CAPE TOWN
GEM & MINERAL CLUB
FOR THE STUDY OF ROCKS, MINERALS & CRYSTALS

WEBSITE NEWSLETTER

APRIL 2024

This is Curious – see below

DIARY

March	*28*	*Easter weekend*	*Gemboree at Barberton*
April	*6*	*10:00–14:00*	*Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.*
May	*4*	*10:00–14:00*	*Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.*

From the Cabinet of Curiosities

Keeping Easter and bunnies in mind, our curiosity this month is known as "The Rotten Rabbit". It is a highly unusual mixture of minerals from Tigers Eye, to chalcedony, quartz and probably calcite. The stone was bought in 2020 at the stoneyard of Kosie Smit at Niekerkshoek near Griquatown. Length is 22 cm, height is 13 cm. Can anyone explain this formation for us in more detail?

BLUE LACE AGATE NEWS

As many of you will know, for the past few years Jo Wicht and Duncan Miller have been working on various aspects of the blue lace agate from Ysterputs in southern Namibia. They have published two articles about this in the Mineral Chatter, also on the Spanish Friends of Minerals Forum.

Wicht, J. & Miller, D. 2020. Blue lace agate from Ysterputs, southern Namibia. *Yacimientos Minerales en FMF* **3**(119):3-12. https://www.foro-minerales.com/forum/viewtopic.php?p=150145#150145

Wicht, J. & Miller, D. 2021. Blue chalcedony pseudomorphs from Ysterputs, southern Namibia. *Yacimientos Minerales en FMF* **3**(126):3-12. https://www.foro-minerales.com/forum/viewtopic.php?t=14865&sid=e8abfa01718e71a81c3cc997db354b85

Now, in collaboration with Megan Welman-Purchase and Frederick Roelofse in the Geology Department at the University of the Free State, they have published a comprehensive article in the *Journal of African Earth Sciences*. This article is available for free download as a pdf from the link below.

Welman-Purchase, M., Wicht, J., Miller, D. & Roelofse, F. 2024. Blue lace agate and chalcedony pseudomorphs from Ysterputs in southern Namibia. *Journal of African Earth Sciences* **212**:105211. https://doi.org/10.1016/j.jafrearsci.2024.105211

In summary, the blue lace agate consists of alternating bands of micro quartz, macro quartz, and sheaves of length-slow chalcedony ("quartzine") growing epitaxially from the faces of the macro quartz. Length-slow chalcedony is characteristic of deposition in a hypersaline environment. The cuboid blue chalcedony pseudomorphs from the nearby locality are sharp-edged, display a characteristic tiled surface texture of their slightly indented faces, and in contrast to the blue lace agate they consist entirely of finer bundles of length-fast chalcedony. We interpret this microstructure as indicating the *in situ* crystallographic transformation ("collapse") of former melanophlogite with its loss of volatiles, without wholesale replacement by hydrothermal chalcedony, which in this environment we would expect to be length-slow quartzine. We considered alternative precursors - halite, fluorite and pyrite - but excluded them on the basis of the distinctive tiled surface texture of the pseudomorph faces, the length-fast chalcedony that formed without precipitation from saline hydrothermal fluid, and the complete absence of any fluorite or pyrite crystals associated with them or the adjacent blue lace agate deposit.

Photograph of Ysterputs cuboid chalcedony pseudomorphs after melanophlogite, showing characteristically tiled, sharp-edged faces. The large central pseudomorph is 5 mm on edge. (Photo by Duncan Miller)

"Back in Black"

By **Peter Rosewarne**

Introduction

The title for this article is borrowed from the title of a blistering single and album by Aussie rockers, AC/DC. Black isn't really a colour but there are some very attractive black minerals, some of which are of the less common type, so we'll ignore that inconvenient fact. As you all know, we see black when all the colours of the spectrum are absorbed by something. When observed from the moon the sky is black because there is nothing to selectively disperse light. Henry Ford famously said of his Model T car, "*You can have any color you want, as long as it's black*." In the mineral world there are numerous references to black: 'black jack' is a miner's nickname for black sphalerite; Black Mountain in the Gamsberg-Aggeneys area is host to an iron-rich magnetite deposit; Black Rock Mine, northwest of Hotazel, was the first mine in the Kalahari Manganese Field. Anyway, enough of this rambling, let's get into some juicy black minerals.

