MINERALS

Issue #8 The Collector's Newspaper 2014

Pala Int'l specimen. J. Scovil photo.

In this issue also:

Mineral photography: Mark Mauthner

Mark started photography as a youngster, with a small Brownie camera that produced 2 x 2 slides. At 13 years of age, he bought his first 35 mm camera to take on his first overseas trip to Spain and Morocco. He became more serious with the hobby in his early 20s and acquired his first SLR camera, a Minolta. At this time, he also began documenting his mineral collection, including photomicrography, combining his camera with his microscope. A few years later ...

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Collectors interview: Alex Schauss

This time in our *Collector Interview* series we have the pleasure of talking to Alex Schauss, vice-president of Friends of Mineralogy, and one of the world's leading collectors of competition-quality thumbnails. Alex shares with us some of his family history, and talks about his career researching nutrition and botanical medicine, and how these disciplines relate to ...

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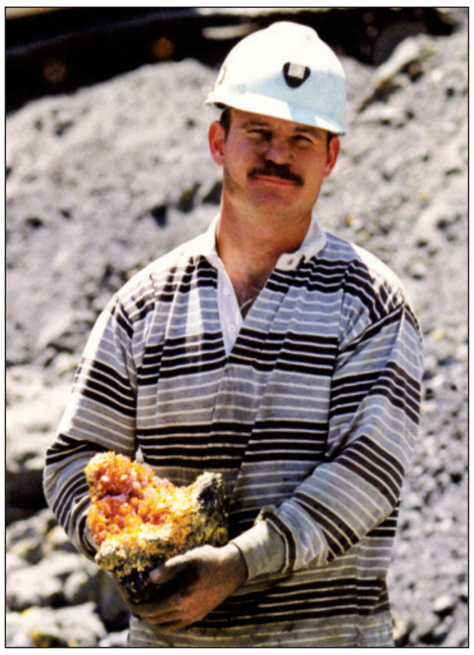
A. Schauss specimen. J. Scovil photo.

Orpiments from Twin Creeks mine, USA

Scott KLEINE, Bryan K. LEES & Malcolm SOUTHWOOD



Graham Sutton of Collector's Edge with freshly mined high quality orpiment specimen. Collector's Edge photo.

INTRODUCTION

Orpiment is not a particularly rare mineral. It occurs in many places in low temperature hydrothermal veins and in hot spring deposits but is rarely of specimen quality. However, when it occurs as well-formed lustrous crystals it is highly prized by collectors on account of its striking, honey-yellow to orange-brown coloration. Unfortunately, such specimens are difficult to extract without damage because orpiment is soft, and the crystals have perfect cleavage.

The discovery of well-crystallised orpiment at the Twin Creeks mine in Northern Nevada, USA, and it's subsequent extraction as fine mineral specimens provides an almost unique example of co-operation between two corporations; one of them the mining company that owns and operates the mine, and the other a company that specializes in the recovery of specimen-quality minerals. Between 1999 and 2001 more than 4000 specimens were recovered by a dedicated team of professionals, through the patient and painstaking extraction of material using advanced mechanical equipment. Whole orpiment-rich bodies were completely worked out

Spectacular orpiment specimen from Cut 62 in Twin Creeks mine, Nevada, USA; 9.6 cm high. Azurite Corporation specimen. J. Scovil photo.

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Marshallsussmanite new mineral species

Marcus J. ORIGLIERI

The vast majority of new mineral species occur as microscopic grains or crystals. These are of little interest to collectors of aesthetic minerals, and are sought-after only by locality specialists or the most die-hard of systematic enthusiasts. The discovery of new minerals is exciting on the one hand, but somewhat routine on the other. In 2013, the International Mineralogical Association (IMA) received over 100 new species proposals.

The recently approved mineral, **marshallsussmanite** (IMA2013-067), $NaCaMnSi_3O_8(OH)$ is a notable exception to this tendency because it occurs in relatively large crystals clearly visible to the naked eye, and with attractive form and color. This new mineral, judging from excitement seen during the 2014 Tucson shows, has made an immediate impact within the collecting community. This is the story of its discovery.

Marshall Sussman with a specimen of the new mineral marshallsussmanite, in Tucson, 2014.

Marshallsussmanite crystals, up to 7 mm, with minor hydroxyapophyllite, from the 2011 find at the Wessels mine, Kalahari Manganese Field, South Africa.

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The saga began in the summer of 2011, when well-known Tucson-based collector and sometime dealer, Marshall Sussman, purchased three flats of specimens in South Africa. The specimens featured an unknown mineral in the form of pink, bladed crystals on matrix. On closer examination, there were two different habits. Some specimens presented thin, pale-pink, bladed crystals with whitish terminations to 1 cm, grouped in sheaves, associated with black prismatic aegirine and hydroxyapophyllite-(K). Others showed thicker, blade-shaped crystals to 2.1 cm, with a richer, peachy-pink color, and associated with later calcite. The specimen sizes varied from thumbnail (3 cm) to large cabinet (15 cm).

Marshallsussmanite with hydroxyapophyllite, specimen 5.7 cm wide. J. Veevaert photo.

Marshallsussmanite with calcite, 5 cm wide. B. Cairncross specimen and photo.

Holotype specimen of marshallsussmanite (i.e. the specimen on which the formal mineral description was based), 9.5 wide. M. Origlieri photo.

Marshall was told that the specimens came from two different pockets found in two different mines in South Africa's famous Kalahari Manganese Field. The deeper pink ones were attributed to the Wessels mine, while the lighter pink specimens were said to come from the N'Chwaning II mine.

Wessels and N'Chwaning II are separate underground mines operated by different companies, but they exploit the same ore body, and they share a common boundary. While it is possible that the two separate mining operations struck such similar material, at more-or-less the same time, on their common boundary, it is unlikely. It is even less likely that both mines could have simultaneously intersected two spatially unrelated pockets which yielded such unique, novel, yet similar material. Bruce Cairncross, co-author of two comprehensive books on the minerals of the Kalahari Manganese Field, believes that all of the material originates from the Wessels mine.

