Website Newsletter of the Cape Town Gem & Mineral Club

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DECEMBER 2023

Vanadinite Crystals on White Barite (ex The Rosey Collection)

DIARY

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.***
JANUARY			***THERE IS NO OPEN DAY IN JANUARY***

Famous Mineral Producing Regions of the World, Part IV: Morocco

by

Peter Rosewarne

Introduction

In Part IV of this series on famous mineral producing regions, we will be looking at Morocco. Fine collector-grade specimens have been coming out of this country for over 50 years, with world-class *vanadinite*, *erythrite*, *skutterudite*, *azurite*, *anglesite* and *fluorite* to name a few mineral types and famous sources such as Touissit-Bou Beker, Mibladen and Bou Azzer. Not for nothing is it known as a Mecca for mineral collectors. The theme of The Munich Show 2012 was "African Secrets" and a theme book was produced including a detailed article on Morocco, which has been used to source much of the information herein.

There are 287 entries under Morocco in 50 Years of What's New in Minerals (Mineralogical Record, 2020), which illustrates its importance in the mineral specimen producing world. Jo Wicht has a sub-collection of colourful Moroccan minerals and they also feature(d) prominently in The Rosey Collection, as you will see under **Minerals**. In terms of international connoisseur collections, I could only find two images from the Sacco Collection (The Mineral

Record, 2014) but I'm sure there are many more in that "best of" reference collection of African minerals. I also found four examples in The Smale Collection, three of vanadinites and one erythrite (The Smale Collection, 2006 and 2021). We'll look briefly at geology first and then run through the main minerals in alphabetical order. Some of the main physiographic features and mineral producing areas are shown on the Google Earth image in **Figure 1**.

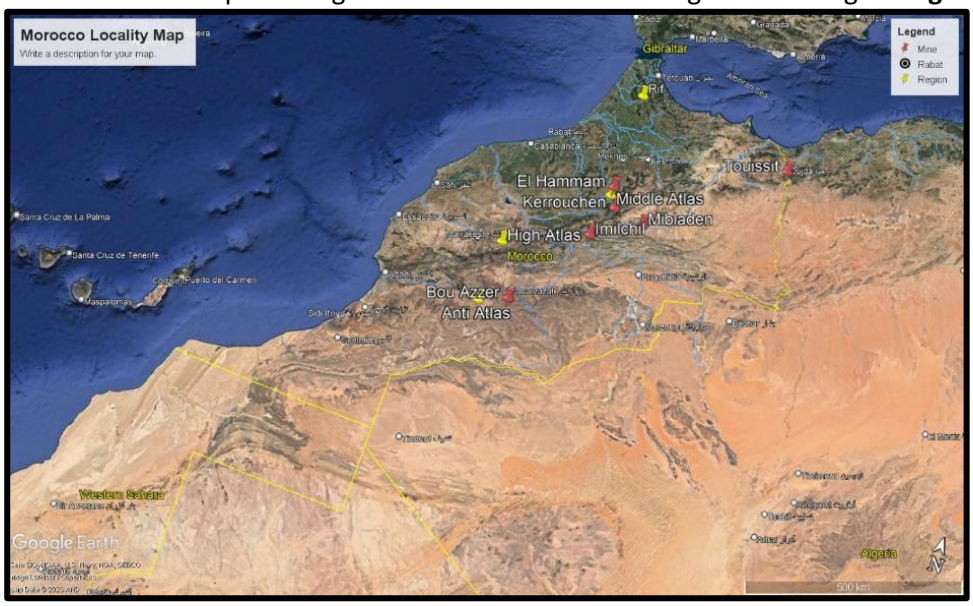


Figure 1: Google Image of Morocco Showing Main Physiography and Mineral Locations

Geology

The country can be divided into a number of distinct physiographic zones, including the High, Anti and Middle Atlas Mountains, whose formation is related to the Alpine orogeny, to the Sahara Desert to the west, east and south and the Rif mountainous area bordering on the Mediterranean Sea to the north. The highest point in the High Atlas is at 4 167 m above mean sea level. The Atlantic Ocean gets its name from the Atlas Mountains. Mineral paragenesis ranges from hydrothermal to secondary alteration and serpentinization and in age from Precambrian to Mesozoic times, the most important being:

