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JULY 2023

Arcturus Gold Mine TSF

DIARY

July	***1***	***10:00–14:00***	***Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.***
August	***5***	***10:00–14:00***	***Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.***

Artisanal Gold Mining in Zimbabwe

by
Peter Rosewarne

Introduction

When I think of Zimbabwe and minerals, *diamonds* come to mind from kimberlite pipes at Murowa, gems such as *chrysoberyl* from the Novello claims near Masvingo and *platinum* group minerals from the Great Dyke, a sort of elongated Bushveld Igneous intrusion - but not *gold*. However, on various birding trips around Harare such as at Christon Bank, part of the Mazowe Botanic Reserve, and most recently, east of the city near the Arcturus gold mine in March 2023, I have come across numerous indications of artisanal gold mining in the form of shafts and rock dumps.

Some of these disused shafts are a menace when you are concentrating on following birds in the *Miombo* woodland and you have to be aware of where you are putting your feet otherwise you might literally get shafted! And surfing the Net I have found that gold is mined in numerous localities where *greenstone belts* occur in Zimbabwe. If you already knew this, you can pass Go and collect $10 trillion old Zimbabwe dollars from me (see **Figure 1**), which, like a verbal contract, aren't worth the paper they are written on. If not, then read on.

Figure 1: Old Zimbabwe Ten Trillion Dollar Note

Gold

Seeing as this article is about gold. I thought we might as well include some basic data on the metal. Gold, chemical symbol Au and atomic number 79, is one of the *noble* metals, along with platinum and the platinum group metals (*silver* is sometimes included). It only reacts with *aqua regia*, a potent mixture of hydrochloric, sulfuric and nitric acids and does not rust or tarnish. It is mainly found in its native state which can be in the form of grains, nuggets, massive or finely crystallised, as shown in **Figure 2**. The Witwatersrand Basin contains/ed the greatest concentration of gold known on Earth, although here the gold is present mainly as fine grains disseminated in 'reefs' of conglomerate or 'banket' along with *pyrite*. South Africa's gold mining industry is in decline and the current (2023) top five gold producers are China, Russia, Australia, the USA and Canada.

Figure 2: Gold Crystals on Quartz, Eagles Nest Mine, California (courtesy of The Mineral Gallery)

It is a soft metal, registering 2.5-3 on the Mohs hardness scale, and in jewelry it is usually mixed with copper or silver to harden it and 9, 18 and 24 carat gold denotes 37.5%, 75% and pure gold, respectively. It is used in dentistry, electronics and coinage and used to form the backing for currencies as the 'gold standard.' Its price was fixed at US$35/oz until 1970 and as of 21 March 2023 it was trading at US$1 967/oz. The Krugerrand is one of the World's premier gold coins for investors, with gold being seen as a 'safe haven' during times of economic turmoil.

There are apparently 20 minerals containing gold, including native gold, but I've never heard of any of them, e.g. *tetraauricupride* (CuAu), *muthmanite* ([Ag,Au]Te) or *aurostibite* ($AuSb_2$). The Mineralogical Record devoted two issues to gold in 1982 and 1987 (I have copies of both in pristine condition, which are collector's items so, if you are interested, make me an offer). Back in 1987, an ounce of gold was worth about US$400 but an ounce of gold in a crystalline form on matrix would have sold for several thousand dollars even back then. Gold is one of the few examples of a mineral that is still attractive to collectors even after being worn down by the action of water, which would destroy the value of most mineral specimens. It isn't affected by humidity, sunlight, airborne acids or pollutants or sudden temperature changes.

Geology

There are apparently over 4 000 recorded gold deposits in Zimbabwe, almost all located on ancient workings. Nearly all of these are located within greenstone belts. These are usually elongate sequences of altered ancient volcanic, mainly *basalt*, and sedimentary rocks where green-coloured minerals such as *chlorite*, *epidote* and *amphiboles* predominate within a *granitoid* host or *craton*. The alteration involved low-grade metamorphism and the rocks have been dated as being as old as 3.5 billion years. They are thought to represent early oceanic crust. The most well-known occurrence in South Africa is the Barberton Mountain Land, which hosts rich gold deposits, e.g. the Sheba Mine.