A preliminary analysis in South Africa gave an X-ray diffraction (XRD) pattern that closely matched ferrobustamite, a rare pyroxenoid mineral. Marshall purchased the specimens, assuming that they were the manganese mineral bustamite, for which they represented excellent specimens.

Headframe of the Wessel mine, type locality of marshallsussmanite. B. Cairncross photo

Sign at the entrance to the Wessel mine. B. Cairncross photo

The author had the pleasure of seeing all of Marshall's specimens shortly before the Denver show in September 2011. It was a great lot, but regrettably he lacked sufficient funds to purchase all of them outright; he therefore travelled to Denver somewhat anxiously to follow further developments. Fortunately, Dan and Diana Weinrich purchased the best three specimens from the lot, allowing a significant discount for the remainder, which the author promptly acquired. During Denver 2011, the author sold three specimens to lucky collectors and kept two specimens for himself, before John Veevaert acquired the remaining 60 pieces. (Please note that John has since dispersed all of these specimens). During that same 2011 Denver show, Paul Pohwat obtained one of the best pieces from Dan Weinrich for the Smithsonian collection.

Marshallsussmanite with calcite, specimen 8.5 cm high. G. and J. Spann collection. J. Veevaert photo.

One of the best marshallsussmanite specimens, 4.3 cm high. S. Rudoplh collection. J. Scovil photo.

The intrigue started when the author returned to the University of Arizona after the Denver show. Raman spectroscopy of the material gave a spectrum similar to pectolite and sérandite, and less similar to bustamite. Moreover, single crystal X-ray diffraction (XRD) study found a unit cell intermediate to those of pectolite and sérandite, and distinct from bustamite (and ferrobustamite).

Independently, scientists at the Smithsonian performed XRD study and

Crystal of marshallsussmanite with calcite, crystal 1.4 cm high. Marin Mineral specimen. M. Origlieri photo.

Marshallsussmanite with minor hydroxyapophyllite, specimen 6.8 cm wide. B. Cairncross specimen and photo.

Probably the best specimen from the marshallsussmanite find, 9.1 cm high. D. and D. Weinrich specimen. J. Scovil photo.

Marshallsussmanite with black aegirine and hydroxyapophyllite, specimen 4.6 wide. J. Veevaert photo.

semi-quantitative chemical analyses on the specimen obtained from Dan Weinrich. The chemical analysis showed roughly equal amounts of sodium, calcium, and manganese, and they concluded that the material was not bustamite, but manganese-rich pectolite. Based on this conclusion, they returned the specimen to Dan Weinrich. (Paul Pohwat tells the whole story of "the one that got away" in the May/June 2014 issue of *Rocks & Minerals*).

Marshallsussmanite with black aegirine and hydroxyapophyllite, specimen 5 wide. J. Veevaert photo.

Meanwhile the author studied the historical literature, which revealed that sodium, calcium, and manganese atoms occupy three separate sites within the crystal structures of pectolite and sérandite. This model suggested that the pink crystals could be a new mineral with a composition intermediate between pectolite and sérandite. Such a new mineral definition relies on the specific rules of nomenclature in current effect for pyroxenes, amphiboles, tourmalines, etc. This revelation was exciting and important, so the author contacted specimen owners and sellers, and informed them that they likely had a new mineral. John Veevaert immediately withdrew his specimens from the market; Dan and Diana Weinrich still hold a choice specimen (considered by some to be the best of species).

Marshallsussmanite with hydroxyapophyllite, 3.4 cm high. M. Sussman collection. J. Scovil photo.

The first publications mentioning this new mineral appeared in 2013, as an unnamed species pending IMA approval, in the recent book *"The Kalahari Manganese Adventure – The Adventure Continues"*, by Bruce Cairncross and Nick Beukes, and also in *MINERALS* newspaper (see interview with Bruce Cairncross in issue #7). These sources showed specimens from Bruce's collection, very similar to the type material, but not from the batch of specimens originally obtained by Marshall. It is possible, therefore, that a few additional specimens exist elsewhere in South Africa (or further afield).

Finally, in November 2013, the new mineral received approval from the IMA, and it was named **marshallsussmanite** after Marshall Sussman. Marshall Sussman has specialized in the minerals of southern Africa for many years and, of course, was responsible for bringing this new species to the market. Ironically, because of the original misidentification, Marshall had kept none of the specimens for himself, although almost all of them had passed through his hands. When the new mineral name was proposed in his honor, he tried to obtain a specimen for his own collection. Finally, at the Tucson show in February 2014, he bought back – third hand – one of the specimens that he had originally sold in 2011, probably for a price considerably higher than he had received for the entire batch less than three years earlier!

Marshallsussmanite with black aegirine, specimen 7.8 wide. Private collection. A. Leszczuk photo.

Marshallsussmanite with black aegirine, specimen 5 cm wide. J. Veevaert photo.

The author would like to express his thanks to Bruce Cairncross for his help in researching the origin of these specimens, and to Marshall Sussman for bringing this gorgeous material to his attention.

Marcus J. ORIGLIERI
Tucson, Arizona, USA
www.mineralzone.com
e-mail: moriglie@email.arizona.edu

Orpiments from Twin Creeks mine, Nevada, USA

Scott KLEINE, Bryan K. LEES & Malcolm SOUTHWOOD

Commemorative medal showing excavator used in Twin Creeks mine.

Map of North America with insert showing satellite photo of the Twin Creeks mine.

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and an enormous volume of specimen material was saved from the crushers, including some of the world's finest examples of orpiment. Arguably, the Twin Creeks discovery was, and remains, the most important find for this attractive mineral species.


View of the Mega Pit of Twin Creeks mine showing location of 1999 Cut 62 orpiment find (arrow). Collector's Edge photo.

LOCATION AND MINING HISTORY

The Twin Creeks gold mine is located roughly 72 km northeast of Winnemucca, and 16 km northeast of the Getchell gold mine, in the Potosi Mining District, Humboldt County, Nevada, USA.