- Precambrian serpentinization and subsequent volcanism and veining as at Bou Azzer, producing cobalt-bearing minerals such as skutterudite and erythrite, and native silver;
- Cavities in layered dolomites producing azurite and malachite at Kerrouchen;
- Hydrothermal vein emplacement related to igneous intrusions such as fluorite at El Hammam;
- Mississippi lead-zinc type replacement deposits and oxidation zones as at Touissit-Bou Beker with anglesite, smithsonite and cerussite; and
- Remobilisation of elements during formation of the High Atlas, e.g. vanadinite at Mibladen.

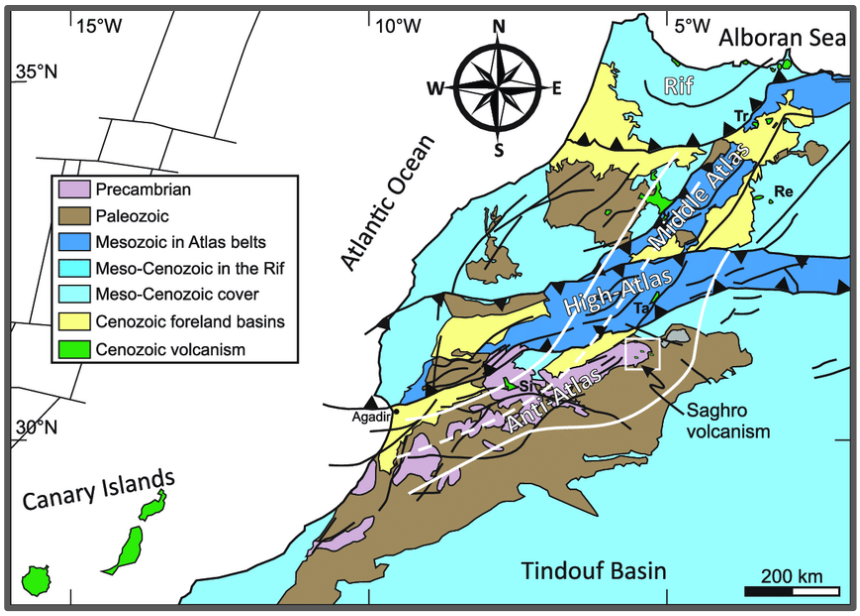


Figure 2: Simplified Geological Map of Morocco (by JP Liegeois)

The  symbols on **Figure 2** represent thrust faults, which are typical features of orogenic areas.

Minerals

Anglesite ($PbSO_4$)

Touissit-Bou Beker has produced thousands of mineral specimens over its almost 100 years of history. It produced the World's finest *anglesite* (see **Figure 4 further below**), first described from there in 1965 and then producing gemmy yellow crystals through the 70s, 80s and 90s. Unfortunately, the mines were closed and subsequently flooded in the early 2000s and the deeper levels were where the best minerals were found. A modest example of the characteristic yellow anglesite from this area is shown in **Figure 3**.

Figure 3: Anglesite on Galena (ex The Rosey Collection)

For sheer aesthetics, the crystal in **Figure 4** takes some beating – stunning! It featured on the front cover of The Mineralogical Record in 2013. And the example from The Sacco Collection in **Figure 5** (11 cm) isn't far behind, despite my poor copy photograph.