The Minerals

I came up with *melanite, morion, ilvaite, cassiterite, sphalerite, manganite, uvite* and *schorl* as a first list of black minerals and no doubt some more will come to mind as this article progresses. That's quite a range of species including *garnet, quartz, tourmaline*, plus *tin* and *manganese oxides,* a *sulfide* and a *silicate*. Others that have just come to mind are the *pyroxene, ferro-augite* and the *amphiboles, ferro-hornblende* and *arfvedsonite*, all important minerals in igneous rocks. And *spinel*.

Melanite

Melanite is a *titanium*-rich variety of *andradite* garnet and forms attractive lustrous crystal groups, as shown in **Figure 1**. However, I think that it is *iron* that gives it its black colour, not titanium. The specimen below is from La Prieta Mine, Chihuahua, Mexico.

Figure 1: Melanite, Mexico (The Rosey Collection)

Ivaite

Ilvaite is a complex silicate containing *calcium* and iron and the best specimens come from Dal'negorsk, Russia, comprising of elongated prismatic crystals with striations along the *c-axis*. An example is shown in **Figure 2**.

Figure 2: Ilvaite Crystals, **Russia** (ex The Rosey Collection)

Cassiterite

Cassiterite comes in a number of colours and forms, ranging from the example of black twinned crystals in **Figure 3** to translucent honey-coloured crystals. The example here comes from the Pingwu Mine, Sichuan Province, China and is on a matrix of *muscovite*.

Figure 3: Cassiterite Crystals on Muscovite, China (ex The Rosey Collection)

Pyroxene and Amphibole

These two mineral groups supply a large percentage of the dark minerals in basic and ultrabasic igneous rocks, such as *gabbros*, *basalts* and *pyroxenites*, and metamorphic rocks such as *amphibolite*. The most common in the former is ferro-augite (**Figure 4a**) and in the latter, ferro-hornblende (**Figure 4b**). The common ion that causes the dark brown to black colour is Fe^{2+}. The augite crystal is from Turner Lake, Ontario, Canada and the hornblende is from Limpopo Province, South Africa.

Figure 4a: Ferro-augite, Canada (The Rosey Collection)

Figure 4b: Ferro-hornblende, RSA (The Rosey Collection)

Arfvedsonite is a sodic amphibole found in alkali igneous rocks. The example in **Figure 5** is from the well-known pegmatites at Mount Malosa, Malawi, which also produces fine crystals of *aegirine*, a sodic pyroxene (and buff-coloured *zircon*).

Figure 5: Arfvedsonite Crystals with Feldspar, Malawi (The Rosey Collection)

Manganite

A particularly fine crystal specimen of manganite from the classic German location at Ilfeld, Thuringia is shown in **Figure 6** It has well-formed lustrous black striated prismatic crystals of magnetite measuring to 1.3 cm. It contains Mn^{4+} and I think all manganese oxides, e.g. *pyrolusite* and *psilomelane*, are black. I've mentioned this in a previous article but at my interview with the South African Minerals Counsellor in London in 1974 he asked me which base metal South Africa had the World's largest reserves of? Nerves got the better of me and I gave the stupid answer of *platinum* whereas it was and still is manganese. They must have been desperate for candidates because I still got the job.