Massive blasting in Twin Creeks mine. Collector's Edge photo.

Gold was discovered in the Twin Creeks area in 1984 by Goldfields Mining Company geologist Paul Tietz, and the deposit was originally named Chimney Creek. This was followed by an additional discovery, in 1987, in the same area by the Santa Fe Pacific Gold Corporation, who named their deposit Rabbit Creek. Even at this early stage orpiment veins, and even some free-growing crystals, were noted in some diamond drill cores!


View of Cut 62 during orpiment collecting operation, note heavy equipment. Collector's Edge photo.

Initially these discoveries were developed as separate mining operations, but in 1993 the two companies merged and consolidated the properties to form the Twin Creeks mine. In 1997 Newmont Mining Corporation acquired Santa Fe Pacific. Newmont was the owner of the Twin Creeks mine at the time of the major orpiment discoveries and specimen recovery operations, and remains the owner today.

In the late 1990s when the orpiment discoveries occurred, Twin Creeks mine was the third largest gold producer in North America and it comprised two open pits: the Vista pit, exploiting oxide ores, and the Mega pit, working sulfide ore. At that time over 700 people were working there on a 24-hour, 7-day-per-week schedule. The Mega pit, at that time, was about 1 km long with average daily ore production in excess of 40,000 tons. Yearly gold production was about 28,000 kg produced from over 15,000,000 tons of ore!

Recent production has declined somewhat, but is still in the order of 12,000 kg per year! Historic gold production and known future reserve at Twin Creeks total more than 600 tons of contained gold – enough to form a solid cube that is more than 3 meters on an edge!


Workings in orpiment rich zone in 1999. Collector's Edge photo.

GENERAL GEOLOGY

The Twin Creeks area is underlain by sedimentary rocks of Palaeozoic age that host auriferous mineralization characteristic of Carlin-type deposits. These are sediment-hosted, disseminated gold deposits, characterized by invisible (typically microscopic and/or dissolved) gold in pyrite and arsenopyrite. This type of deposit is named after the Carlin mine, which was first large deposit of this type discovered in the Carlin Trend near Carlin in Eureka County, Nevada.


ELKO DAILY FREE PRESS Weekender

Today

Woodbury decides against death penalty

Water board wants lawyer for protests

Sports

Business

Mystery

Twin Creeks hosts crystals so rare they're being mined

Local newspaper from July 1999 featuring orpiment discovery in Twin Creeks mine.

The Carlin type deposits show enrichment in the elements gold, antimony, arsenic, mercury, thallium, and barium, created by circulation of hydrothermal fluids with a temperature of up to 300°C. The underlying rocks out of which these elements are dissolved are normally silty carbonates, although silicates and other sediments are also possible source rocks.

The Twin Creeks mine lies at the intersection of the renowned Getchell trend and the lesser-known Valmy trend, along which lie a number of other Carlin-

Orpiment collecting operation using heavy equipment. Collector's Edge photo.

Collecting operation using heavy equipment, note yellow opriment rich zones in the upper photo. Collector's Edge photo.

type gold deposits. At Twin Creeks the orpiment bodies occur in rocks of the Comus Formation, a thick sequence of carbonates, siltstones, basaltic rocks and tuffs of Ordovician age which contain most of the sulfide gold reserves at

Collecting orpiment specimens in the pocket-rich zone. Collector's Edge photo.

Twin Creeks which are mined in the Mega pit.

The Robert's Mountain Thrust brings another Ordovician formation – the Valmey Formation – over the Comus Formation. The Valmey Formation is unconformably overlain by the Etchart Formation (limestones, siltstones and sandstones of Permian age) which host the mine's oxide gold reserves, but no orpiment. Oxide gold ores are mined in the Vista pit. Unmineralized mudstones, siltstones, and sandstones of Mississippian-Permian age – the Havallah Formation – have in turn been thrust over the Etchart Formation, and the entire Palaeozoic sequence has been cut by sills and dikes of Cretaceous granodiorite which, again, is not mineralized. "Tertiary" volcanics and "Tertiary"/Quaternary alluvium overlie the Palaeozoic rocks.

The gold (and orpiment) mineralization is much younger than the host rocks and is structurally controlled, occurring in a complex north-trending

Orpiment rich zone in Cut 62. Collector's Edge photo.

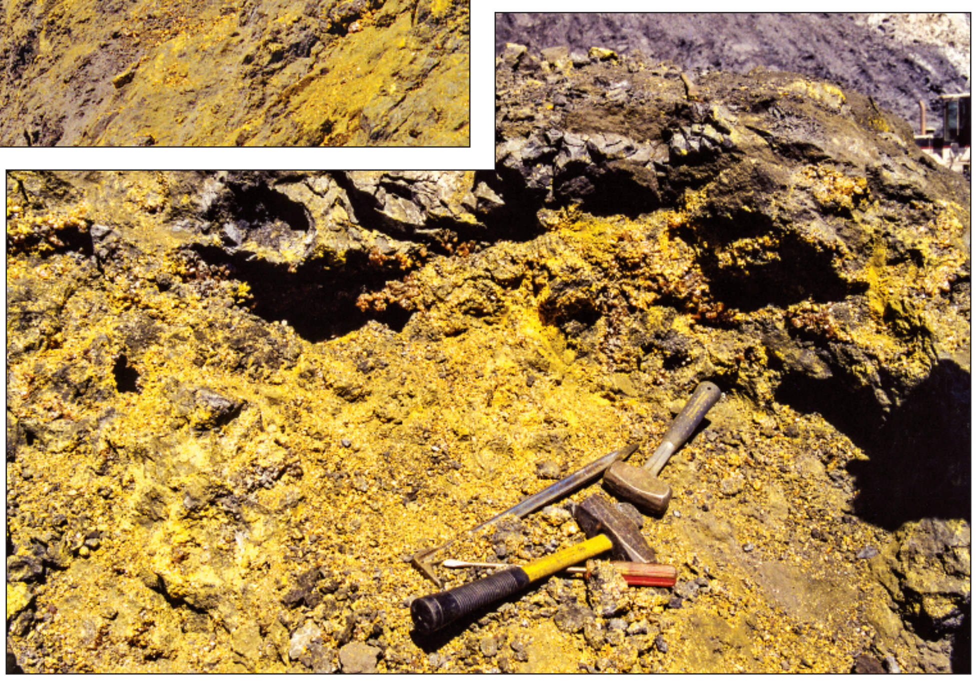
fold called the Conelea anticline, which developed during the Antler Orogeny. The mineralization post-dates the anticline and occurs within the overturned nose of the fold, which has in turn been broken up by a series of north-east trending faults. The best-crystallised orpiment is found in the upper hinge area of this fold structure, where maximum stress resulted in open areas that provided conduits for mineralizing fluids and cavities conducive to crystal formation. These areas also contain some of the highest gold grades in the deposit. The mineralization event has been dated by argon isotope analysis at 41.9 Ma.