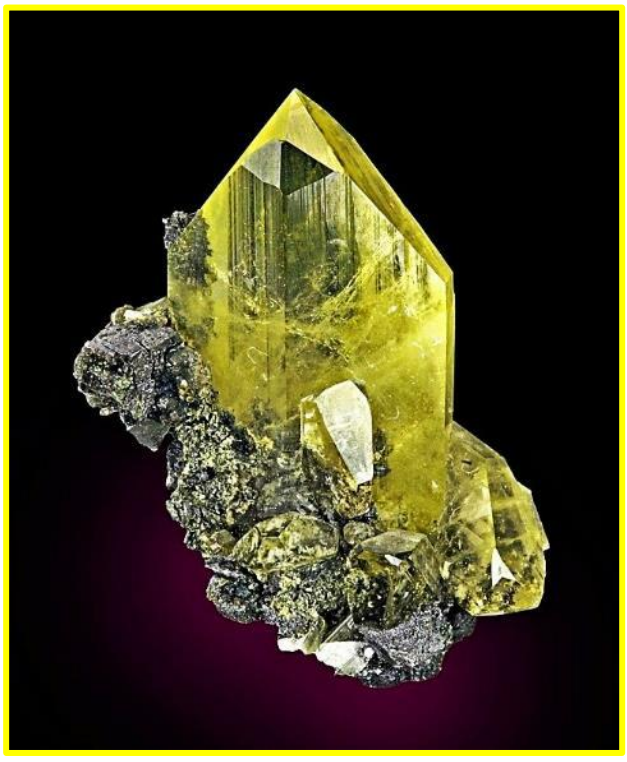
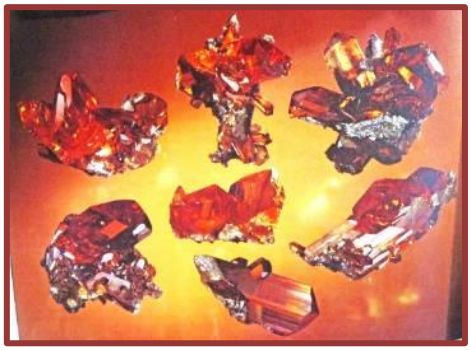


Figure 4: Anglesite Crystal, 4 cm (original photograph by O. Medenbach)
Figure 5: Anglesite, Touissit-Bou Beker: The Sacco Collection (original photograph Udo Kieslich/Jonty Peters)



The "best" anglesites were of an incredibly deep orange colour, as shown in **Figure 6**. Unfortunately, they turned out to be fakes with lead oxide coatings on the prism faces! I couldn't find any information on the source of the natural yellow colouring (if you have any information → letters to the Editor).

Figure 6: Fake Orange Anglesite Crystals (Tucson Show 1988)

Azurite $[Cu_3(CO_3)_2(OH)_2]$

Azurite and *malachite* are found in cavities in layered dolomites in a small outcrop at Kerrouchen. A composite 4.5 cm crystal of azurite is shown in **Figure 7**.

Figure 7: Azurite Crystal, Kerrouchen (ex The Rosey Collection)

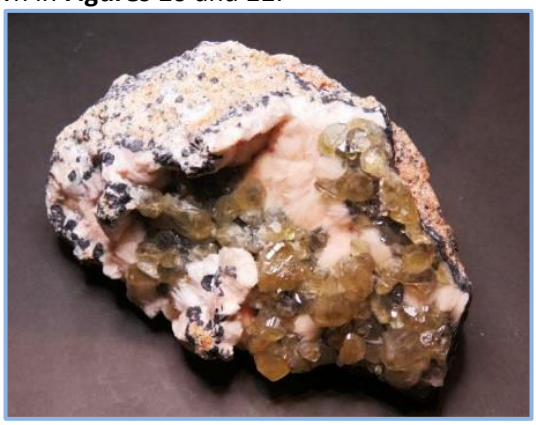
Barite ($BaSO_4$)

Beautiful pale blue bladed *barites* on contrasting limonite matrix were found at the Ouichane Mine, L'oriental Region in 2011 and two examples are shown in **Figures 8** and 9. The barites are hosted in Jurassic-Cretaceous age metasediments. Rob Smith has a flat or two of these superb barites.

Left. Figure 8: Blue Barite on Gossan (courtesy of Hummingbird Minerals)
Right. Figure 9: Blue Barite on Gossan (The Rosey Collection)

Cerussite ($PbCO_3$)

Cerussite was quite common at Mibladen and Touissit-Bou Beker, the former sometimes on pink bladed barite with flecks of *galena* and the latter as colourless to brown crystals, some as 'arrowhead' twins. Some modest examples are shown in **Figures 10** and **11**.



