

# Mineralogical Society of Western Australia Inc.

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Newsletter May 2015



**Cover photo:**

Topaz and damourite from Main Mount Farmer.

Fov 45cm. Photo and specimen S. Koepke.

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At the March General Meeting Dr Martin Gole gave a talk on the importance of certain talcites in the zonation of sulphide assemblages at the Mt Keith Nickel mine. Martin Gole is an accomplished speaker and his interesting lecture was much appreciated by some 26 members and visitors. For the benefit of those who couldn't be there, and to refresh the memory of those who were, Dr Gole kindly provided the following summary for our newsletter.

## Iowaite and Pyroaurite:

Key minerals in the formation of sulphide assemblages,  
Mount Keith Ni deposit, Western Australia

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by Dr Martin Gole

The Agnew-Wiluna greenstone belt hosts komatiite-hosted disseminated Ni sulphide deposits at Mount Keith, Honeymoon Well (Hannibals, Harrier, Corella deposits), West Jordan and Yakabindie (Six Mile, Goliath North deposits). Metamorphic grade within the belt varies from low grade in the north to low-amphibolite in the south. Disseminated deposits located below the olivine isograd and which are hosted by totally serpentinized dunite (Mount Keith, Honeymoon Well, West Jordan) have complex, strongly zoned sulphide assemblages, show a wide range in Ni/S (averages of 5 deposits 1.2 – 2.0) and have a high proportion of the mineralization with very low Cu (28 – 51% of the mineralization). Within mineralized rocks (>0.37% Ni in serpentinized dunite) assemblages range from pentlandite-pyrrhotite-chalcopyrite±pyrite to pentlandite±chalcopyrite, pentlandite-heazlewoodite (or millerite), heazlewoodite or millerite-only, and rarely to heazlewoodite-native Ni. Deposits that are located above of the olivine isograd (Yakabindie) are dominated by less complex assemblages, have lower Ni/S (averages of 2 deposits 0.76 – 1.04) with a lower proportion of low-Cu mineralization (5 – 7%).

In the serpentine-hosted deposits the sulphide zonation is reflected by reductions in whole-rock S, Cu, Fe and Zn over the whole range of Ni grade (i.e. 0.37% - ~2%). Evidence for some mobility of these elements is seen in the presence around deposits of Fe-Cu-Zn sulphides and magnetite in veins and a halo of elevated S. Although there is uncertainty as to the original bulk composition of the mineralization it is proposed that variable loss of these components from sulphide assemblages and the whole rock was initiated by highly reduced conditions that were produced during low fluid/rock ratio serpentinization. Ratios of Ni to PGE and, with some exceptions, Co are unaffected by the alteration. Consumption of H<sub>2</sub>O resulted in Cl, a component of the fluid, being concentrated sufficiently to stabilize iowaite as part of lizardite-rich assemblages. Some serpentinites containing pentlandite-pyrrhotite-chalcopyrite±pyrite assemblages have exceptionally high Cl contents (up to >2% Cl) whereas

rocks containing heazlewoodite or millerite-only assemblages and with low whole-rock S, Cu, Fe and Zn contents have lower Cl contents (mostly <0.6%).

In the latter stages of serpentinization when the olivine hydration rate declined and after expansion and associated fracturing of the ultramafic sequence, a more fluid-dominated environment formed and allowed carbonate-bearing fluid to gain variable access to the mineralized rocks. In places this drove Cl from iowaite (to form CO<sub>2</sub>-bearing pyroaurite) and caused variable leaching of components from original magmatic assemblages to those assemblages stable at prevailing  $fO_2$  and  $fS_2$  conditions. Mass transfer was made possible via metal chloride complexes and H<sub>2</sub>S with fluids driven by D2 deformation associated with the metamorphism (M2). This produced a complex sulphide assemblage zonation within the deposits reflecting variable timing, compositions and flow rates of fluids over an extended period involving serpentinization and a later recovery period where fluids readjusted from the extremely reduced imposed by the serpentinization. The presence of iowaite and pyroaurite were key for the operation of this process.

## Mineral Market

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(photo Allan Hart)

The inaugural MinSocWA mineral market was held at the Lapidary Club from 10 till 3 on Sunday, April 12. Though it was organised at short notice, and received only a minimum of publicity, it was a great success. On offer was a wide range of minerals varying in price from two dollars to a thousand dollars. Top of the shelf was a huge crocoite matrix piece from the Adelaide mine brought in by Frank Doedens. Juan showed some affordable Spanish minerals, and Clive had a nice selection of rare WA nickel minerals, only some of which were purple. Jason Bennet offered some Pilbara specimens he had saved from becoming forever China, while Kim Macdonald sold off a lot of his non-Australian collection. Others made the most of the opportunity to create some space on their shelves at home. In all there were

nine sellers, and most seemed satisfied with the amount of stock shifted. The prize for the best turnover was a close run thing between Kim and Juan, both of whom managed to shift 75% of their wares.