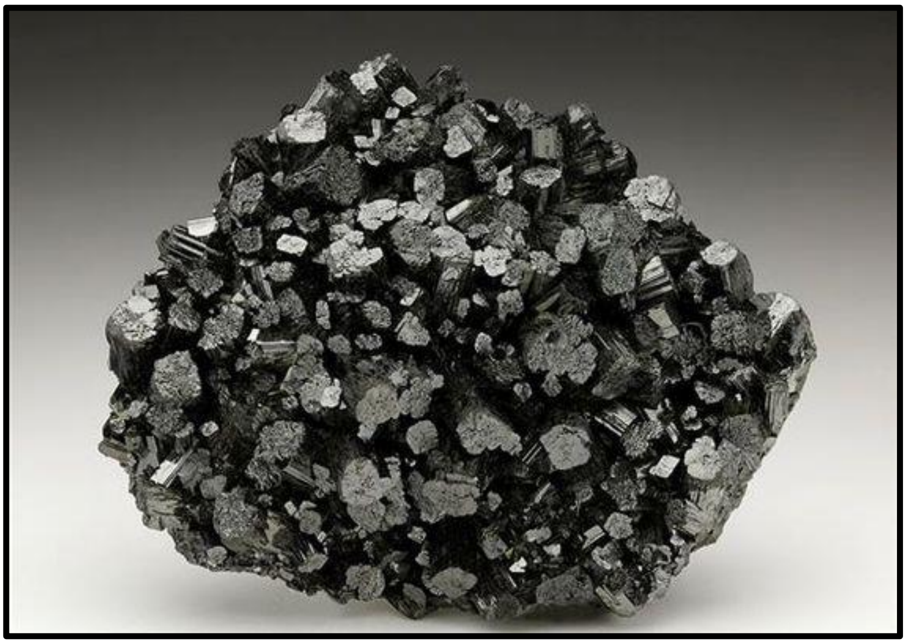


Figure 6: Manganite, Ilfeld, Germany (courtesy of Crystal Classics)

Uvite

Mention uvite tourmaline and most people will think of the lovely green and reddish-brown crystals from Bahia, Brazil. However, a famous site at Powers Farm in New York State, USA produces large, attractive black striated uvite crystals, as shown in **Figures 7a** and **7b**. According to John Betts Fine Minerals, from whom I purchased the specimen in **Figure 7b** and then re-sold it to him, the correct terminology is *Dravite*-Uvite based on its crystal chemistry.

Figure 7a: Uvite, USA (The Rosey Collection)

Figure 7b: Uvite, USA (ex The Rosey Collection)

Schorl

Schorl is the classic iron tourmaline commonly found in simple *granitic* pegmatites. I think I've got possibly one specimen in The Rosey Collection that could be termed as "World class," and that is a group of large schorl crystals bought from Danie Maree at a Club Open Day last year (**Figure 8**). The largest crystal is 13 x 9 x 8 cm. It is from the Erongo Mountains area of Namibia.

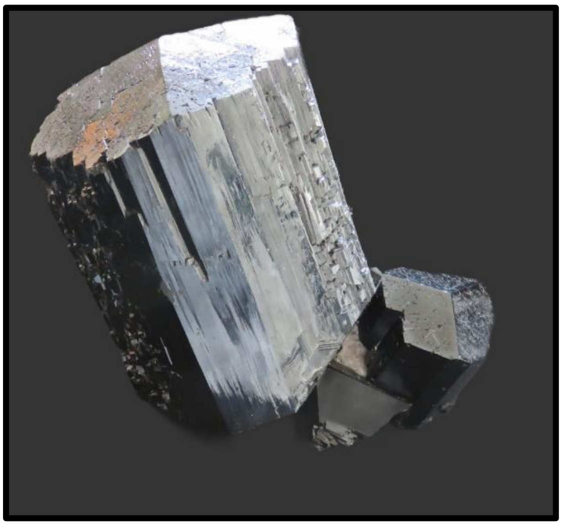


Figure 8: Schorl, Namibia (The Rosey Collection)

Diamond

Black *diamond*s owe their colour to multiple inclusions of e.g. *graphite*. They used to be largely ignored by the gem trade and only a few famous black diamonds are known, such as the 67.5 carat Black Orloff (**Figure 9**), also called the "Eye of Brahman". It was reputed to have been stolen from an idol in India in the early 1800s and was so cursed that several of its owners committed suicide. It was ultimately recut to break the hex (source of information GIA).

Figure 9: Black Orlof Diamond, India (courtesy of the Gemological Institute of America)

Concluding Remarks

It's seems a bit strange to me that the highest scoring ball in snooker is black, the highest suit in most card games is spades and the highest grade in judo is a Black Belt, rather than a vibrant colour? But then at the other end of the spectrum you have 'black sheep of the family' and a 'black mark' at school (probably banned long ago by the woke brigade). To end this article, take this thought home with you; until we expose minerals formed at depth in the Earth to the light of day or artificial light, they are all black. And Eskom is doing its best to ensure that this situation is perpetuated on surface too by their regular blackouts…

Now we need some colour:

The Sources of Colour in Minerals

***By* Peter Rosewarne**

Introduction

With very few exceptions (native sulfur comes to mind), colour is the most unreliable physical characteristic on which to base mineral specimen identification. However, it is the most obvious and the most attractive of their physical characteristics and aesthetics. We've had Minchat articles on, "*Beryl, a Gem of a Colourful Mineral*;" "*Colourful Botryoidal Minerals*," and "*Fluorite; a Colourful Journey Around the World*." The current article seeks to explain the sources of those colours and others in minerals, with a bit of Chemistry 101 thrown-in.