Greenstone belt occurrences in Zimbabwe are shown on **Figure 3** and the area covered by this article is the belt extending to the east, west and north of Harare. Artisanal miners are known locally as *marokokoza* or ASMs for short. Along with small-scale miners they produce more gold than the conventional large-scale producers. Estimates of the number of ASMs varies from 500 000 to 2 000 000. In 2020, gold was Zimbabwe's main export product, making up

25% of the total. The gold is contained in *quartz* veins and *sulfide* deposits in shear zones within the greenstone rocks and also in alluvial deposits derived from gold-bearing strata.

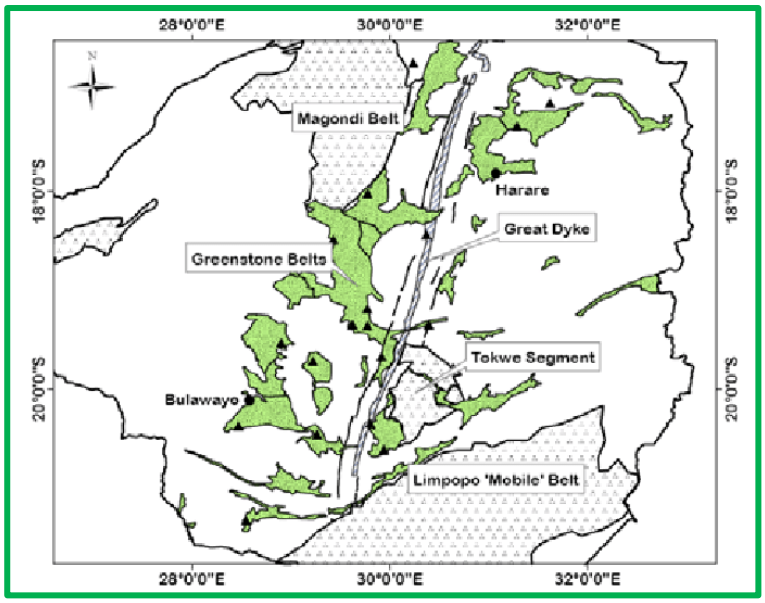


Figure 3: Greenstone Belts of Zimbabwe (Internet image)

Some of the rubble/waste rock from artisanal mining is shown in **Figure 4** with the dark rock being greenstone with brown weathered surfaces.

Figure 4: Waste Rock Pile

Gold Mining in Zimbabwe

The Arcturus Mine's tailings storage facility (TSF) is shown in **Figure 5** below from near a primitive-looking ASM processing 'plant' next to a track leading down into a valley with evidence of ASMs in the form of shafts, rock dumps and primitive shelters.

Figure 5: Arcturus Gold Mine TSF

As we were leaving the valley after some good birding on 11 March 2023, a bakkie came past driven by a Chinese-looking individual, who may be the licence holder, on his way up to the plant and then coming down again, presumably after having picked up the day's or week's gold production. I'm not sure how the ASMs or licence holders locate favourable areas to sink their shafts as the area is covered in fairly dense ground cover vegetation and as a trained geologist, I couldn't see any particularly favourable features from a cursory look. Perhaps they are guided by

signs of ancient workings but then the same question arises; how did the ancients locate favourable sites? Typical shafts are shown in **Figure 6** and **7** and a processing plant in **Figure 8**.

Figure 6: Crude Shaft in the Mazowe Area

Figure 7: Shaft in the Arcturus Mine Area

Figure 8: ASM Processing Plant (courtesy of the Mail and Guardian)

Mercury and *cyanide* are used to separate the gold from the milled ore and country rock and there are reports of pollution of surface water from such activities in, e.g. the Mutare area. There is little control over the individual ASM operations and no attempt at rehabilitation of any mined areas/shafts. Miombo trees are cut down to use as fuel and shaft 'headgear' and some of these trees can be centuries old and form beautiful woodlands, as shown in **Figure 9**, which are under threat, as in Mozambique, although charcoal production is the cause there.

Figure 9: Miombo Woodland near Mazowe

Concluding Remarks

Stumbling upon some shafts and piles of discarded rocks on a birding excursion east of Harare led me to some interesting facts about gold and Zimbabwe; it is its number one export commodity. It is hosted in greenstone belts and artisanal and small-scale miners produce more gold than the large-scale conventional miners. I haven't touched on the political/corruption aspects of this ASM gold mining which are beyond the scope of this article, but they are rumoured to play a large part in the bigger picture. And, now that I think about it, one of my Rosey's Crystals clients from Somerset West, Richard Dollar, has some fabulous gold specimens, and consults to a gold mine there. We were going to collaborate on an article on gold in a future Minchat article but, sadly, I learned today, 12 June 2023, that he passed away on his last trip to Zimbabwe. RIP Richard.