Working on an orpiment rich boulder using a drill hammer. CE photo.

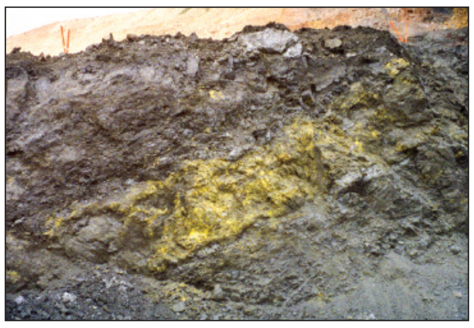
Low grade orpiment is abundant throughout the northern portion of the Twin Creeks Mega pit, and mapping the orpiment mineralization has been useful for mine geologists because of the strong correlation with high gold grades. Well-formed crystals were discovered in the open spaces in the nose of the anticline, in rocks that are heavily decalcified, argillized and silicified. The decalcification and silicification processes enlarged and strengthened the cavities initiated by folding and provided ideal conditions for orpiment crystallization. In some cases fluids, possibly of meteoric origin, have remobilized and deposited a fine, light-coloured coating on the surfaces of some of the orpiment crystals. Analysis has shown that this coating typically comprises around 40% silica, and that it is rich in aluminium (c.7%) and iron (c.4%).

ORPIMENT DISCOVERIES AND PROJECT DEVELOPMENT

Specimen quality orpiment was first encountered by mine geologists in late



Collecting orpiment specimens in the pocket-rich zone. Collector's Edge photo.



Easily visible yellow orpiment rich zone. Collector's Edge photo.

1998, on the 4220 bench of Cut 62, which coincided with the deepening of the northern portion of the pit over the Conelea anticline. The quality of the crystals was better than anything that had been encountered previously, and this encouraged mine geologist Leroy Schutz to contact Collector's Edge. It was agreed that the mine geologists would continue to monitor the orpiment rich zones for signs of better specimens. Early in 1999, mining in Cut 62 continued down through increasingly better orpiment zones, until in March incredible orange-

Working in orpiment rich zone using a drill hammer. Collector's Edge photo.

colored orpiment was discovered by Newmont geologist Pat Donovan.

At this point Newmont's regional geologist, Ron Thoreson, contacted Collector's Edge to propose an on-site evaluation. Ken Roberts, working for Collector's Edge at the time, travelled to

Pocket with orpiment crystals in situ. Collector's Edge photo.

the mine, intending to spend a day inspecting the find, but ended up staying an entire week collecting the newly discovered pocket on the 4220 bench of Cut 62. Sadly, many of the specimens were blast-damaged and few really fine pieces were discovered. Nevertheless, the potential was clear; this orpiment discovery was world-class.

By April 1999, news of the discovery had spread and there was growing excitement in the mineral community, and finding a way of preserving as much of the specimen quality material as possible became the first priority. Collector's Edge presented a proposal to Newmont, suggesting how the two companies might work together in a manner that allowed maximum recovery of specimens with minimal disruption to commercial mining operations. Newmont responded with an excellent plan to identify orpiment zones and to protect them from damage during blasting operations. A project model was developed, incorporating suggested collecting schedules, techniques and requirements that would allow commercial mining to continue in tandem with specimen recovery; understandably, it was unthinkable that the mine's overall production schedule could be curtailed to facilitate the collecting operation. A collecting contract was completed in May, and Collector's Edge relocated one of its collecting crews from the Sweet Home mine in Colorado to Twin Creeks, supervised by Graham Sutton. Meanwhile, Newmont staff, led by Production General Foreman Randy Ford, and Drill and Blast General Foreman Lyle Avey, worked out ways to continue gold mining around the collecting areas without loss of production.


Graham Sutton of Collector's Edge extracting orpiment pocket in Cut 62. Collector's Edge photo.

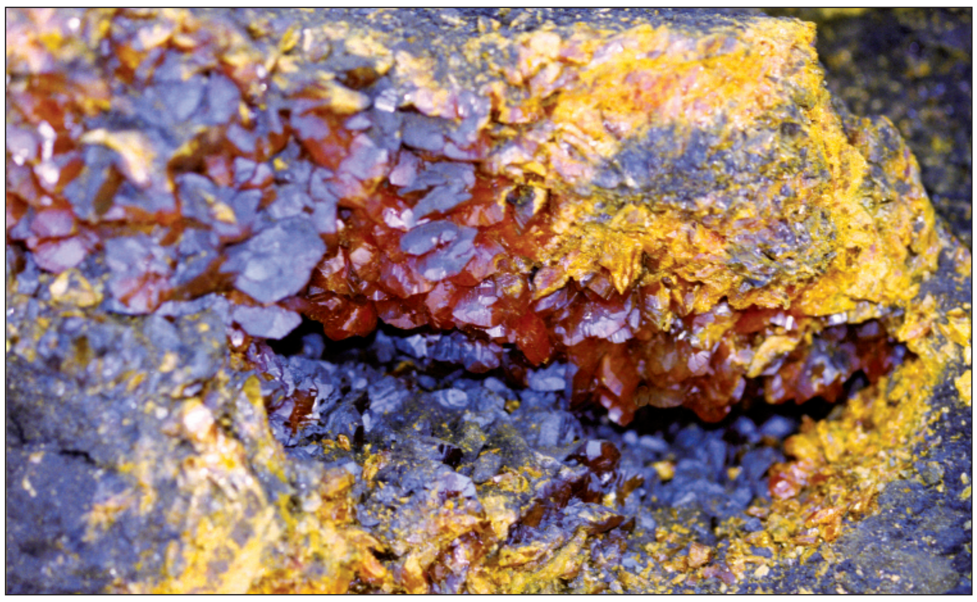

Another pocket almost extracted. Collector's Edge photo.