Unlike the frenzy of auction night the atmosphere was very relaxed with a steady trickle of buyers (mostly MinSoc and Lap Club members). The club microscope had been set up at one end of the hall and many used it to look before they bought. The microscope also proved a great fascination for some of the younger folk present. At the end of the day some 55 people had attended, and the feedback was all very positive. The betting is, Mineral Market is an innovation that will soon turn into an institution. WA collectors have few opportunities to trade specimens that no longer meet their collecting criteria, and Mineral Market helps to fill that gap.

## Wild Party Rocks the Hills

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Last January a MinSocWA social occasion passed unreported, possibly due to our regular editor's innate sense of modesty. On the evening of Saturday, 23<sup>rd</sup>, Susan and Vernon Stockmayer held their annual New Year byo bbq at their home in Lesmurdie. This is the fourth time they have organised the event, so it is becoming bit of a tradition. All MinSocWA members were invited, and asked to bring a salad to share as well as their own meat and drink. As usual it was a terrific night. The weather was balmy, the food scrumptious, the conversation engaging, and the wine very amusing indeed. There were even a few rocks (I use the term advisedly) to be handed around. And the company wasn't bad either. This year some 16 members attended and, I dare say, a good time was had by all. Thank you Susan and Vernon for taking the effort to organise this social event. Keep up the tradition. And for any of you who haven't been before, it is well worth the trek up the hill next January.

## Small is Beautiful

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The MinSocWA micro group got together at short notice on Sunday, March 15<sup>th</sup>. No particular theme had been set, so everyone brought along samples of their latest projects. Ted had some fern gold, superbly mounted, which he and Clive had collected on a recent expedition. He also showed some very nice Milgun material. Clive had some micro-micros of wavellite and aragonite. Max brought along his gemmological microscope, which was very interesting for those of us who had not used one before. They are just the best thing for looking at inclusions. Jason Bennett had a box of Area C material, about which he recently wrote an article for the ANZ Micromin News. Juan proved to us that Spanish minerals aren't



always cabinet size, while Geert showed some stellerite he had found on a bund in the Goldfields. The prize for the best display went to Manuela, who brought along 6 months old Teresa. Small is beautiful indeed.

## Door Prize

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The door prize at the March General Meeting – a black dravite from Yinnetharra donated by Sue Koepke – was drawn AND won by Jenna Sharp. Now there's a clever girl!

## Page 3 Girl

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Rupert Murdoch may have given them up, but this month for the first time your newsletter brings you our very own "page 3 girl". She is exotic Miss Malachite from the Congo, a very pretty crystal of mammillary habit. Her measurements are a petite 80-45-65. "I am a carbonate", she tells us, "no silicon implants for me." This verdant beauty is all class, and freely admits she likes



showing off her curves, but only in quality display cabinets. It took some persuasion to get her to pose en plein air for your newsletter. (Apologies from the editor for putting her on page 6, but lay-out is a severe mistress.)

## Camel under Construction

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Your committee met at Stewart's office on Saturday March 21. In attendance were Vernon, Sue, Juan, Ida, and Stewart himself. Also present was Jason Bennett, who, as first order of business, was unanimously co-opted onto the committee to fill a casual vacancy. Congratulations Jason and good luck.

The meeting was very productive and lots of topics were discussed. After a complete lack of fieldtrips for three years, our new trip leader, Juan, now has two expeditions on the drawing board. The first one is to the Widgiemooltha area. Stewart has gained permission for access to Ni, Co tenements around Mount Thirsty, and we will also be able to borrow a handheld XRF from his office to bring along on the trip. The other exciting proposal is for a trip to the DeGrussa mine, for which tentative management approval has now been received.

Some of the other issues actioned were finalising the list of upcoming speakers, the long standing problems with the microscope camera, and the organisation of the mineral market. Also, it was felt that, in view of the downturn in the mining industry, now might be an opportune time for MinSocWA to acquire a quality second hand handheld XRF at an affordable price. Stewart is looking into the possibilities. We are all looking forward to the result.

## Fossicking at Mount Farmer

Fun and special FX with XRF

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by Geert Buters



The Main Mount Farmer pegmatite has been a favourite collecting ground for many years. It is easy to find: turn west at Mount Magnet and follow the haul road through Boogardie for about 85 kilometres. You'll know you have arrived when you see a pile of white quartz north of the road. You can't miss it – the heap of mullock sticks out like dogs' rhyming slang.

