



Website Newsletter of the Cape Town Gem & Mineral Club

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NOVEMBER 2023



Figure 17: Brucite, Quetta, Balochistan (ex The Rosey Collection)

DIARY

November	4	10:00–14:00	Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.
December	2	10:00–14:00	Open to the Public Day – Rocks, gems, jewellery, mineral specimens to look at, chat about, swap, sell or buy.

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Famous Mineral Specimen Producing Regions/Countries: Part III - Pakistan

by Peter Rosewarne

Introduction

We've had Afghanistan and Mexico and now it's the turn of Pakistan. I think President George Bush Jnr coined the phrase, "Axis of evil" for some anti-West countries; well Afghanistan and neighbouring Pakistan could well be called the nexus of mineral specimen excellence. They not only share a border but mountain ranges and gem-bearing pegmatites that have yielded "best-of" specimens of e.g. *topaz*, *aquamarine*, *morganite* and *elbaite*. They also share a justified reputation for being some of the most challenging places in which to search for or buy specimens because of harsh climatic conditions, high altitude and remote specimen sites, and volatile political and tribal situations. However, thanks to the perseverance of local miners and middlemen (and they *are* men in Pakistan) and intrepid Western dealers/collectors such as Wayne Thompson, Steve Smale, Herb Obodda, Daniel Trinchillo and Peter Lykberg, the mineral collecting/viewing community has been treated to some true masterpieces of the mineral world.

I don't think The Mineralogical Record has ever had a "Pakistan" issue, but Lapis certainly has (out of print unfortunately) and Pakistani aquamarine, topaz and *schorl* specimens rate an impressive 10 mentions in Wayne Thompson's authoritative monograph, "Ikons". **Figure 1** is a general locality map.

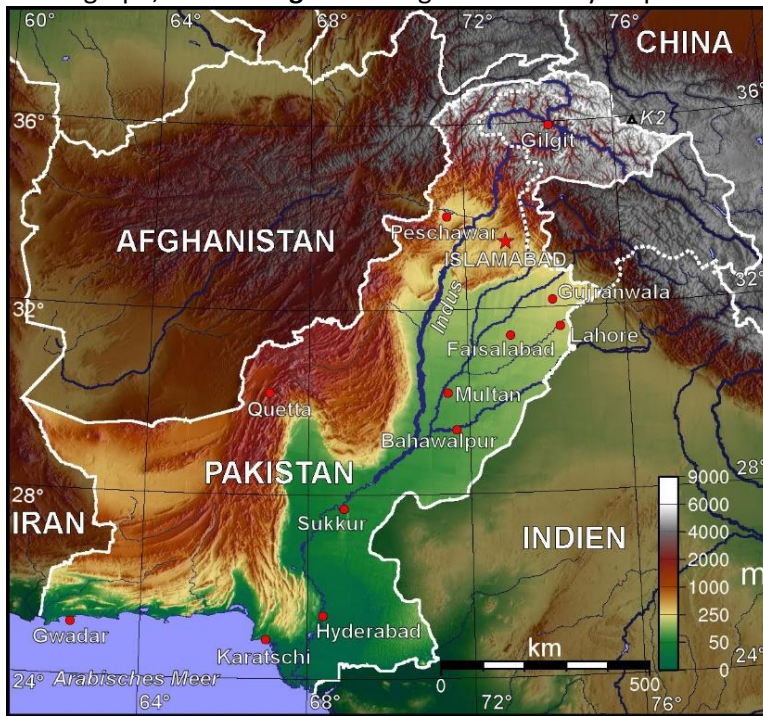


Figure 1: General Locality Map

Pakistan

Geology and Mineral Regions

A bit of overlap with the article on Afghanistan is unavoidable here given their shared geology. This is a geologically young area characterized by the collision of the Indian plate northwards with the European plate (converging boundary), which formed the still-rising Himalayas, of which the local Hindu Kush and Karakorum ranges form part. The pegmatites of the northeastern part of the country are dated at <30 million years old, the blink of an eye in geological terms. The positions of the various 'plates¹' involved in the geological formation of the area are shown in **Figures 2a** and **2b**. The diagram in **Figure 2b** shows why the Himalayas are so high; they have a double layer of lithosphere.