I think I have only ever had one mineral specimen from Zimbabwe in my collection, namely chrysoberyl, as shown in **Figure 10**.

Figure 10: Chrysoberyl Crystal Group from the Novello Claims, Masvingo (ex Rosey Collection)

Departing from the script, I have been travelling to Zimbabwe since 2007 on numerous birding trips to Harare, the Zambezi Valley, Nyanga & Eastern highlands and Victoria Falls and have never had a scary moment, apart from nearly walking into a pride of lion near Hwange National Park. The tourist facilities are first rate, places aren't crowded, the scenery is awesome and the people are the friendliest I've come across on my many travels. The main drawback is that everything is priced in US$ and the 'new' Zimbabwe dollar is going the same way as the old one shown in **Figure 1**. By contrast, I've got a Zimbabwe $10 note (**Figure 11**) from a trip to the Murowa site in 2000 just before it all went pear-or should that be nought-shaped - and 12 noughts eventually ended up being added and the worthless notes being sold as souvenirs to tourists like me in Victoria Falls for US$1.

Figure 11: Zimbabwe $10 Note from 2000

References

Mail and Guardian (2020), *Inside Zim's illicit gold mine trade*.
The Mineralogical Record (1982), *Gold!* Vol. 13, No. 6. November-December 1982. Tucson.
The Mineralogical Record (1987), *Gold!* Vol. 18, No. 1. January-February 1987. Tucson.
Various Internet sites
ZimFieldGuide.com: *Zimbabwe's artisanal miners, popularly known as makorokoza, risk their lives to make a decent living*.

One Million US Dollars' Worth of Mineral Specimens

by

Peter Rosewarne

Introduction

The idea for this article came to me over Xmas 2022, the time of giving, and receiving, so here goes…

Prices of good mineral specimens have rocketed in the past 20 years or so and things have perhaps never been the same since Steve Smale shocked the mineral collecting world by paying $40 000 for a *blue-cap tourmaline* back in 1980. One dealer's take on mineral prices is that if a specimen sells it was underpriced. John Betts cites the 'greater fool theory': "*Each owner would buy a mineral and eventually sell it to a greater fool that will pay more. Eventually the mineral works its way up the price ladder until it reaches a practical limit. As a dealer, all that matters is whether there is a bigger fool out there to pay more than we did. And there always is*." Our much-missed Maurice Conradie once asked me how much a mineral is worth when I bought a miniature Tsumeb *azurite* on *malachite* from him one Open Day for R1 500. I replied, "As much as someone will pay for it," which was apparently the correct answer. Many world-class specimens are not sold *per se* but are traded amongst the top collectors and museums, although these are probably mostly in the price range >$1 million.

Wayne Thompson, in his seminal work, *Ikons* (2007), put forward three categories of world-class mineral specimen namely, *Ikons*, *Classics* and *Contemporary Masterpieces*. Within these categories are "*castes*" which broadly define the value of such specimens. The first caste includes rare and beautiful minerals such as *phosphophyllite* and *euclase* and the second caste includes gems and native precious metals. The third and fourth castes include the more commonly collected minerals such as *wulfenite*, *azurite* & *dioptase*, and *smithsonite*, respectively. These castes and categories broadly determine the price and investment value of mineral specimens and all specimens in a world-class collection would come from the first four castes. A top phosphophyllite will always command a higher price than a top azurite, for example. Not one of my favourites and just as well because I couldn't afford one. The one illustrated below is 2 cm in length and sold for $20 000, shown at real size, and doesn't even warrant its own Figure no. in my opinion.

A Fantasy

After browsing through Ikons again and trawling yet again through some favourite dealer and auction internet sites and drooling over images of impossible-to-own specimens, I thought it might be interesting to fantasize. Imagine you have one million US dollars (about ZAR18 million) to spend on the mineral specimens of your choice/dreams, what would you choose? Would you go for local or international, quantity or quality? In terms of the latter approach, you could spend the whole lot on one specimen in today's market or go for hundreds of very nice specimens in the range c.$500–$1 000 each. My favourite minerals, in no particular order, include *smithsonite, wulfenite, tourmaline, dioptase*, *pyromorphite*, *garnet*, *heliodor*, *fluorite* and *vanadinite*, i.e. mainly third caste minerals. With some of those, I'd probably struggle to spend more than about $50 000 per excellent specimen. Assuming I'm going to go for quality, and for reasons of space for this article I've got to, here are my choices from surfing the internet, which are a mix of local and international.

