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

WEBSITE NEWSLETTER

MAY 2024

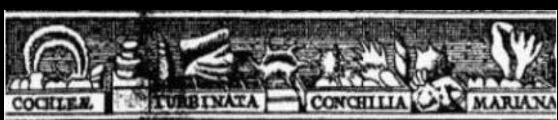
Duncan Miller's latest cerussite; a 23 mm square cushion brilliant weighing 118 ct

See page 11 for the whole story

DIARY

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.***
	11	***14.00–16.00***	***!! Come and Say Farewell to Margaret and Malcolm Jackson !!***
June	***1***	***10:00–14:00***	***Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.***

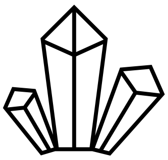
From the Cabinet of Curiosities



This month's Curiosity is related to the colour-theme articles and is a mutli-coloured or polychrome Elbaite crystal from Barras de Salina, Minas Gerais, Brazil. I can see black, blue, green, brown-pink-orange and red. If you blow the image up and use your imagination you can also see yellow. The pink to red colours are caused by Mn but only with low levels of Fe. The transition to blue near the termination indicates increasing levels of Fe, culminating in the black termination. **PR**

Figure 1: Multi-coloured Elbaite Crystal - 4 x 2.5 x 1.5 cm
(image credit GetGemstoned)

"Colourless **Characters**"



by
Peter Rosewarne

Introduction

From one extreme – "Back in Black" – to the other – "Colourless Characters". At first glance that looks like a typo and sounds like an oxymoron; a character can't be colourless? However, this isn't a scientific paper and so a bit of poetic licence is allowed, although it's not a poem either. An object is colourless if it lets all light pass through it. Most minerals contain *ions*, such as *iron, chrome, copper and manganese*, often present in only trace amounts, but sufficient to impart a pleasing hue to the human eye as they absorb certain wavelengths of light. However, pure *calcium carbonate* and *calcium fluoride*, for example, are colourless. Some have specific names; colourless rhombs of calcium carbonate are known as *Iceland Spar* and colourless *quartz* as *rock crystal*, whereas colourless *fluorite* crystals are just that, colourless fluorite crystals.

Minerals

My list of colourless minerals off the top of my head is quartz, *calcite*, fluorite, *cerussite*, *barite, topaz*, *halite*, *gypsum*, *goshenite* and *diamond*. That covers carbonates, *halides, silicates, sulfates* and native elements. We'll kick-off the list with one of the cheapest colourless minerals, quartz, and finish with one of the most expensive, diamond.

Rock Crystal

Everyone has heard of rock crystal and knows what it looks like, so I won't waste precious Minchat space with an image. Instead, we'll focus on another type of colourless quartz, *Herkimer Diamonds.* These are found in *dolomites* in and around Herkimer County, in New York State, USA. They were termed 'diamonds' because of their clarity and sharp crystal faces (**Figure 1**). Good examples, although mostly of thumbnail size, don't come cheap.

Figure 1: Herkimer Diamonds (courtesy of Weinrich Minerals)

Quartz has *piezoelectric* properties, i.e. applying pressure to a crystal produces an electric charge. It is this property that drives quartz watches. I'm not sure if these crystals have to be pure quartz, i.e. rock crystal, but that intuitively makes sense. Large quantities of piezoelectric quartz were mined from pegmatites in what was then Soviet Russia but is now the Ukraine, the same pegmatites that later yielded tonnes of beautiful *heliodor* crystals. Quartz wedges are used in petrographic microscopes to carry out advanced optical measurements.

Fluorite

The purest grades of fluorite are a source of *fluoride* for *hydrofluoric acid* manufacture, which is the intermediate source of most *fluorine*-containing fine chemicals. Optically clear transparent fluorite lenses have low dispersion, so lenses made from it exhibit less chromatic aberration, making them valuable in microscopes and telescopes (Wikipedia). **Figure 2** shows a nice specimen of colourless fluorite cubes on matrix from Dal'negorsk, Russia. Cubes to 1.5 cm.