Many colourful minerals are actually colourless in their pure state, such as fluorite, and owe their colours to one or more factors, the more common of which are substitution of *ions* in the crystal lattice by certain metallic *cations* and ionising radiation. The colour of some minerals/gems, such as *tanzanite* and *amethyst*, can be changed or enhanced by heating. The colour of porous minerals such as *lapis lazuli* can also be enhanced by the addition of pigments and oils. However, these artificial processes are not covered here.

Chemistry 101

First, a few basic chemistry terms and processes that have relevance and apologies to those who know all this basic information; you can skip to the next section. We are all familiar with rainbows and the colours displayed are what is called the visible spectrum, ranging from longer wavelength red to shorter wave-length blue/violet. These are the components of natural white light discernable to the human eye. Beyond the red end of the spectrum lies infra-red and then radio waves, while beyond the violet end lie ultra-violet, X-rays and gamma rays, all forming part of the electro-magnetic spectrum.

Colours in minerals obviously fall in the visible spectrum and what amazes me is that, for all but the blink of an eye (pun intended), these colours were unseen for about 4.5 billion years of the Earth's history. Is this the Anthropogenic Principle at work, *i.e*. we exist purely because the universe we live in is conducive to the development of humans and therefore it follows that colours that we can see would exist too? As the Americans would say, "Whatever!" The visible spectrum is shown in **Figure 1** and is mimicked by the minerals shown in the title 'ribbon,' being, from red to violet, *vanadinite, pyromorphite, brucite, elbaite, amazonite, tanzanite* and *sugilite*.

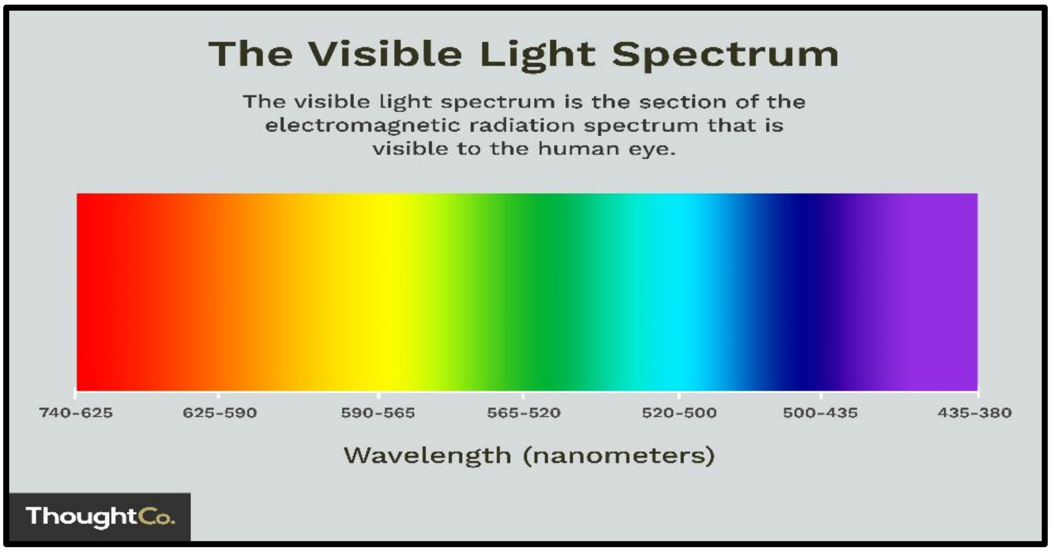
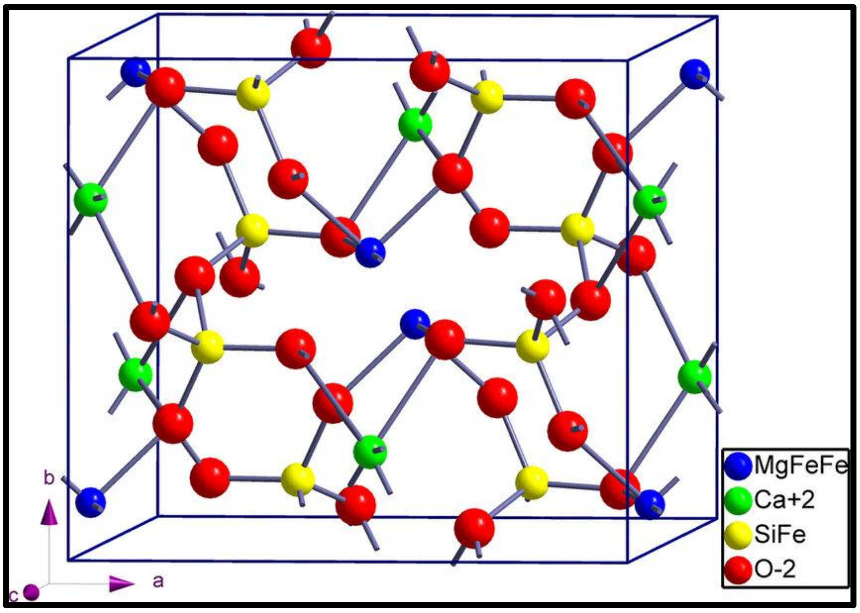