Something to bear in mind when assessing the prices is that many of the specimens featured below were sold at auction many years ago and so the figures quoted here are probably on the low side by today's standards. Also, one is limited to specimens that are listed on the internet with auction/sale prices and so some of the ones featured below wouldn't necessarily be my first choice for the species. Specimen and image sources are indicated on Figures and listed under Acknowledgements, and many thanks to these dealers for permission to use their material.

The Minerals

First up in **Figure 1** is a heliodor (second caste) crystal from the classic pegmatite deposits in the Ukraine which featured as one of Minchat's Curiosities. This sold for **$43 750** at auction and measures 11.8 × 4.8 × 3.7 cm.

Imaged by Heritage Auctions, HA.com

Figure 1: Heliodor, Ukraine

Next in **Figure 2** are two specimens of dioptase (third caste) from Tsumeb Mine – where else? The first example (**2a**) sold for **$93 750** and is 20.2 × 16.7 × 5.1 cm. The second example on calcite (**2b**) sold for **$21 250** and is 9 × 8 × 4 cm

2a

2b

Figure 2: Dioptase, Tsumeb Mine, Namibia

Figure 3 (below left) is a wulfenite (third caste) crystal group from the classic Red Cloud Mine locality in Arizona, USA, from the famous 1996 find. This sold for **$71 700** and is 6.9 × 6.2 × 5.6 cm.

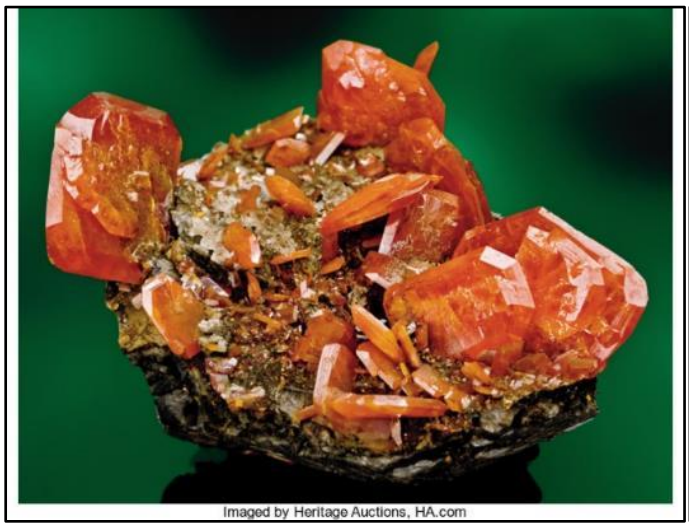


Figure 3: Wulfenite, Red Cloud Mine, USA

Figure 4: Smithsonite, Masua Mine, Sardinia, Italy

Figure 4 at right is a smithsonite (fourth caste) from the famous Masua Mine, Sardinia, Italy. This one sold for **$44 812** and is 13.7 × 8.7 × 8.1 cm. I would happily swap this one for a similarly-sized pink cobaltian or green cuprian smithsonite from Tsumeb (appreciative nod dear reader?).

A group of blue-cap tourmalines from the Tourmaline Queen Mine, San Diego County, USA are next in **Figure 5**, which sold for **$119 500**. It measures 11.2 × 11.2 × 6.9 cm. A striking fluorite (fourth caste) crystal cluster on barite and sphalerite from the Elmwood Mine, USA is next in **Figure 6**. It sold for **$125 000** and measures 26.7 × 24.8 × 15.2 cm.

Figure 5: Blue-cap Tourmaline Group, Tourmaline Queen Mine, USA **Figure 6: Fluorite on Barite and Sphalerite, Illinois, USA**

Figure 7 below is a pyromorphite (third caste) from the Bunker Hill Mine, Idaho, USA which sold for **$131 450**. It measures 16.2 × 13.1 × 11.2 cm.

