaper, on page 3, although by that time it was already being exploited. Mining concentrated on the oxidized zone. Ore was mined, sorted manually and bagged upon which it was transported to the port of Cossack to be shipped to England. Donkey caravans brought the sacks of ore down from the hills to the narrow-gauge railway that went to Balla Balla Creek, from where it was barged out to ships, bringing it to England. The mangrove made it impossible for the ships to land at Balla Balla Creek itself so the barges had to sail a little further to islands near Cossack on the Dampier Peninsula, where it was possible for them to anchor.

Manfred mentioned the following minerals from the oxidised ore zone, having been recognised by mineral collectors: Malachite, Azurite, Chrysocolla, Goethite (at times as stalachtite), Wulfenite, Smithsonite, Beaverite and Plumbogummite.

The mine closed during both world wars. Interestingly, in 1914 the mine was owned by German interests and in 1941 the mine was owned by Japanese interests.

Whim Creek Hotel was originally built to accommodate the mine workers. It was severely damaged by a cyclone in 1973 but was then restored beautifully. It has suffered subsequent damage from other cyclones, including Cyclone Veronica in 2019, following which the hotel has not reopened. However, refurbishment works are planned for 2024.

Creasy's Mining Collection

Talk by Jenna Sharp to MinSocWA

Wednesday 8th November 2023

Compiled by Susan Stocklmayer

Jenna, a geology graduate, has worked for the Creasy Group for about 11 years, firstly as an exploration geologist and then as Curator of the Creasy collection.

Mark Creasy, a well-known Western Australian mining entrepreneur, is a long-time friend and Patron of the MinSocWA. He is also an avid collector of items and ephemera related to mining and mining heritage, including books and journals, mineral collections and specimens, scientific equipment and mining paraphernalia. Many of the mining related objects and literature sources have a German origin. Whole mineralogical collections, such as the Blair Gartrell and Borner collections were purchased by Creasy from their original owners but many items came from mineral and mining auctions world-wide.

Jenna's talk focused on the displays organized for the recent PGMS, describing some of the exhibits and telling us how items fitted into the collection as a whole. All through her talk, she emphasised that the only "theme" of the collection was "mining".

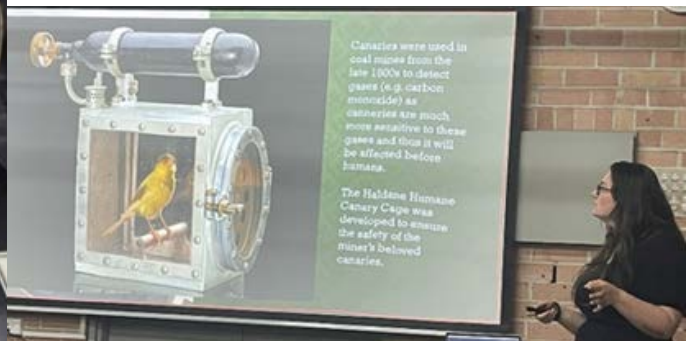
One cabinet displayed a group of figures made of various materials, including bronze, tin, stone and coal, depicting miners at work and others, as candlesticks. The standout items in this collection included the figure of a burly miner by 19th century Belgium sculptor, Constantine Meunier, a tragic figure of a miner carrying an injured worker and a piece of whimsical folk art from the USA, constructed from tin and waste metals, depicting a miner and his working burro.

The mining paraphernalia cabinet contained various types of mining lamps and safety headgear of its time, made from leather, and felt. The Cornishman's mining helmet with its little clay plug to hold the candle dated to the late 19th century.

An intriguing safety device was the canary cage. Essentially this metal box, with transparent mica panels, was used as a safety device for detecting noxious gases in the mine, but also had the means by which the little bird could be revived after succumbing by supplying oxygen from a small attached cylinder.

The Cornish felt hat with its tallow candle holder.

"Haldane Humane Canary Cage" – miner's safety device – the canary (model) shown within its container with the oxygen tank mounted above.



Creasy's Mining Collection cont.

Antique German silver goblet and cover embossed with mining activities – featured at the talk.

Another of the cabinets was devoted to miner's brooches – a particular style of jewellery developed during the worldwide gold rushes of the late 19th to early 20th centuries that were extremely popular in South Africa and Australia. (Note: a brief summary of Australian mining jewellery has recently been published in AJM Volume 23, Number 2.) Another cabinet contained a collection of decorative souvenir silver spoons.

The mineral cabinet at the PGMS, with a large spodumene (kunzite) crystal on show

The mineral cabinet displayed large and spectacular single crystals of tourmaline and spodumene as well as fluorite, and impressive polished slabs of the Sinclair pegmatite (second only to the even larger slab at the front entrance belonging to the museum pictured on page 2, above) and a beautiful stalactitic rhodocrosite slab showing its colourful concentric patterns.

Finally, Jenna talked about the mineral collection housed in a series of cabinets at the Creasy offices. What is on display is a small proportion of the total collection and she expressed the mammoth task to keep up with the identification and cataloguing especially as the input seemingly exceeds the output! Many Mineral Society members have already had the opportunity of visiting the mineral collection and library but we were extended an invitation to return another time.

MEMBERSHIP & MEETINGS

The Mineralogical Society of WA would like to welcome the following new members:

Charles Begley
Grant Boxer
Toby Dickson
Lily Grace
Joe Houldsworth
Nicola Italiano
Phillip Mason
Judith Paish

Please ensure that your contact details are up to date.
Please notify the Secretary if you change your email address or phone number so that you continue to receive MinSocWA communications.
Membership forms can be downloaded from the MinSocWA web page www.minsocwa.org.au/membership.

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)
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.

UPCOMING MINSOCWA EVENTS

Next meeting on Thursday, 18th January 2024*, 7:30pm.
(**Please note the change to the usual meeting day*)

Mineral Mini-Market - Sunday, 25 February 2024, 10am to 4pm
WA Lapidary clubrooms, 31 Gladstone Rd, Rivervale
Door Charge $2, Children 12 yrs and under FREE

SAVE THE DATE

Field trip to Greenbushes - February 2024 (date to be confirmed)

46th Joint Seminar of the Mineralogical Societies, Australasia
will take place on 5-7 October 2024
at Queensland Museum, Brisbane