Figure 1: The Visible Spectrum



The crystal lattice of all non-native element minerals is made up of metallic *cations*, such as iron, magnesium and calcium, and *anions* such as oxygen, hydroxide and fluoride. An example, the pyroxene diopside, is shown in **Figure 2**.

<Figure 2: Crystal Lattice of Diopside

Cations are positively charged, *i.e.* they are deficient in one or more electrons, while anions are negatively charged, *i.e.* they have one or more 'spare' electrons. The common colour-forming cations are those of the so-called transition metals with atomic numbers (number of protons in the nucleus of an atom) 22 through to 29, being *titanium, vanadium, chromium, manganese, iron, cobalt, nickel* and *copper.* Some of these occur naturally in minerals, such as manganese (Mn) in *spessartite*, but others are present in low concentrations substituting for e.g. *aluminium* or *silicon* in the crystal lattice and are known as *chromophores*. Other metallic elements causing colour in minerals include *cadmium* and *arsenic* (semi-metal). The *valence* of an atom (number of free electrons in the outer 'shell') can also affect colour differently with divalent manganese, Mn^{2+} for example, forming pink colours while trivalent Mn^{3+} forms deeper pink or red colours.

Sources of Colour

Cations

Now for some pictures and minimum text for those who've made it this far. First up is cadmium, which imparts an attractive yellowish colour to *smithsonite.* Botryoidal examples from Mexico and China and a crystal group from Tsumeb are shown in **Figures 3**, **4** and **5**.

Left. Figure 3: Cadmium Smithsonite, Mexico (The Rosey Collection)>
Right. Figure 4: Cadmium Smithsonite, China (The Rosey Collection)

Right. Figure 5: Cadmium Smithsonite Crystals, Tsumeb (ex The Rosey Collection)

In **Figure 6** we have rare *cuprian* smithsonite crystals on *calcite* from Tsumeb. Copper can also cause an attractive blue colouration in smithsonite, as shown in **Figure 7**.

Figure 6: Cuprian Smithsonite Crystals, Tsumeb (ex The Rosey Collection)

Figure 7: Blue Smithsonite, Mexico (The Rosey Collection)

Cobalt can impart an attractive pink to deep pink colour to calcite, as shown in **Figure 8**.

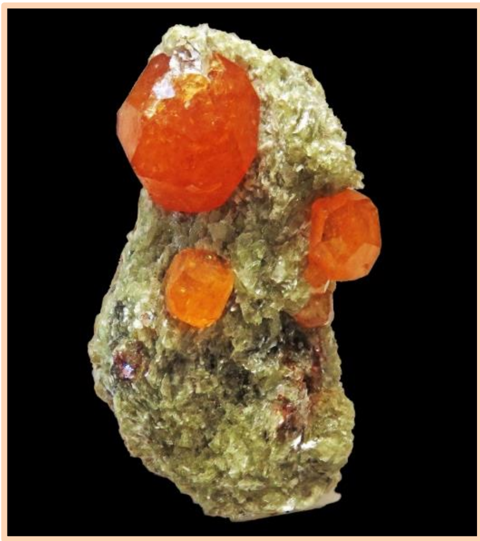
Figure 8: Cobaltian Calcite, Morocco (The Rosey Collection)

Arsenic imparts an attractive reddish-orange colour and distinctive lustre to botryoidal *pyromorphite* from the Bunker Hill Mine, Idaho, USA, as seen in **Figure 9**.