Figure 2: Fluorite, Russia (The Rosey Collection)

Halite

Staying with halides, halite or *rock salt* crystalises in the cubic system and a large group of crystals from Poland is shown in **Figure 3a**. It is usually colourless but some attractive blue specimens are known from this and a few other countries. Specimens can degrade irreparably if exposed to moisture but the specimen shown below managed to retain its sharp crystal faces over many years of display. Halite crystals often show a characteristic 'hoppered' form as shown in **Figure 3b**.

Figure 3a: Halite, Poland (ex The Rosey Collection)

Figure 3b: Hoppered Halite Crystals (courtesy of Dakota Matrix)

Cerussite

Some of the best examples of cerussite ($PbCO_3$) came from the Tsumeb Mine in Namibia. A nice cluster of colourless crystals is shown in **Figure 4**. Multiple shapes, sizes and colours came from this prolific producer, especially in the 1970s.

Figure 4: Cerussite, Namibia (ex The Rosey Collection)

Goshenite

Pure beryl ($Be_3Al_2Si_6O_{18}$) is colourless and is called goshenite and the cluster of glassy hexagonal crystals in **Figure 5a** is from the famous Spitzkoppe locality in Namibia.

Figure 5a: Goshenite, Namibia (The Rosey Collection)

Figure 5b: Goshenite Crystal (ex The Rosey Collection)

Danburite

Danburite is a calcium, *boron* silicate with the formula $CaB_2(SiO_4)_2$. The example in **Figure 6** is from San Luis Potosi in Mexico. The crystals often have characteristic striations parallel to the *c-axis*. It often has a slight pink tinge but I think it belongs more in this article than the "In the Pink" one. The main crystal is 5 cm tall.

Figure 6: Danburite, Mexico (The Rosey Collection)

Smithsonite

Colourless *smithsonite* ($ZnCO_3$) is known as *silver* smithsonite and a nice example is shown in **Figure 7** from Santa Eulalia, Mexico. As with fluorite, smithsonite comes in just about every colour you can think of so it probably has to try very hard to remain colourless when all around is taking on yellow, green, blue, pink and grey colours and shades in between.

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

Topaz

Colourless topaz (Al_2SiO_4 (F.OH)) is also called silver topaz and good crystals come from the Spitzkoppe area of Namibia. A modest example is shown in **Figure 8** showing typical orthorhombic crystal faces.

Figure 8: Silver Topaz, Namibia (The Rosey Collection)

Diamond

As with the "In the Pink" and "Back in Black" articles, we end off with diamond and the classic colourless and flawless variety. **Figure 9a** shows a flawless, D colour, Type IIa rough diamond of 271 carats discovered at the Victor Mine in Ontario, Canada. It might be colourless but that's a character reference second-to-none for a diamond? It is the largest diamond of its kind ever found in North America. After being cut, the process for which took a year, it yielded the 102.39 carat gem shown in **Figure 9b** (Gem Voyager).

Figure 9a: Flawless 271 carat Diamond

Figure 9b: 102.39 Carat Flawless Diamond (picture credits Sothebys)

Concluding Remarks

The cast of this "Colourless Characters" article has taken us from one of the cheapest and commonest minerals, rock crystal, to one of the most expensive and rarest, diamond, and also from one of the softest, halite, with a Mohs hardness of 2, to the hardest, diamond, with a Mohs hardness of 10. It has also included one of the most important minerals known in halite or rock salt, essential to healthy human metabolism, to minerals used in the fields of optics, agriculture, watchmaking and jewellery.

The Tucson Gem and Mineral Show has had colour-themed days/exhibits, including a "Shades of Blue" theme for the 2016 edition of the show. Minchat has given you pink and two extremes in black and now colourless, so it will be back to a vibrant colour for the next edition.

And don't be misled by thinking the title of the next article means just black minerals!

Gangue Minerals

by

Peter Rosewarne

Introduction

The term "*gangue minerals*" conjures up to me pictures of boring unaesthetic minerals and to a mining company/miner seeking "paydirt," rich pickings and good profits, they are a nuisance and must be separated from the ore by expensive extraction processes. However, to the mineral collector they can be objects of great beauty and worth, not for what elements they contain but how they look, *i.e*. their aesthetics. They are also often far more aesthetic than the associated ore minerals such as, e.g. massive *sphalerite*, *galena* and *pyrite*.