First pegged in 1961, mining for microlite commenced in 1995, and the licence was surrendered by July 1999. During the operation the quartz core was removed to get at the ore below, leaving a dry pit with a radius of 30 meters surrounded by discarded gangue. Basically the pegmatite was turned

upside down and only the tantalum ore removed, leaving a perfect environment for mineral collecting.

Standing in the pit you can see the unmined remnants of the pegmatite in the south and west walls, and you can still observe in situ some of the zoning described in Jacobson et al (2007). Turning to face north, a 4-8 inches thick contact alteration zone separates the pegmatite and the gabbro hanging wall.



The Main Mount Farmer pegmatite is best known for the large euhedral crystals of topaz found on the dump. They are blueish white in colour, and usually surrounded by an alteration rind of damourite, which makes identifying the topaz all the easier. The specimen featured on the front cover measures 42 cm across, and weighs 16.5 kg, but is by no means the largest piece seen at the site.

Topaz is not the only xl that comes in XL at Mount Farmer. Large lumps of pyrite, now exposed to the weather, slowly rot away amongst the rubble, and fluorite can be found not just as chips, but as



large blocks up to several kilograms. The colour is usually glassy white or brownish from contact with the pyrite. A specimen in the author's collection is translucent to 55 mm. In small quantities fluorite also occurs as purple on albite. Unfortunately none of the fluorite is euhedral, and neither does it fluoresce.

Tourmaline occurs in fine sprays as schorl, and as pink, or green, and very minor blue elbaite. Broomfield (1988) reported red and green lateral colour zonation in the elbaite. Green elbaite also shows central and lateral variation ranging from green to colourless. The colourless material can be quite gemmy under the microscope.



Beryl comes in a yellowish and a more greenish colour. A terminated yellow crystal was 65 mm across the face, and a lump of green beryl weighed 1.5 kg.

Recently I unpacked some boxes of Main Mount Farmer material that had been gathering dust for years. The content was sorted, scanned with UV, and inspected for micro minerals. A handheld XRF was used to confirm the composition of some selected specimens. This was the first time that I have been able to use this technology, and a very interesting experience it proved to be.

UV scanning did not show up a great deal of fluorescence amongst my Main Mount Farmer specimens, though lamping on site might reveal a different picture. Tiny bright yellow spots can be observed under SWUV, but these are hard to distinguish from their albite matrix in daylight. One of the largest of these spots (associated with cleavelandite, green elbaite, quartz and mica) measured 13 mm across, and was tested with the XRF. The result indicated the presence of significant calcium and phosphor, supporting the conclusion the spots could be apatite. Broomfield (p26 and fig 11) refers to blocky green Mn-rich apatite in coarse primary green mica books. While there were several pieces of green mica amongst my samples, this close association with apatite was not observed. Microscopic examination uncovered two broken specks of a glassy, blue mineral on albite. The specks did not fluoresce, and because they were so small and in matrix it was not possible to obtain useful XRF data. Based on appearance alone they could be apatite, or elbaite.

A 256 gr portion of an 85mm anhedral lump of what I thought might be tantalite on albite was found to have a specific gravity of 6.3. This compares to an SG of 6.443 for a manganocolumbite, which Jacobson (p134) calculated to have a  $Ta_2O_5$  content of 48%.

An attempt to analyse my specimen with the XRF at first appeared destined for frustration. It showed significant niobium, and indicated a Mn:Fe ratio in the order of 20:1, but it also indicated a whole load of copper and tungsten that just wasn't supposed to be there. The problem was, as I soon found out, the equipment was not calibrated to detect tantalum. A test on some Tabba Tabba tapiolite proved that the machine was literally doing the next best thing by reporting Ta as W and Cu (why the copper is beyond me). Tests of my "tantalite" specimen had shown a ratio of Nb:(Mn+Fe) of 1.45:1, and, now that the presence of tantalum was confirmed, I applied this ratio to the generic columbite formula, and calculated that my specimen might be a mangano-columbite with a Ta:Nb ratio of 38%.

Adhering to one face of the mangano-columbite were some tiny, broken crystals. Mostly light brown, a few had a honey yellow colour as per Jacobson's description of microlite at Mount Farmer (p134). They also looked like they could belong in the cubic system. But that is as far as I got. Due to the background of columbite it was not possible to get a useful XRF reading, so speculation has to remain just that, speculation.