Fortunately, the sheer size of the Mega pit operation allows for considerable production flexibility. Typically three of four areas are being mined at any one time, while orpiment recovery was from a single mining area. Mine planners were therefore able to adjust production strategies in parts of the pit remote from the orpiment recovery project to ensure that overall gold production was maintained.


Graham photographing freshly opened pocket in situ, Cut 62. *CE photo.*

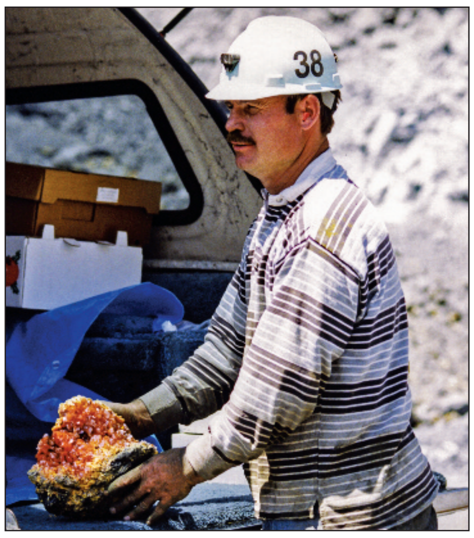
By late May 1999, the Collector's Edge crew was busy collecting orpiment on the 4200 Bench of Cut 62 and, over the ensuing five months, the zone was worked to a depth of 30 m and thousands of specimens were recovered. Collecting crews rotated in and out of the project on a monthly basis, with each crew comprising three to four persons "borrowed" from the Sweet Home operation. Graham Sutton remained as the crew leader, with Scott Betz and Jon Price rotating as his assistants. Each crew member was required to have mine safety and health administration certification in order to be allowed site access, and additional on-site training was provided by Newmont in order to ensure that all specimen recovery activities were fully compliant with modern mining codes.

Between March and September a total of six collecting campaigns took place, each lasting between one and two weeks. During the first trips the two companies – Newmont and Collector's Edge – devised operating strategies to recover orpiment while minimizing the disruption to gold mining. The plan began with logging and mapping the orpiment zones during the drilling stage of the blasting schedule; while drilling each blast hole, care was taken to log the areas in which orpiment was observed in the drill cuttings. Next, all of the holes, except for those that showed orpiment, were shot so that, after the blasted material was removed, a long column of orpiment-bearing material was left standing in the pit floor. Typically such a column would measure some 30 to 60 m in length, perhaps 8 m wide and maybe 6m high. This block of material would be entirely removed by the collecting crew, with work slowing right down once pocket zones were encountered. Pockets were broken open with air chisels and hand tools, and several excellent specimens were removed with a diamond chain saw. When the block was completely removed, the drilling cycle would begin again to drop the floor by another 6 m or so.


Close-up of the orpiment pocket in situ *shown above. G. Sutton photo.*


Freshly mined high quality opriment specimen. Collector's Edge photo.

As the pit was deepened, further orpiment discoveries were made. Beginning with the 4220 bench (which cut the top of the fold structure), the pit was deepened through the 4120 bench so that a 100 feet (c. 30m) thick zone of orpiment-rich ground was removed in 20 foot (c.6m) intervals. Below the 4120 bench, the fold structure pinched out and no further specimen quality pockets were found in Cut 62. All in all, the Cut 62 orpiment zone comprised a block of ground some 30 m thick, 7 m wide, and 90 m long, constituting a rock volume of some 19,000 cubic meters.


Graham with freshly mined high quality opriment specimen, see close-up at left. Collector's Edge photo.

A second orpiment zone was encountered in Cut 20 of the North Mega pit during the fall of 2000, and a Collector's edge team made over a dozen visits to the mine, successfully collecting further high quality specimens during that time. A year later, in the fall of 2001, a final orpiment zone was intersected, again in Cut 20, comprising a rich block roughly 3 by 4 by 4 m that, fortunately, had been well protected from blasting. All together some 1000 specimens were recovered from the Cut 20 discoveries and these display somewhat different color and morphologies from the Cut 62 material as noted below. Of particular note in Cut 20 was a 30 by 30 by 100 cm geode-like pocket of deep orange-red orpiment rosettes that, despite being collected in conditions of driving snow and rain, and weighing some 80 kg, was miraculously preserved intact.

Selecting and packing specimens. Collector's Edge photo.

Orpiment on matrix; 10 cm high. J. and Ch. Webb collection. J. Budd photo.

SPECIMEN COLLECTING

Once or twice a day, all mining and collecting activity in the Mega pit ceased, as workers were evacuated ahead of blasting. The scale of the blasting operation was impressive, with each blast breaking over 350,000 tons of rock and consuming some 60 tons of explosive. After the blast, roughly 85% of the broken rock was trucked to the waste dumps, while the remaining 15%, or roughly 45,000 tons, went to the processing plant for gold recovery.

Work also resumed in the specimen collecting zones after the blast, with collectors completing a ten hour day, before driving for one hour back to Winnemucca for a shower, dinner, and sleep. Time was of the essence because the Newmont staff went to enormous lengths to work around the collecting effort and therefore the Collector's Edge team did everything to expedite specimen extraction so that normal gold mining activities could resume as quickly as possible. By October 1999, 4000 individual specimens had been recovered. Amazingly, just two of the collecting campaigns accounted for some 2000 specimens.