Figure 9: Arsenian Pyromorphite, Bunker Hill Mine, USA (The Rosey Collection)

The *garnet* group shows one of the widest ranges of colour variation in the mineral world, from black to just about any colour in the spectrum, even a blue variety from Madagascar. Some examples are given below of green *grossular* (chromium) from the Jeffrey Mine, Canada (**Figure 10**) and *tsavorite* from Tanzania (**Figure 11**), pink "raspberry" grossular (Mn^{3+}) from Mexico (**Figure 12**) and orange (Mn^{2+}) spessartite from Tanzania (**Figure 13**). Then we have *demantoid* garnet from Iran (**Figure 14**), the green colour being caused by chromium. The main garnet crystal is 2 cm across. The very rare blue garnets from Madagascar owe their colour to a combination of spessartite, with Mn^{2+} causing an orange colour, and pyrope, with traces of vanadium causing a green colour. Lastly, we have black, *titanium*-rich *andradite* from Mexico, variety *melanite* (**Figure 15**), a fitting 'colour' to end on.

Left. Figure 10: Green Grossular Garnet, Jeffrey Mine, Canada (The Rosey Collection)
Right. Figure 11: Green Grossular Garnet, var. "Tsavorite," on Graphite, Tanzania (The Rosey Collection)



Left. Figure 12: Pink "Raspberry" Grossular Garnet, Mexico (The Rosey Collection)
Right. Figure 13: Orange Spessartite Garnet, Tanzania (The Rosey Collection)

Left. Figure 14: Andradite Garnet, var. Demantoid, Iran (The Rosey Collection)
Right. Figure 15: Andradite Garnet, var. Melanite, Mexico (The Rosey Collection)

Radiation

Sources of ionizing radiation to minerals include radioactive minerals such as *uraninite* and naturally occurring radioactive isotopes such as ^{40}K that occur in *potassium feldspars*. This is a key source of colour in pegmatite gems but because it is so weak, hundreds of millions of years are required for it to have a significant impact on colour. This is why gems in the young (15–20 million years old) *pegmatites* of northwest Afghanistan and Pakistan often have pale colours.

Concluding Remarks

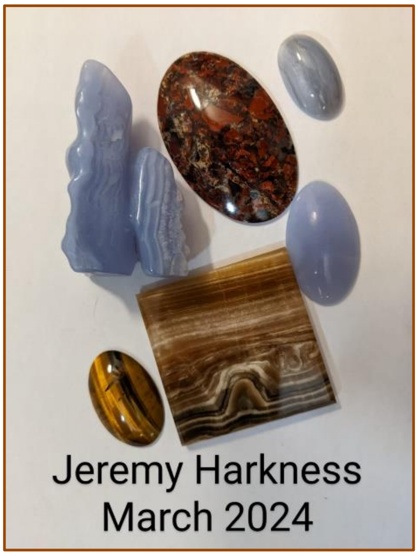
Cations, valency, chromophores, ionizing radiation, the electro-magnetic spectrum and the Anthropogenic Principle; where else can you find such a depth of intellectual discourse, apart from at a Fikile Mbalula press conference? And some pretty pictures thrown-in as well. And who had heard of blue garnets? And we haven't even mentioned all the multi-coloured examples of fluorite and tourmaline but they have been covered in earlier Minchat articles.

References

Menzies, M. and Scovil, J. (2022), *Pegmatites and Their Gem Minerals*. The Canadian Mineralogist Special Pub. 15. Canada.
Schumann, W. (1999), *Gemstones of the World*. Revised and expanded Edition. N.A.G. Press. London.
Staebler, G. *et. al.* Eds. (2008), *Garnet: Great Balls of Fire*. Lithographie, LLC. Connecticut.

Workshop Activities

The past couple of months in the Workshop have been busy with the first two newbies achieving their competency certificates. Photos of their quality work are shown below:



"FACETIPS – A Gem Cutter's Notebook" by Duncan Miller.

The faceting articles published over the past few years in the Mineral Chatter have now been compiled into a single 128-page document. The pdf file is available for download for free from http://ctminsoc.org.za/articles.php for those interested in having all the articles together.

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