Left. Figure 10: Cerussite on Pink Barite, Mibladen (ex The Rosey Collection)
Right. Figure 11: Cerussite, Touissit (ex The Rosey Collection)

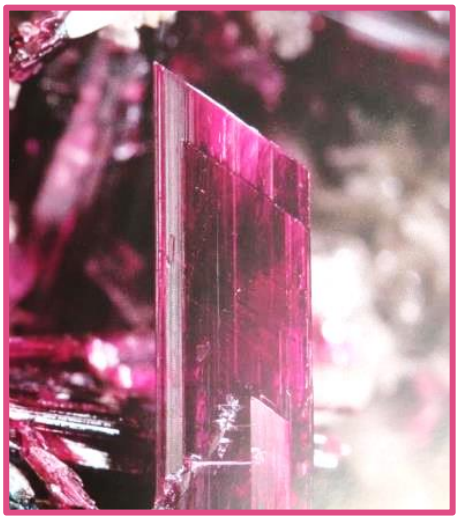
Cobaltian Calcite

Unsurprisingly, some of the *calcites* associated with cobalt (Co) mineralization at Bou Azzer are coloured lovely shades of pink by the incorporation of Co ions into the crystal lattice. An example is shown in **Figure 12**.

Figure 12: Cobaltian Calcite, Bou Azzer (ex The Rosey Collection)

Erythrite [$Co_3(AsO_4)_2.8H_2O$]

Erythrite is an oxidation product of Co ores such as *skutterudite* and forms attractive bladed and striated crystals whose colour is reminiscent of the "cranberry" *elbaite* from the Jonas Mine, Brazil. A group of crystals on massive *skutterudite* is shown in **Figure 13a** and detail of a single crystal in **Figure 13b**, showing typical striations.



Left. Figure 13a: Erythrite on Massive Skutterudite (ex The Rosey Collection)
Right. Figure 13b: Erythrite Crystal Detail

Fluorite (CaF_2)

El Hammam is famous for its *fluorite* specimens of many colours and the specimen in **Figure 15** is an attractive grouping of translucent yellow cubic crystals. The mine complex is shown in **Figure 14**.

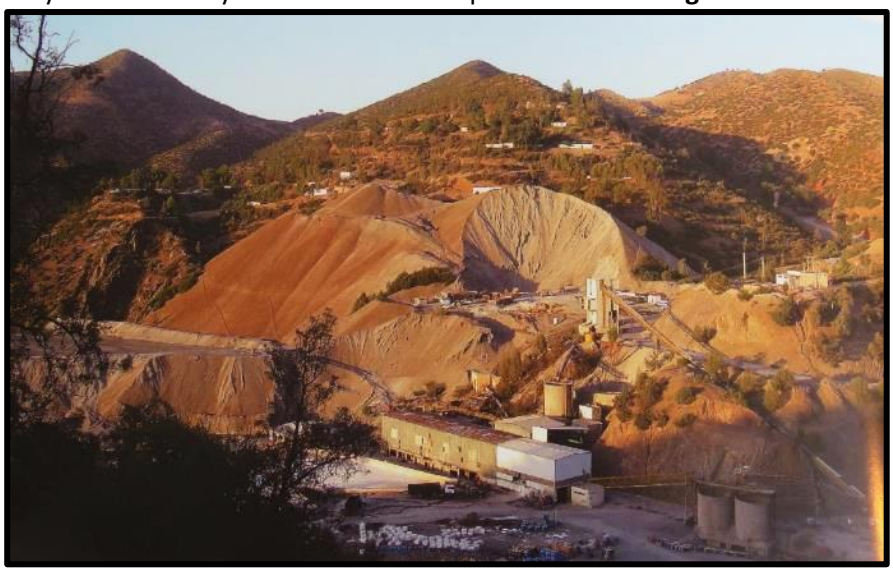


Figure 14: El Hammam Mine Complex (original photograph by C. Gineste)

Figure 15: Fluorite (The Rosey Collection)

Fluorapatite [$Ca_5(PO_4)_3F$]

Figure 16 is a specimen of pale greenish-yellow prismatic *fluorapatite* crystals on *feldspar* from Anemzi near Imilchil in the central part of the High Atlas. These crystals are found in pegmatites and are up to 7 cm in length. The largest crystal in **Figure 16** is 4 cm in length.