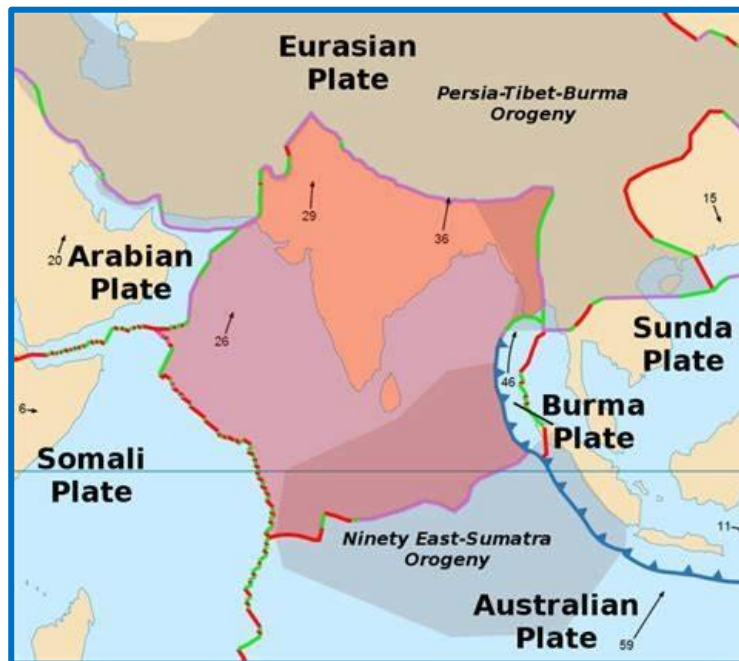


Figure 2a: Asian Plate Tectonics (Wikipedia)

¹ According to plate tectonics, the Earth's upper c.100 km, the lithosphere, moves over the underlying semi-molten but denser asthenosphere, as a series of plates, with converging, diverging or slipping/grinding boundaries.

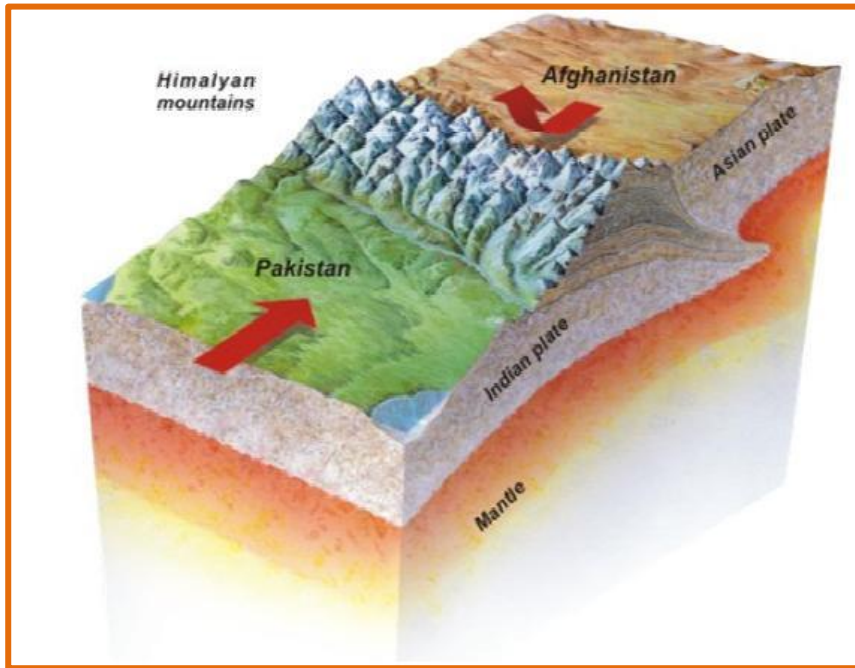


Figure 2b Cross-Section of Asian Plate Tectonics (Internet image)

The main mineral specimen producing area is the Gilgit-Baltistan Region, formerly known as the Northern Areas. Key mining areas/towns are, from west to east, Gilgit, Shengus, Stak Nala, Shigar and Skardu (**Figure 3**). These areas produce some of the World's best aquamarine, topaz, schorl, elbaite, fluorite and garnet specimens from pegmatites associated with the Himalayan orogeny. The Baluchistan Region further south is known for its yellow brucite and large epidote crystal specimens from the ophiolitic² belt of peridotites (hosting brucite) and dolerite dykes (hosting epidote). Peshawar is a key centre for trade in Pakistani and Afghan gems and mineral specimens. Two famous 8 000 m+ high mountains are located around the area of interest; K2 (8 611 m) and Nanga Parbat (8 126 m).