Happy miners resting after after a heavy day. Collector's Edge photo.

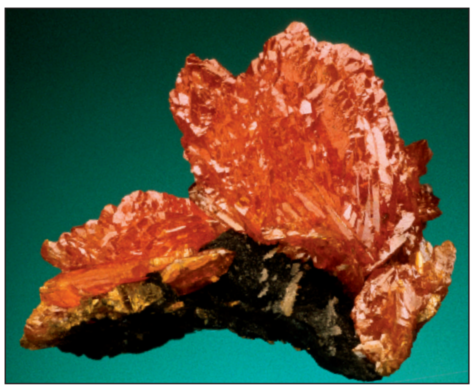
Bryan Lees examining specimens in Collector's Edge lab. Collector's Edge photo.

The ideal collecting scenario is one in which specimen material can be removed from large, open cavities, unencumbered by pocket bridging. Large pockets are far more likely to yield plates of crystals with minimal contact damage. Cut 62 contained a few large cavities that met these ideals, allowing the recovery of some large, clean and quite outstanding specimens but, unfortunately, most of the largest plates showed some minor damage.

Perhaps the most critical factor determining the condition of specimens was the orientation of pockets relative to the closest blast hole. Newmont's mining engineers made every effort to blast around potential pocket zones, yet some shots still telegraphed into nearby open spaces, and it was the larger open pockets that suffered the most damage. Quite often, large pockets (more than one meter long) were partly collapsed due to blast damage, and it was rare to pull a completely undamaged, uncontacted orpiment specimen from anywhere in the Mega pit.

Generally, the orpiment pockets were quite small, averaging 25-30 cm across, and just 2-8 cm wide. Occasionally a pocket of more than a meter across, and perhaps 15 cm wide was encountered.

Good pocket zones typically comprised many pockets clustered together and, generally speaking, the more isolated pockets, up to 30 m away from the main pocket zones, did not contain significant numbers of specimens. Even the better pockets generally produced less than ten specimens each, and many yielded only one. This was common because of the narrow pocket dimensions which increased the tendency for contact damage through "pocket bridging" due to stalactite-like growths from one wall of the pocket to the other. Damage also occurred as specimen plates were pulled apart during the collecting process, and as interlocking crystals broke away from around the pocket margins.



Well formed orpiment crystals on matrix from Cut 20 North zone; 5.2 cm wide. F. Benjamin specimen. J. Scovil photo.

Specimens ready to be trimmed and cleaned in Collector's Edge lab. Collector's Edge photo.

Collecting conditions were often quite challenging. Weather conditions ranged from snow blizzards in March, to sunny days above 40 degrees Celsius in August, when sunburn and heat exhaustion were constant threats. The other notable difficulty was the omnipresent black, sooty pyrite dust which coated everything and everyone as specimens were being extracted. The build-up of mud on vehicles was also problematic and, on one occasion, the weight of wet mud on the bottom of the collecting crew's 4 by 4 actually ripped out the vehicle's transmission cables.

On another occasion, a drenching summer monsoon left the floor of the Mega pit flooded, and the crew was forced to walk through knee-deep mud to get to the working area. At the end of the day, all specimens, securely packed in banana boxes, had to be hand-carried in multiple soggy trips back through the lake. Showers were only partly effective, and crew members had black-stained hands, knees and faces, and working clothes had to be replaced every few days having become irretrievably saturated with this sticky black mess.

Preparation of the orpiments in the Collector's Edge lab. Collector's Edge photo.

SPECIMEN PREPARATION

Experiments commenced at the Collector's Edge laboratories in Golden, Col-

Spectacular specimen of orpiment crystals on matrix; 2.4 cm high. Collector's Edge photo.

Orpiment from Cut 62; 9.5 cm wide. Collector's Edge specimen. J. Scovil photo.

orado, in May 1999 to determine the best methods for specimen preparation. After many tests, it became clear that heavy coatings could not be removed without damaging the luster of the crystals. Furthermore, specimens with any degree of natural etching could not be improved. Some specimens were coated with, or partly included by, an unattractive gray-brown material that left them unpleasing to the eye. Indeed, were it not for such coatings, the number of recoverable specimens would have been very much higher – possibly in the tens of thousands!

Rare combination of orpiment with baryte, from Cut 62; 3.4 cm high. Collector's Edge specimen. J. Scovil photo.

Hundreds of specimens with a glassy luster were recovered, and these needed no chemical cleaning at all. Similarly, specimens with a resinous luster due to complex crystal overgrowths also required little or no cleaning. Specimens with only light coatings could usually be cleaned to display an excellent to perfect luster. In such cases the coating was removed in a bath of sodium citrate, which was later neutralised with sodium bicarbonate and water. Strong bases and acids were avoided because most of them react with orpiment.

About one third of the 4,000 specimens recovered could not be improved and these were returned to Twin Creeks for processing through the gold plant.

Orpiment from Cut 62; 7.1 cm high. Collector's Edge specimen. J. Scovil photo.

THE SPECIMENS

We noted above that, while orpiment is a reasonably common mineral, attractive well-formed crystals are comparatively rare. Prior to the Twin Creeks discovery, the best-known examples were those from the Quiruvilca mine in Peru, and from Shimen, in Hunan Province, China. The crystals of orpiment from Twin Creeks generally share a broadly similar habit with these localities, typically as equant, to slightly elongated chisel-shaped crystals with striated faces, and are at least equal in terms of quality.

However, specimens recovered from the 2000 and 2001 discoveries in Cut 20 comprise wider, stubby, fan-shaped crystals, sometimes with no prism faces at all. These sometimes occur as attractive rosettes with a color resembling Red Cloud wulfenite. A very few orpiment stalactites to 7 cm were also recovered from Cut 20, as well as rare hollow orpiment molds, possibly epimorphs over what may have been 0.5 to 1 cm tall stibnite crystals.

Glossy orpiment crystals from Cut 62; 2 cm high. Collector's Edge specimen. J. Scovil photo.