Gangue comes from the German word for vein, *gang* and such minerals are commonly oxides, carbonates, silicates or halides. Some common examples include *quartz*, *calcite* and *fluorite*. Less common and less well-known examples include *siderite* ($FeCO_3$), *barite* ($BaSO_4$), *smithsonite* ($ZnCO_3$) *feldspar* and *pyroxene*, the latter two associated with chrome ore from the *Merensky Reef* of the Bushveld Igneous Complex. Some minerals that can be regarded as being gangue, such as *uraninite* in the gold ores of the Witwatersrand, are not considered here as they are present as microscopic grains, and in any case, it eventually became an ore mineral. Some gangue minerals can also be problematic in terms of the environment, *e.g*. pyrite being responsible for acid rock drainage from waste dumps and tailings storage facilities.

Examples

For the examples chosen for inclusion here, I've looked for the more unusual and aesthetic associations rather than common ones, and also tried to feature some local examples.

Barite and Fluorite

The example in **Figure 1** is one of my favourites and provides for very aesthetic specimens, particularly those from the Elmwood Mine in the USA. At this mine, the sphalerite ore was sometimes found in association with very attractive purple fluorite and off-white barite, the former as sharp, transparent cubes and the latter as blobs of barite crystals that remind me of lumps of mashed potato. **Figure 2** shows purple (**2a**) and yellow (**2b**) fluorite crystals on sphalerite.

Figure 1: Fluorite and Barite on Sphalerite, Elmwood Mine, USA (The Rosey Collection)

2a

2b

Figure 2: Fluorite on Sphalerite (The Rosey Collection): 2a Purple, 2b Yellow

Figure 3 shows an intimate combination of yellow fluorite and dark brown sphalerite from the Illinois fluorite region of the USA, whose mines are now sadly all sealed-off.

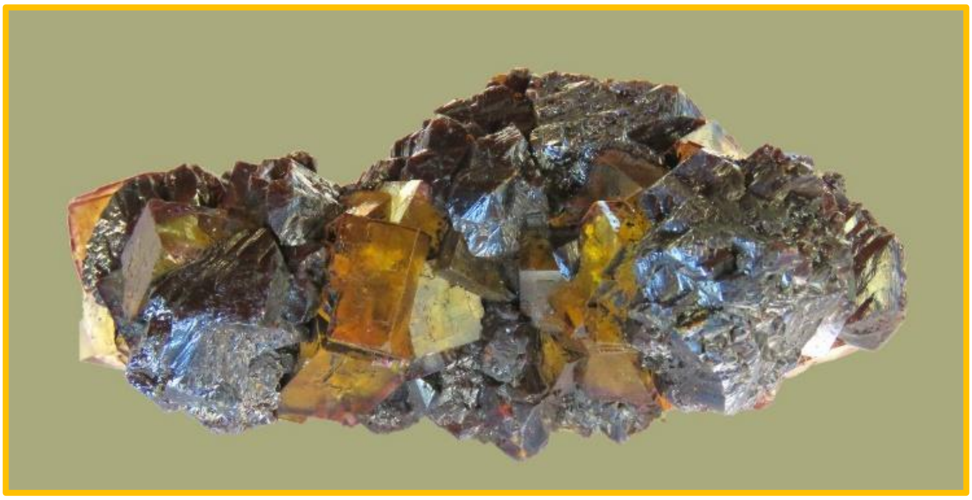


Figure 3: Fluorite and Sphalerite, Minerva #1 Mine, Illinois, USA (The Rosey Collection)

Figures 4 and **5** feature not just any barite but that from the Rosh Pinah Mine in southern Namibia, specimens from which are considered to be the best examples from southern Africa. The two contrasting examples are from the first and best finds in late 1989.

Figure 4: Barite, Rosh Pinah Mine, Namibia (ex The Rosey Collection now in the Francois and Lorraine Retief collection)

Figure 5: Barite, Rosh Pinah Mine, Namibia (The Rosey Collection)

Rhodonite and Spessartite

An unusual combination of *rhodonite* with sphalerite comes from Broken Hill in Australia and forms very attractive mineral specimens, as shown in **Figure 6**. Other unusual gangue minerals from this site include *inesite*, *bustamite, spessartite* and *hedenbergite*.