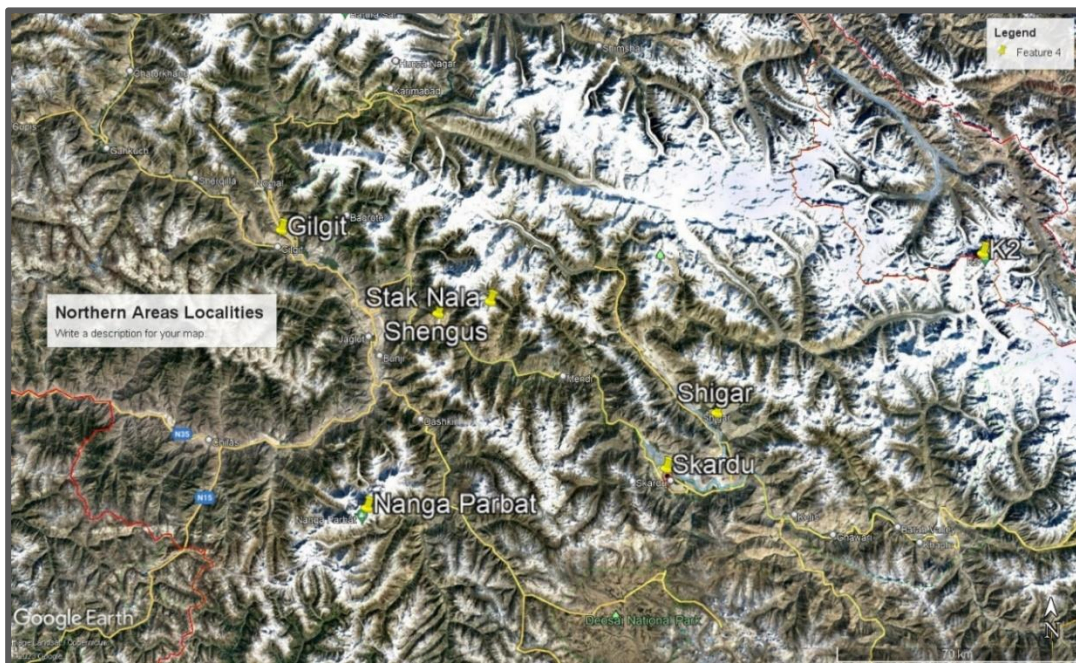


Figure 3: Google Image of Key Localities in the Northern Areas

Mining is taking place up to an altitude of 5 500 m as the lower sites are worked-out. I can attest to the problems of mining or even just existing at such altitudes, having visited an old mining site (see **Figure 4**) at 5 500 m altitude above the Collahuasi copper mine in the Andes of Chile in 1994; just walking a few paces at normal speed brought me gasping for breath.

² Ophiolite: sequence of peridotitic and basaltic rocks that formed part of the oceanic crust and upper mantle that have been uplifted/thrusted and exposed above sea level



Figure 4: Ruins of Old Copper Mine at 5 500 m in the Andes

The Minerals

The extraordinary minerals presented below come mainly from pegmatites but also from hydrothermal Alpine-type veins and ultrabasic and basic igneous rocks. A comment about the origin of colour in pegmatite minerals is apt at this stage. The most common is substitution of a cation for an essential ion in the crystal lattice, e.g. iron or aluminium substituting for silicon in quartz. Such ions are called chromophores. Different valence states of the same ion can also cause colour changes, e.g. Mn^{2+} causes a pink colour whereas Mn^{3+} causes a deeper red colour. A second cause is radiation, which in pegmatites, comes mostly from the radioactive isotope potassium 40 which is present in potassic feldspar. However, this latter effect is very weak and takes hundreds of millions of years to produce strong colours. Given the very young ages of Pakistan pegmatites, colours are usually pale, e.g. in smoky quartz.