Orpiment crystals from Twin Creeks are fairly consistent in size throughout the deposit, ranging from 5 mm to 20 mm along the c axis, and from 2.5 mm to 10 mm across. A very few crystals reach 40 mm long, but these are generally of poor quality. The color of the crystals varies from reddish-orange to orange, yellow-orange, and honey yellow, with many subtle, intermediate shades.

Crystal clusters and matrix specimens are generally less than 15cm across, and most consist of plates of interlocking crystals covering a dark colored matrix, although a few specimens were found in which isolated crystals and small clusters are perched aesthetically on a larger matrix. The general quality of the specimens varies considerably; most specimens have a bright luster but others are dull as a result of coatings or natural etching.

Orpiment crystal 3.2 cm high on matrix. D. and D. Weinrich specimen and photo.

The only significant associated species is baryte, which occurs rarely as thin blades to 70 mm on the orpiment, and with color ranging from opaque gray to golden-yellow. About 100 good combination pieces of baryte on high quality orpiment were recovered, with baryte crystals to 70 mm growing on orpiment plates to 100 mm across. All of the baryte crystals are either singly or doubly terminated and belong to one of four distinct habits. The most common and largest of these are white to transparent tan, tabular-prismatic crystals, 1 to 5 cm wide, 0.2 to 0.5 cm thick and up to 7 cm long. They are typically frosted on one side and mirror-lustrous on the other. Much of this baryte shows faded-like extensional growth deformation caused by tectonic fault movement during crystal

Orpiment from Cut 62; 7 cm wide. Collector's Edge specimen. J. Scovil photo.

Orpiment from Cut 62; 10.8 cm wide. Collector's Edge specimen. J. Scovil photo.

Orpiment from Cut 62; 13 cm wide. Collector's Edge specimen. J. Scovil photo.

Orpiment on matrix; 12 cm wide. Collector's Edge specimen. J. Scovil photo.

growth. In a few cases drusy stibnite has been observed coating the baryte.

The second most commonly observed morphology is dramatic, mirror-lustrous, golden gem baryte with sharp, arrowhead-type serrations on the side edges. These thin, diamond shaped crystals repeatedly expand out and then contract back with up to seven repetitions per crystal, with individuals up to 2 cm wide and 5 cm long.

The third form occurred as two-stage, sceptered, prismatic baryte crystals to 5 cm long, 1 cm wide and 0.5 cm thick. These elongated crystals were attacked and subsequently etched by hydrothermal fluids, after which a second generation of mirror-lustrous, gemmy golden baryte scepter growth capped the terminations. Doubly terminated "dumbbell" examples of these baryte scepters are particularly interesting, especially when seen growing on orpiment.

The rarest of the four baryte morphologies occurred as very delicate, nearly paper-thin, tabular-prismatic, lustrous crystals to 3 cm, pale gold in color and spread out into semiparallel, floral patterns. A few baryte and orpiment combination plates exceeding 20 cm were recovered, although these larger pieces are on jasperoid matrix and tend to show a lot of baryte but just a few scattered orpiment crystals.

Orpiment from Cut 62; 5.4 cm high. Collector's Edge specimen. J. Scovil photo.

Orpiment from Cut 62; 10.2 cm wide. Azurite Corp. specimen. J. Scovil photo.

Microcrystalline pyrite, realgar and stibnite have been found in or near the ore zones. The pyrite is commonly seen as a dusty, sooty-looking dark layer on the rock matrix. Finely disseminated gold is also present in these arsenic rich zones, although it is seldom visible to the naked eye.

PERSPECTIVES

The discoveries of orpiment in Cut 62 and Cut 20 of the Twin Creeks Mega pit are exhausted, and much of the

Orpiment from Cut 62; 7.1 cm high. Collector's Edge specimen. J. Scovil photo.

fold structure controlling the location of the mineralized pockets is completely mined out. However, there are places within the walls of the current pit shell that contain orpiment zones intersected by diamond drilling. Unfortunately, these

Orpiment from Cut 62; 6.5 cm high. Collector's Edge specimen. J. Scovil photo.

Orpiment from Cut 62; 9.6 cm wide. Collector's Edge specimen. J. Scovil photo.

zones coincide with lower gold grades and are not part of the current mining plan although this could change, perhaps, under different economic conditions.

In quality terms, Twin Creeks orpiment is at least the equal of specimen

Orpiment from Cut 62; 9.5 cm wide. Collector's Edge specimen. J. Scovil photo.

Orpiment from Cut 62; 13.3 cm wide. Collector's Edge specimen. J. Scovil photo.

material from the Quiruvilca mine in Peru, and from Shimen, in China.

The Twin Creeks orpiment story is remarkable not only for the recovery of numerous world class mineral specimens, but also for the extensive co-operation between a major mining company (Newmont) and an organization that specializes in specimen extraction (Collector's Edge). Sadly, partnerships of this nature are seldom likely to be encouraged in today's mining industry.

Scott KLEINE
Reno, Nevada, USA
www.greatbasinminerals.com
scottkleine@greatbasinminerals.com

Bryan K. LEES
The Collectors Edge
Golden, Colorado, USA
www.collectorsedge.com
bryan@collectorsedge.com

Malcolm SOUTHWOOD
Melbourne, Australia
malcolm.southwood@gmail.com

Mineral photography: Mark Mauthner (USA)

Mark Mauthner collecting inside the pocket in 9th September mine, Madan, Bulgaria in 2013. J. Gajowniczek photo.

Mark started photography as a youngster, with a small Brownie camera that produced 2 x 2 slides. At 13 years of age, he bought his first 35 mm camera to take on his first overseas trip to Spain and Morocco. He became more serious with the hobby in his early 20s and acquired his first SLR camera, a Minolta. At this time, he also began documenting his mineral collection, including photomicrography, combining his camera with his microscope. A few years later, Mark upgraded to a Nikon system including several FE bodies and a bag full of lenses and gadgetry. Throughout his 20+ year career in museums, he used his photographic skills to produce multimedia presentations, images for articles, exhibit graphics, collection documentation and several other interesting projects, including over 200 images used in an early, "fuzzy logic"-based mineral identification software package developed at the University of British Columbia. His first "magazine cover" was a shot of a lizard that was used in a collage on the first issue of Pacific Rim magazine.