OK, we are up to about $650 000 so far and have a few hundred grand or so left to spend. Let's see what we can find…

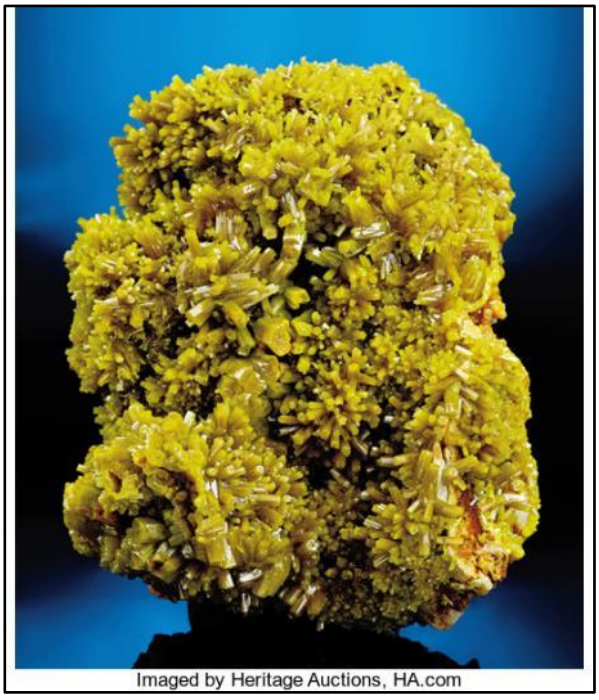


Figure 7: Pyromorphite, Bunker Hill Mine, USA

Figure 8: Rhodochrosite, N'Chwaning II Mine, South Africa

In **Figure 8** at right we have a group of rhodochrosite scalenohedrons from N'Chwaning II Mine, South Africa. It sold for a mere **$30 000** and measures 5.1 × 5.1 × 3.2 cm.

I couldn't resist adding another fluorite, the one in **Figure 9** being a stunning specimen from the Yaogangxian Mine in China. It sold for **$41 825** and measures 8.1 × 6.2 × 5.6 cm.

Figure 9: Fluorite on Quartz, Yaogangxian Mine, China

This selection wouldn't be complete without a tourmaline specimen from the Pederneira Mine, Brazil. Feast your eyes on the multi-coloured grouping of crystals in **Figure 10**. This sold for **$65 726** and measures 23.7 × 21.2 × 15.0 cm. I think most of these multi-crystal specimens from this mine are repair jobs but that seems to have been accepted by the market.

Figure 10: Bi-colour Tourmaline Group, Pederneira Mine, Brazil

For the following few specimens, I don't have a sale price, but I am assuming that their combined worth would easily make up the money remaining from my US$1 million. And they are some of my favourites. First is a stunning combo of azurite crystals on velvety malachite in **Figure 11** from the Milpillas Mine, Mexico. It measures 7.5 × 9.5 × 4.5 cm and to me it is aesthetic perfection.

Wulfenite from the Erupcion Mine, Los Lamentos, Mexico is one of my favourite minerals. The cabinet specimen in **Figure 12** is spot on the money for me and Kevin Ward reckons it would fetch about **$25 000.**

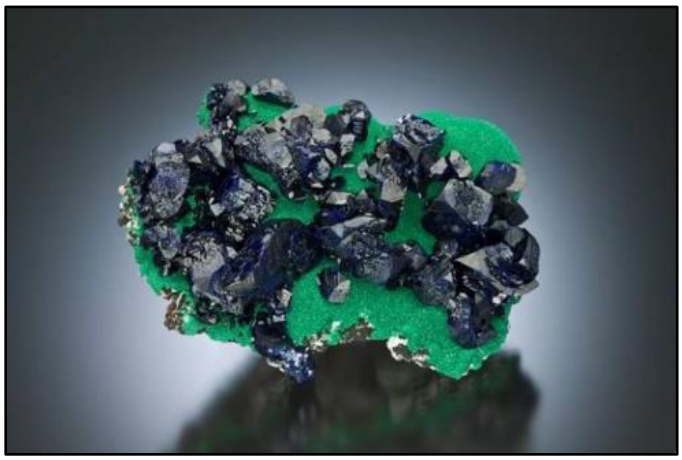


Figure 11 left: Azurite on Malachite, Milpillas Mine, Mexico (courtesy of Collector's Edge)
Figure 12: Wulfenite on Calcite with Endlichite, Los Lamentos, Mexico (courtesy of The Mineral Gallery and Auction)

And lastly, one of my all-time favourites, *grossular* (var. *hessonite*) garnet from the Jeffrey Mine, Canada. **Figure 13a** shows a matrix specimen with the typical colour and striations on the crystal faces (caused by oscillating growth between the trapezohedron and dodecahedron) and **13b**, detail of two immaculate crystals (different specimen). Those two crystals say it all for me – absolute perfection!