Aquamarine

Pakistan produces the World's best aquamarine crystals in terms of size, colour and gemminess. Feast your eyes on **Figures 5, 6, and 7**, the latter being the famous "King of Kashmir" specimen (81 cm wide and 200 kg in weight) removed intact from a cavity by local miners under the guidance of a Fine Minerals International expert over a two-week period (300 m up a vertical cliff face and 30 m down a tunnel, with very basic 'amenities' and at >4 000 m altitude) in the Shigar area. I saw somewhere on the Internet that it was sold for \$8 million. The aquamarine-schorl combo in **Figure 5** is rated as one of the best mineral specimens ever found.



Figure 5 left: Aquamarine, Schorl and Cleavelandite, Skardu District (© Elliott/Fine Minerals International/MIM Museum)

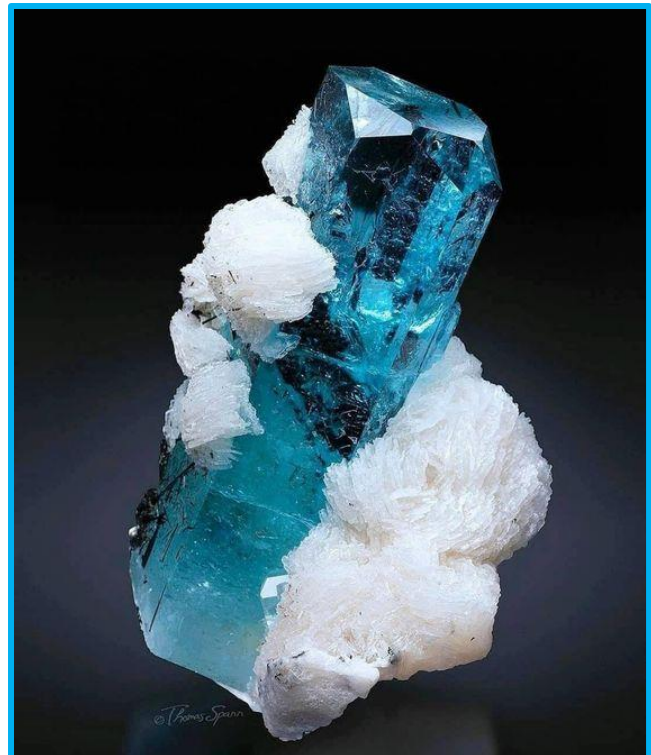


Figure 6: Aquamarine and Cleavelandite, Gilgit (Facebook image)



Figure 7: The King of Kashmir, Shigar (© James Elliott/Fine Minerals International)

Topaz

Beautiful sherry-coloured topaz crystals are found in the Skardu area and a spectacular example is shown in **Figure 8**. Pakistan is one of only three countries where pink topaz is found (the other two are Brazil and Russia) and a rare specimen on matrix is shown in **Figure 9**. This is from Ghundao Hill, about 60 km northeast of Peshawar, which consists of *limestones* within which *calcite* veins contain the topaz.



Figure 8 left: Topaz Crystal with Cleavelandite (Internet image)



Figure 9: Pink Topaz on Matrix, Ghundao Hill (Thomas Spann image, Irv Brown collection)

Fluorite

Sticking with a pink/red theme, I never associated Pakistani pegmatites with fluorite but a site near Nagar, northeast of Gilgit, produced a spectacular find in a small cavity in 2006. These were deep pink to red mostly octahedral fluorites to match those from the Alps of Switzerland and France only much larger at up to 9 cm. Check out **Figure 10**. Other colours, but mostly green, are found at sites across the gem-bearing pegmatites of the Gilgit-Baltistan Region.



Figure 10: Pink Fluorite on Muscovite, Nagar ("Tumblr", Facebook site)

Elbaite/Schorl

Stak Nala is the prime elbaite-producing site in Pakistan and the crystals usually have a dark green base and contrasting light green or pink terminations. Examples are shown in **Figures 11** and **12** with bladed *cleavelandite*³ crystals.



Figure 11: Elbaite with Cleavelandite, Stak Nala (ex Rosey Collection)



12a



12b

Figure 12: Elbaite, Stak Nala (12a courtesy of The Mineral Gallery; 12b The Rosey Collection)

³ Term refers to a crystal form of albite rather than an actual mineral species.