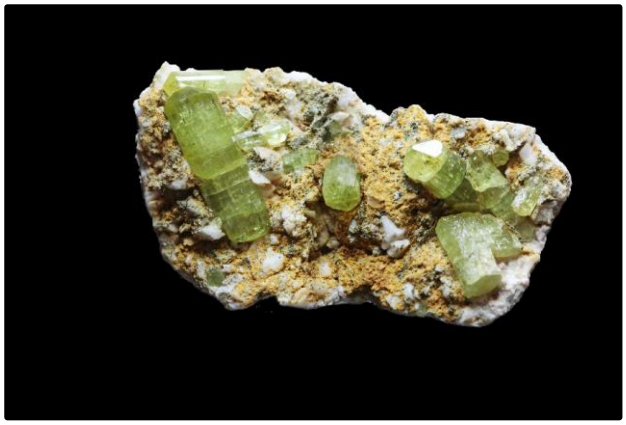


Figure 16: Fluorapatite on Feldspar (The Rosey Collection)

Pyromorphite [$Pb_5(PO_4)_3Cl$]
Pyromorphite isn't a mineral that I normally associate with Morocco but Jo put me onto an article in Rocks & Minerals about a relatively new discovery. This is from the Bou Iboulkhir Mine on the western margins of the Middle and High Atlas Mountains, exploiting a shallow hydrothermal vein. An example is shown in **Figure 17**.

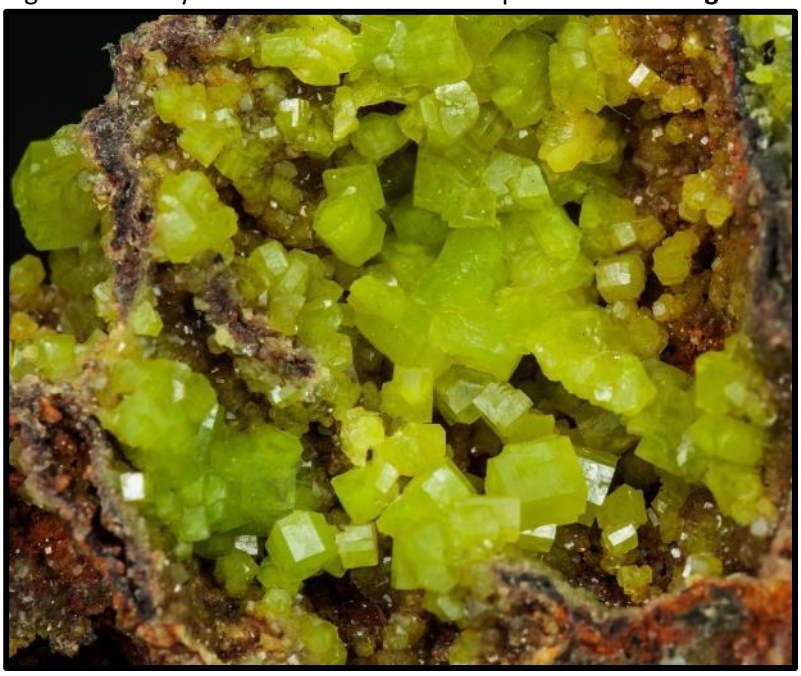


Figure 17: Pyromorphite, Bou Iboulkhir Mine (courtesy of Fabre Minerals)

Quartz (SiO_2)
Quartz is included here mainly as a curiosity as it forms perimorphs, *i.e*. a mineral crust after unknown pre-existing minerals. They occur in basalts within geodes in the Marrakech area.