Left. Figure 6: Rhodonite with Sphalerite, Broken Hill, Australia (ex The Rosey Collection)

Another combination from the same area is spessartite and galena as shown in **Figure 7, right**.

Figure 7: Spessartite and Galena, Broken Hill, Australia (The Rosey Collection)

Muscovite and Fluorapatite

The Panasqueira Mine in Spain has been a major *tungsten* producer for the past 100 years but is better known by mineral collectors for some of the world class associated minerals such as *fluorapatite*. The specimen in **Figure 8** has main bladed grey *wolframite* (var. *ferberite*) crystals encrusted with *muscovite* and quartz crystals. **Figure 9** is a gangue mineral specimen of green fluorapatite with accents of mauve fluorite crystals.

Left. Figure 8: Muscovite on Wolframite, Panasqueira Mines, Spain (ex The Rosey Collection)
Right. Figure 9: Fluorapatite with Fluorite, Panasqueira Mines, Spain (ex The Rosey Collection)

Figure 10 below shows a nice grouping of fluorapatite crystals with a supporting cast of muscovite, quartz and siderite (with the ore mineral ferberite) from the same mine.

Figure 10: Fluorapatite with Siderite, Quartz and Muscovite (and Ferberite), Panasqueira Mines, Spain (courtesy of Fabre Minerals)

Figure 11 Below is an attractive specimen of twinned black *cassiterite* crystals nestled on a bed of muscovite crystals from the Pingwu Mine, Mt Xuebaoding, China.

Figure 11: Muscovite and Cassiterite, China (ex The Rosey Collection)

Pyroxene and Anorthosite

Not the most aesthetic mineral specimen but interesting to petrologists and mineralogists is the Merensky Reef from the Bushveld Igneous Complex. The section in **Figure 12** shows an upper *norite* layer followed by coarse grained pyroxene and *anorthite* feldspar, then a thin *chromite* ore layer and then *anorthosite*. I guess the pyroxene and anorthite are not considered gangue minerals in the broader sense but that's what they are here. *Platinum* group minerals are found in the rock above the chromite layer. Part of the famous Dwars River exposure, a national monument, is shown in **Figure 13**, with dark bands of chromite contrasting with off-white anorthosite.

Figure 12: Merensky Reef, Bushveld Igneous Complex

Figure 13: Exposure of Chromite Seams in Anorthosite, Dwars River, Limpopo

Andradite and Hematite

The Kalahari Manganese Field (KMF) is renowned for its World-class gangue minerals such as hematite, *rhodochrosite*, inesite, *sturmanite* and andradite. **Figure 14** shows small red crystals of andradite covering hematite crystals from the Wessels Mine, while **Figure 15** shows mirror-sharp hematite crystals and **Figure 16**, andradite crystals from N'Chwaning II.

Figure 14: Andradite Crystals on Hematite, Wessels Mine, KMF (ex The Rosey Collection)

Left. Figure 15: Hematite Crystals, Wessels Mine, KMF (ex The Rosey Collection, now in the Francois and Lorraine Retief collection)
Right. Figure 16: Andradite Crystals, N'Chwaning II Mine, KMF (ex The Rosey Collection)

Concluding Remarks

So, there you have it, a selection of mostly aesthetic gangue minerals, some of which can be or become ore minerals, either depending on favourable commodity prices or necessity when the main ore runs out and the gangue mineral then becomes economic to mine. Just about any mineral you can think of has probably been a gangue mineral in one or more mines around the world and I've probably omitted some of your favourites. Gangue minerals are often discarded onto waste dumps but I often wish I hadn't discarded some of those shown in this article, albeit they were to dealers and collectors, not waste dumps and I still have a photographic record; Seller's remorse! The mineral collecting literature is also rife with tales of collector-grade gangue specimens being fed into the ore chute.

FACETING A THIRD CERUSSITE … WARTS AND ALL

Duncan Miller

Cerussite is lead carbonate ($PbCO_3$). You can think of it chemically as the lead version of calcite, although the crystallography is different. Calcite is trigonal, whereas cerussite is orthorhombic. It is only slightly harder than calcite, also has good cleavage, is brittle and very heat sensitive. If you heat a fragment in a flame it decrepitates, bursting into fragments very dramatically. Large pieces from Tsumeb present a faceting challenge.Both the fragility and heat sensitivity are described as 'extreme' in *Faceting for Amateurs* by Glenn & Martha Vargas.