Even boring *schorl* crystals can take on an enhanced form as shown in **Figure 13a** with a flat basal pinacoid termination and **Figure 13b** with a trigonal pyramid termination. Sometimes these crystals are studded with small orange *spessartine* crystals.



13a



13b

Figure 13: Schorl with Albite (13a © Elliott/Fine Minerals International; 13b The Rosey Collection)

Garnet

The spessartine specimen shown in **Figure 14** is regarded by many connoisseurs as the best garnet specimen on matrix (11 cm) ever found. It now resides in the collection of the MIM Museum and seems to glow with an internal fire. Lesser but still very attractive specimens feature spessartine crystals on white feldspar (**Figure 15**). A gem quality spessartine was mined from a pegmatite near the Indian border and marketed under the name *kashmirine*.

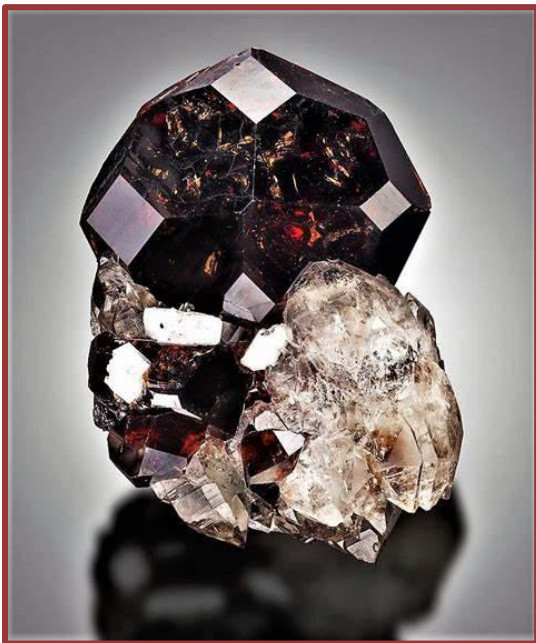


Figure 14 left: Spessartine on Quartz, Shigar Valley (© The MIM Museum)

Figure 15: Spessartine Crystals on Feldspar, Gilgit (© Elliott/Fine Minerals International)

And now for some perhaps less well-known Pakistani minerals such as forsterite (peridot), brucite, axinite, titanite (sphene) and epidote.

Forsterite (Peridot)

Forsterite is the magnesium end-member of the olivine group and peridot is the gem variety. Large forsterite crystals from Pakistan started appearing on the mineral scene in the early nineties and the location was eventually determined to be Sapat Gali in an area of thrustured ophiolitic rocks at the margin of the Indian and Eurasian plates. A

very nice example is shown in **Figure 16a** and some very lesser examples in **Figure 16b** and **16c**, the latter on magnetite. Crystal habits vary between prismatic, tabular and blocky.



16a



16b



16c

Figure 16: Forsterite Crystals (16a courtesy of The Mineral Gallery; 16b and 16c ex. The Rosey Collection)

Brucite

Probably the best brucite (magnesium hydroxide) specimens in the World have come from the Quetta area in Baluchistan, with a nice example in **Figure 17**. In this area they are an alteration product of the serpentinisation of olivine peridotite (dunite). The yellow colour is due to traces of iron.



Figure 17: Brucite, Quetta, Balochistan (ex The Rosey Collection)

Axinite

Axinite, a calcium aluminium boro-silicate, is found in Alpine cleft-type deposits near Shigar and a nice example is shown in **Figure 18** with sharp bladed, mauvish-brown crystals. This type is iron-bearing.

Figure 18: Axinite-Fe, Shigar Valley (ex The Rosey Collection)



Titanite

Very attractive apple-green crystals of titanite, a calcium titanium silicate, are shown in **Figure 19** on a matrix of biotite (clinocllore?) and albite. This specimen comes from the Tormiq Valley area of Skardu District, from Alpine-type hydrothermal deposits.