Roselite [$Ca_2(Co, Mg)(AsO_4)2.H_2O$]
Roselite is a rare Co-arsenate and is found in Co-bearing hydrothermal veins. The fine example in **Figure 18** is from the Agoudal Mine, Bou Azzer.

Figure 18: Roselite, Agoudal Mine, Bou Azzer (courtesy of Hummingbird Minerals)

Siderite ($FeCO_3$)
One doesn't normally associate *siderite* with aesthetics but the blocky brown rhombohedrons with clear *quartz* crystals in **Figure 19** make for quite an attractive specimen?

Figure 19: Siderite on Quartz, Iouriren Mine, Western Anti Atlas (ex The Rosey Collection)

Silver (Ag)

The Bou Azzer mine complex, as it was in c.2012, is shown in **Figure 20** (reminds me of the shape of the Blue Mosque in Istanbul). **Figure 21** shows crystals of native *silver* on matrix from the Bouismas Mine, Bou Azzer. Native *silver* and *gold* specimens are not my favourites so nothing more to say here!

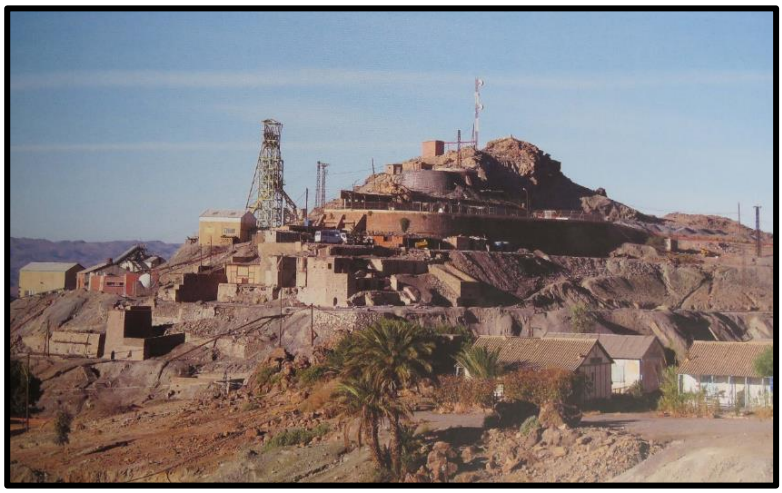


Figure 20: Bou Azzer Mine Complex c.2012 (original photo by J. Gajowniczek)

Figure 21: Native Silver Crystals, Bouismas Mine (courtesy of The Mineral Gallery and Auction)

Skutterudite [$(Co,Ni)As_3$]

This is the Co end-member of the *skutterudite* series and the world's best crystals have come from Bou Azzer. This is also one of the top 12 or so diverse mineral localities in the World, with over 220 species recognized. A modest crystal cluster grading into massive form is shown in **Figure 22**.

Figure 22: Skutterudite, Bou Azzer (ex The Rosey Collection)

Smithsonite ($ZnCO_3$)

Not a mineral I normally associate with Morocco but I found the aesthetics of the *smithsonite* specimen in **Figure 23** irresistible. This specimen is from Touissit-Bou Beker and has a lovely sparkling lustre caused by multiple crystal faces forming the botryoidal mounds.

Figure 23: Smithsonite (The Rosey Collection)

Vanadinite [$Pb_5(VO_4)_3Cl$]

Morocco is probably most famous, mineral-wise, for *vanadinite* and by association, the town of Mibladen. It comes in a multitude of habits and associations, the most classic of the latter being tabular hexagonal crystals on white barite or glistening, black *mottramite*. **Figure 24** shows crystals *in-situ* in a pocket waiting to be removed. It comes in bright red, dark red, brown and orange colours, as shown in **Figures 25** to **32**, plus the tan-coloured arsenian variety *endlichite* in **Figure 33**.