Some years ago Len Freeman generously gave me two chunks of Tsumeb cerussite to test my endurance. The larger weighed 119 g, but needed sawing. Because of the cleavage I did not trust it to the diamond trim saw, so I sawed it by hand with an old diamond wire saw with a manual water drip to keep it cool (Figure 1). It went surprisingly quickly and resulted in two pieces, 90 g and 26 g (Figure 2). I decided to tackle the larger piece to cut a square cushion brilliant, using a design and angles for sapphire (a slightly modified 'Ultrabrilliant Square Cushion' by John Broadfoot).

Left. Figure 1 Sawing a 119 g piece of cerussite by hand with a diamond wire saw
Right. Figure 2 The resulting two pieces of cerussite, the larger being 90 g

The heat sensitivity necessitated cold dopping. A thick pad of low melting-temperature jeweller's green wax on a face-plate dop, flattened while still warm and pliable against another flat dop in a transfer fixture, formed a flat surface on which to cement the prospective table surface of the stone with epoxy glue **(Figure 3).** Grinding the facets was quick and easy, using a 1200 mesh diamond sintered bronze lap and prepolish on the outer band of an old 'fine' Gearloose Greenwing lap that actually behaves like a 3000 mesh lap. Polishing was very difficult, on a wax lap with a thick slurry of tin oxide at the slowest rotational speed of the lap, around 100 rpm on my machine. This was the only effective polishing combination, discovered several years ago by experimentation on previous cerussites I have cut. The problem is that the cleavage and directional hardness combined make every facet behave differently, and often it is necessary to change polishing direction to achieve a polish rather than deep scratches. Scratches have to be polished out, which tends to impact adjacent meets, so it becomes a repetitive process, sometimes returning to a facet that polished reluctantly in the first place. On some facets I could not get a perfect polish at all, and simply had to accept very fine scratches, barely visible with the naked eye but definitely visible under 10× magnification.
Cutting and polishing the crown revealed two different inclusions that were not noticeable in the rough. One was a fine veil of flat bubbles and the other a somewhat larger flat bubble near one side of the stone. Cutting these out would have made it very much smaller, so I decided to live with them, as well as the imperfect polish on some facets. After all, I have never seen anyone look at one of my stones with a loupe, and this one is destined to reside in a box anyway.

Transfer again necessitated cold dopping. A conical 'anti-dop' **(Figure 4)** was used to make an impression in green wax filling a cone dop, and the pavilion was glued in place with epoxy. After that had set overnight, the first dop was heated just enough to free it from the initial wax pad, without heating the stone. The adhering wax and epoxy glue were simply ground off on a 600 mesh lap, and facet cutting proceeded again with the 1200 mesh sintered lap. An additional polishing problem presented itself on the crown. The larger of the bubble inclusions formed an open linear void like a crack on one of the facets. Before a final pass on the pre-polish lap, I sealed it with a drop of cyanoacrylate 'super glue' so that polishing oxide would not get caught in the open void.

Left. Figure 3 The dopped 90 g piece of cerussite, roughly ground square
Right. Figure 4 A set of 'anti-dops' for making suitable impressions in wax for cold transfer

Polishing the crown proceeded with the same problems and frustrations as the pavilion, but with no further mishaps. An overnight soak in acetone dissolved the wax and epoxy to release the finished 23 mm square stone weighing 118 ct (**Figure 5).** Using epoxy in the transfer was not ideal, leaving some roughened patches and several small chips on the pavilion facets, perhaps from my impatiently picking off residual glue with a fingernail. It may have been better to have used cyanoacrylate glue, which dissolves more readily. Someday I may fix it, but as the stone is included anyway, for now I can live with it as is. Thank you, Len, for the challenge, although it isn't one I feel like taking on again in a hurry!

Duncan's cerussite family is shown below. They grow bigger with time…

Cerussite 55 ct **Cerussite 75 ct** **Cerussite 118 ct**

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

Most of 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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