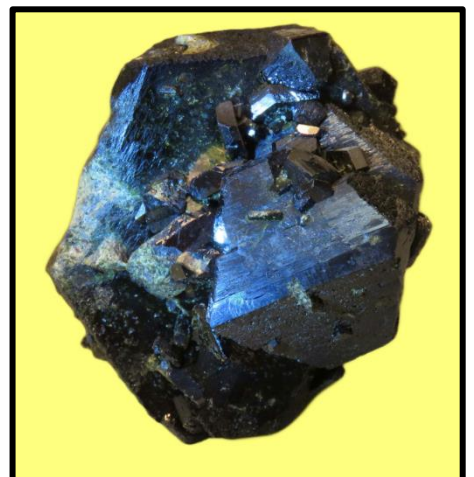


Figure 19: Titanite on Biotite and Albite, Tormiq Valley (courtesy of M&W Minerals)

Epidote

A find of impressive epidotes from Quetta, Balochistan, occurred in 2011 and the example in **Figure 20** shows a large (9 cm) dark green main pseudo-orthorhombic crystal with numerous subordinate crystals attached. These specimens were associated with dolerite dykes. Epidote is a calcium-aluminium-iron silicate.

Figure 20: Epidote Crystal Group, Quetta (The Rosey Collection)





And finally, some aesthetic combos and rarities. **Figure 21** is aquamarine with spessartine on feldspar and **Figure 22** is topaz and ‘hot’ pink fluorapatite on muscovite. The former was recovered from the Aqua-Garnet Pocket at the Dassu Mine, Shigar Valley in 2018 as a prelude to the discovery and recovery of the King of Kashmir.

Left. **Figure 21: Aquamarine with Spessartine Garnet and Albite, Dassu Mine** (courtesy of Wilensky Fine Minerals)



Right. **Figure 22: Aquamarine and Fluorapatite on Muscovite** (© The MIM Museum)

And, last but not least, a rare mineral species I’ve never heard of, väryrynenite, a phosphate of beryllium and manganese from the Shigar Valley (**Figure 23a**) and uncommon brookite, a titanium dioxide, polymorphic⁴ with anatase and rutile (**Figure 23b**) from Balochistan. The former is an alteration product of pegmatitic beryl while the latter is an Alpine-cleft type mineral. A 5.7 cm specimen of väryrynenite was apparently on the market for \$19 800 in February 2021.



23a



23b

Figure 23: Väryrynenite, Shigar Valley (courtesy of Fabre Minerals) and **Brookite, Balochistan** (© Elliott/Fine Minerals International)

Concluding Remarks

Another block-buster mineral specimen producing country/region and a hard act to follow, with at least three specimens that are up there with the “best-of” and one that is the best-of-species, the King of Kashmir. I wondered how these national treasures were exported out of the country and asked Fine Minerals International, who stated

⁴ Minerals with the same chemical composition but different crystal structure.

that there are generally no problems with following country protocols. However, Canada, for example, requires natural treasures to be catalogued and offered first to government for research/public museums (pers. comm. Crystal Suh, Fine Minerals International).

China is one country that can compete, although about 35 years ago almost nothing was known in the West about the treasures that were about to be unleashed on the mineral collecting and viewing community. The opening up of the Chinese economy in the mid-1980s changed all that and raised the bar on what “world-class” means in terms of mineral specimen perfection. You will be treated to some examples in Mineral Regions in an upcoming Minchat. Possibly there will be some new geological terms therein to add to your vocabulary in chromophore, ophiolite, kashmirine and polymorphic?

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'Participating' dealers/collectors: *Fine Minerals International, The MIM Museum, Wilensky Exquisite Minerals, The Mineral Gallery, The Rosey Collection, M&W Minerals and Fabre Minerals*



© MIM Museum

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From the Cabinet of Curiosities



This month's **Curiosity** is a mineral in **Disguise**. Can you guess what it is? To quote from the dealer's website:

"A beautiful intergrown sculptural network of individual hexagonal (?) crystals aesthetically displayed on a ? matrix. The ? crystals, measuring to 8 cm, span 180 degrees across the front of the specimen in a pinwheel fashion around the matrix. Each crystal is coated with yellowish brown iron staining but has a clear translucent glassy window pane center. In fine condition."

It is from the Tieshan Fe-Cu deposit, Hubei, China, if that is of any help to anyone. It certainly stumped me. Answer at the end of the newsletter. **PR**



Figure 1: Mystery Mineral 14.8 × 14.3 x 9.5 cm (© Hummingbird Minerals)

“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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Curiosity = Calcite