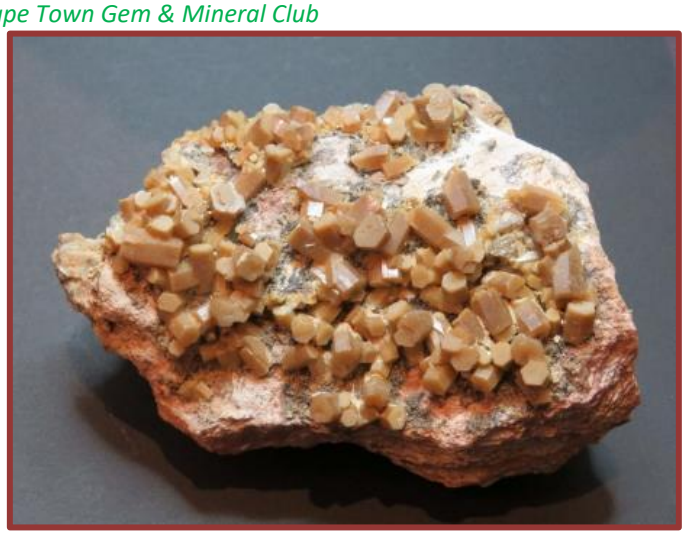
Left. Figure 24: In-situ Crystals at the ACF Mine (original photographer uncertain, possibly J. Gajowniczek)
Right. Figure 25: Orange Vanadinite Crystals on Siderite (ex The Rosey Collection)

Left. Figure 26: Blood-red Vanadinite Crystals on Matrix, 14 cm (The Rosey Collection)
Right. Figure 27: Vanadinite Crystals on White Barite (ex The Rosey Collection)

Left. Figure 28: Vanadinite Crystals on Black Mottramite, Coud'a Workings (ex The Rosey Collection)
Right. Figure 29: Vanadinite Crystals on White Barite (ex The Rosey Collection)

Left. Figure 30: Dark Reddish-brown Vanadinite Crystal Cluster (The Rosey Collection)
Right. Figure 31: Orange Vanadinite Crystal Cluster (ex The Rosey Collection)

Figure 32 below shows blocky brown crystals to 2 cm from the ACF Mine, Mibladen.



Left. Figure 32: Vanadinite, 9 cm, ACF Mine, Mibladen (The Rosey Collection)
Right. Figure 33: Arsenian Vanadinite Crystals var. Endlichite (ex The Rosey Collection)

And finally, an example (8 cm) from The Sacco Collection from the Mibladen area in **Figure 34**.

Figure 34: Vanadinite, Mibladen Area: The Sacco Collection (original photograph by Udo Kieslich/Jonty Peters)

Wulfenite ($PbMoO_4$)
Wulfenite was quite common at Touissit and was found in *dolomite*-lined karst cavities. A typical example in terms of crystal habit and colour is shown in **Figure 35**.

Figure 35: Wulfenite, Touissit (The Rosey Collection)

Concluding Remarks

There you have it, Morocco, truly a Mecca for the mineral specimen enthusiast; aesthetics, colour, rarity, variety - another blockbuster mineral specimen producing area for your edification. That's four hard acts to follow. I wonder where we'll be headed to next…Thanks to Jo Wicht for bringing some key references on Moroccan minerals to my attention.

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From the Cabinet of Curiosities

This month's Curiosity is Meteorites, specifically the latest two to be discovered in South Africa. Did you know that there were only 49 known meteorite occurrences in South Africa up until 2021 when the latest two were discovered? These were found by farmer Gideon Lombard on his farm in the Northern Cape and are shown in **Figure 1**. They were verified as meteorites by the Meteoritical Society's Nomenclature Committee and named Brierskop and Wolfkop after landmarks near their discovery sites. But here's the curious part – despite being found only a kilometre apart, they have been proven to be parts of two separate meteorites although both are chondrites with well developed fusion crusts. They are the first new meteorite discoveries in South Africa in 40 years. This brings the total of meteorites discovered in South Africa to 51, the highest number in sub-Saharan Africa, but pales into insignificance compared to the 14 000 so far discovered in the Sahara Desert. **PR**

Figure 1: The Brierskop (L) and Wolfkop (R) Meteorites (photograph by L Vonopartis)

"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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