Figure 13 below: Grossular var. Hessonite Garnet, Jeffrey Mine, Canada

13a (image from Geologyin)

13b (courtesy of Crystal Classics)

Closing Remarks

So, there you have it, **a hastily compiled collection worth about US$1 million and only 14 specimens to show for it**. On reflection I think I would rather plump for about 400 very fine specimens for around $2 500 each and **Figures 15**, **16** and **17** show a few minerals at that price level that I would happily add to my collection. I think the most I have ever paid for one specimen is $1 500, back in the period when the ZAR was about 7–12 to the US$. The pyromorphite in **Figure 14** was one of them.

Figure 14 left: Pyromorphite on Barite, Les Farges, France (photograph Hummingbird Minerals)
Figure 15: Smithsonite, Choix, Mexico, 10 × 5 × 7 cm (courtesy of Weinrich Minerals)

Figure 16 left: Fluorite. Illinois, USA, 14 × 9 × 4 cm. (courtesy of Hummingbird Minerals)
Figure 17: Pyromorphite, Daoping Mine, China, 4.6 × 7.1 × 4.7 cm. (courtesy of The Mineral Gallery and Auction)

A final closing thought, taken from Ikons, is that mineral collecting is unique in that world-class specimens are continually being discovered at existing and new sources whereas a fine art collector, for example, is never going to come across a new old master. For probably just about everyone 'local' reading this article we are never going to own a world-class specimen, but we can still derive much pleasure from seeing one displayed on the internet, in a journal, in a top museum or mineral show and reading about new finds in What's New in the Mineral World by Thomas P Moore that Jo circulates to some of us.
So, what specimens would you choose with US$1 million to spend on the minerals of your choice – local vs international, quality vs quantity? You could also spend it all on a suite of minerals from a single mine such as Tsumeb, and many of you will no doubt be shaking your heads and muttering about it being under-represented here**.**

References

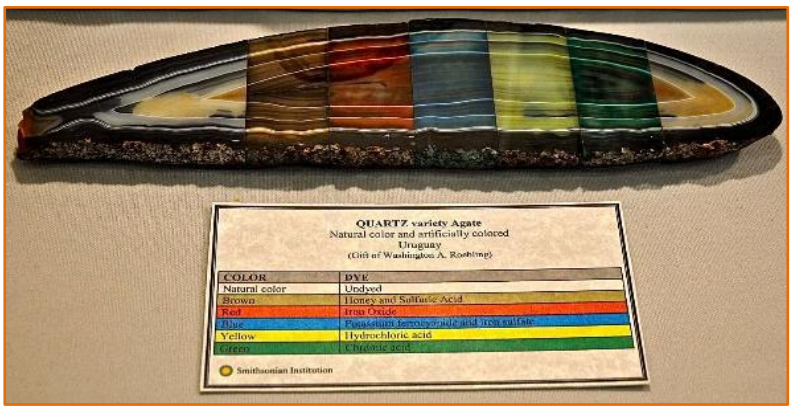
Thompson, W.A. (2007), *Ikons, Classics and Contemporary Masterpieces*. Supplement to The Mineral Record, Vol. 38, No.1, Jan-Feb 2007. Tucson.

Acknowledgements
Collector's Edge Collector's Edge Minerals - Mineral Specimens for Sale (collectorsedge.com)
Crystal Classics Crystal Classics Fine Minerals
Heritage Auctions Heritage Auctions | World's Largest Collectibles Auctioneer (ha.com)
Hummingbird Minerals Hummingbird Minerals
The Mineral Gallery and Auction https://themineralgallery.com
Weinrich Minerals Popular & Rare Minerals For Sale | Weinrich Minerals (weinrichmineralsinc.com)

"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 from http://ctminsoc.org.za/articles.php for those interested in having all the articles together.

Rabbit image in agate

We were sent this photo of a *bunny rabbit* in an agate slice. What do you make of it? Genuine, or not quite real?



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