With the microscope I had also detected a small brown mineral face embedded in a spray of cracked schorl. After hours of careful picking a 2mm octahedron was extracted. I wasn't sure what I had, but the pyrochlore group is isometric, and I was hopeful. Unfortunately, this find did not match Jacobson's microlite description. The obvious thing to do was to use the XRF to see if I could detect any niobium or tantalum. Now that



the crystal was free from the matrix, I could at least be reasonably certain of what the equipment was looking at. And sure enough, the machine did detect very significant levels of “copper” and “tungsten”. Also, the ratio of Nb:W for the tapiolite previously tested had been 4.7%, and the ratio for my little octahedron was about 3.3%. Cubic and chock-full of tantalum, there seemed to be little doubt my specimen was indeed microlite. But was it? The test showed no Ca, but significant levels of Fe, S, Si. Tantalum does not form minerals with sulphur, and compounds with Fe or Si tend to be orthorhombic. The lack of calcium could be explained away by assuming the presence of sodium, which the XRF can’t detect. That would make our little octahedron a natromicrolite. Perhaps.

Being able to use the handheld XRF was a lot of fun, and it is a great aid in mineral identification, but a magic box it aint. Like any method of identification, the equipment has its limitations. The handheld XRF was designed for assaying ore grades, not for identifying mineral specimens. It can provide the answers you seek, but often will only point in the right direction, and sometimes may even give you a bum steer. Still, anything that helps take some of the guess work out of mineral identification must be a good thing. I would like to thank Stewart Cole and Mark Creasy for making the XRF available.

A complete list of minerals and a full description of the Main Mount Farmer pegmatite can be found in the references below. For anyone interested in mineral collecting the area is well worth a visit. Together with Dalgaranga, the Mount Farmer pegmatites form part of a larger pegmatite field, and can be combined with visits to Poona, Boogardie, and the Cue and Mount Magnet goldfields to make up a worthwhile trip. The Main Mount Farmer pegmatite is currently covered by prospecting licence P 59/1773, held by Diversity Resources Pty Ltd in Gingin.

References:

Jacobson M.I. et al, 2007, Guidebook to the pegmatites of W. A., Hesperian Press, p. 129-134.  
Broomfield D.P., 1988, Geology and geochemistry of rare metal pegmatites and associated granitoids in the Dalgaranga greenstone belt, Central Murchison province, WA: UWA, BSc Honours thesis (unpublished).

## Trading Post

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Members can place advertisements in this newsletter free of charge. As no copy was received this month, the editor takes the opportunity to alert you to “Australian Crystals and Minerals for Sale” on Facebook, where you might find some exciting specimens. The page is an off-shoot from “Australian Crystals and Minerals”, which is all show and tell, but no trade. Take a look.

## Tip of the Month

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If you need to clean minerals on a soft matrix, a cheap high pressure cleaner, available from most auto shops, does a pretty good job. It strips schist like butter without leaving nasty chisel marks. But don't point the jet directly at the crystals, or you might not find them back. Of course, it is still a wet and dirty job, so if you can get a fairy to do the work for you, even better.



(photo: Sue Koepke, dravite: Tom Kapitany, wings: Mark Willoughby, body beautiful: Geert Buters)

## The Horse's Mouth

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If you are wondering why your venerable newsletter seems to have gone a bit "tabloid" this month, Vernon is on holidays and has, perhaps unwisely, entrusted me with the crank to the printing presses. Rest assured, he will return from his European sojourn in time for the July edition.

Members' contributions are always welcome, whether it be an article, an interesting photograph, an amusing anecdote, or whatever tickles your fancy. Deadline for the next issue is June 20.

Geert Buters (editor-in-lieu)

## What Next

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At the next general meeting on Wednesday, May 13, John Mill will give a talk entitled: "My excellent Tucson adventure – how those Yankees took all my money, and filled my bags with rocks".



The next Joint Mineralogical Societies' Seminar is in Launceston in November. Make sure you put it in your diary. Ralph Bottrill is involved in organising it, so it is bound to be good (No pressure, Ralph!)

## For Your Eyes Only

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The Society's General Meetings are held at 7.30 on the second Wednesday of odd months, at the premises of the WA Lapidary and Rockhunting Club at 31-35 Gladstone Road, Rivervale.



At all meetings the Society's microscope and UV lamp are available for use by members. Regardless of whatever else may be scheduled for the night, if you have some specimen you want to take a closer look at, bring it along to the meeting, and we will get you set up.



The Society has a library from which members may borrow free of charge. The library is housed at Stewart's office in West Perth, and the catalogue is available from the Secretary.



If you want to find out what is happening with MinSocs in other states, or read their newsletters, go to [mineral.org.au/](http://mineral.org.au/) and follow the links.

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