With the financial crisis of late 2008, Mark saw an opportunity to pursue photography professionally. Since early 2009, he has been photographing mainly natural history subjects, from tiny gems to 7.5 metre dinosaurs throughout the Western US and Canada. A large part of his work is for auction catalogs, but private clients also hire Mark to document their collections. Another specialty for Mark is on-location mining photography, harking back to his geology days when, as a result of a companywide photography contest, he not only won a trip to Mexico but became the company's official photographer for marketing materials.

Today, Mark shoots exclusively with digital equipment and a variety of studio gear and while much of his photographic time is spent with auction house clients, he enjoys taking on private clients with special projects. He may be reached by email at *mmauthner@gmail.com*

Rhodochrosite, large specimen 21.5 cm across, slices 9.5 cm diameter. Las Capillitas mine, Catamarca, Argentina. M. Mauthner photo; courtesy Heritage Auctions.

Stephanite and polybasite, 4 cm high. Husky Mine, Yukon Territory, Canada. M. Mauthner photo.

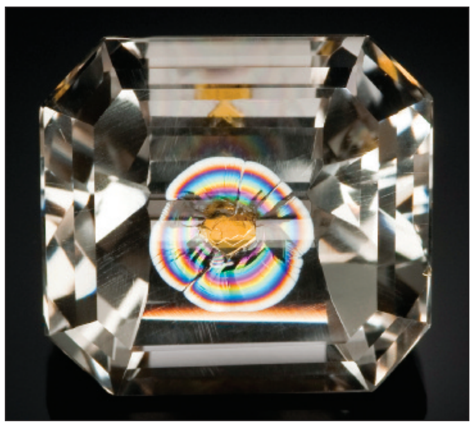
Beryl var. aquamarine, 12.5 cm high. Shigar, Skardu District, Gilgit-Baltistan, Pakistan. Silverhorn specimen. M. Mauthner photo.

Miner drilling in Oceanview mine, Pala District, San Diego County, California, USA. M. Mauthner photo.

Dolomite sculpture, field of view 11.5 cm. Mexico. M. Mauthner photo; courtesy Heritage Auctions.

Selection of old bottles filled with minerals and elements. M. Mauthner photo; courtesy Heritage Auctions.

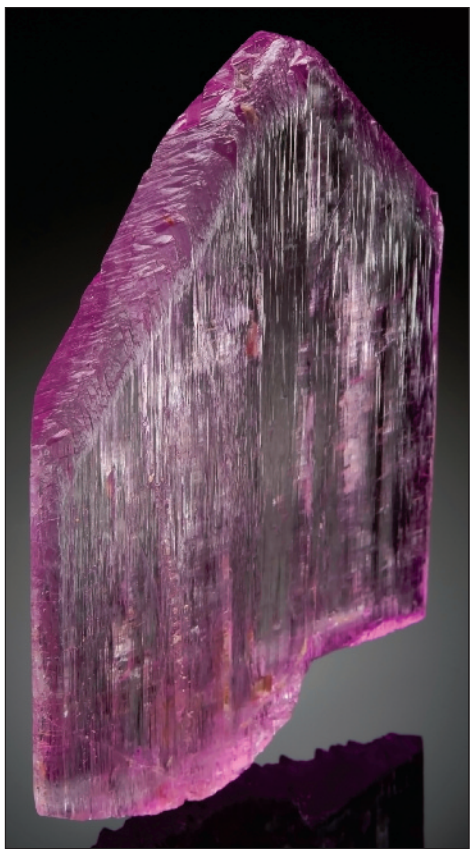
Aragonite, 21.5 cm high. Erzberg, Eisenerz, Styria, Austria. M. Mauthner photo; courtesy Heritage Auctions.



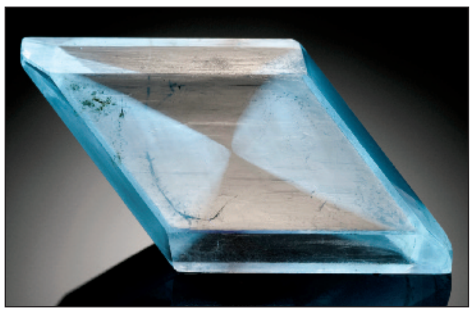
Iridescent fracture around inclusion in topaz, 2.5 cm across. J. Koivula collection. M. Mauthner photo.

Tourmaline glasses, wire-wrapping design by Naomi Hinds. J. White collection. M. Mauthner photo.

Beryl var. aquamarin, muscovite; 8.5 cm wide. Shigar, Pakistan. J. and L. Kent collection. M. Mauthner photo.



Famous George F. Kunz kunzite, 16.6 cm high. Pala Chief mine, California, USA. W. Larson collection. M. Mauthner photo.

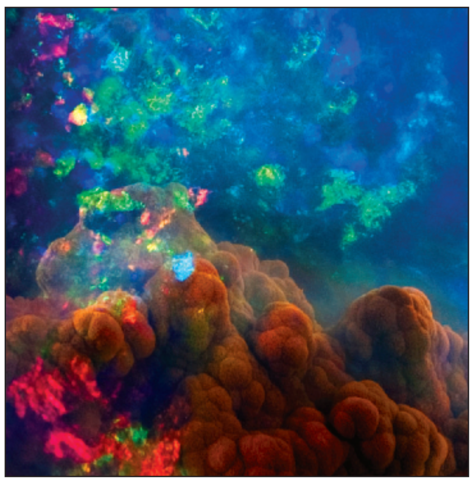


Gypsum in SW UV light, 5.1 cm wide. Willow Creek, Canada. M. Mauthner photo.

Sulphur, 12.5 cm across. Agrigento Province, Sicily, Italy. M. Mauthner photo; courtesy Heritage Auctions.

Spodumene var. kunzite, 201.00 ct., from the Oceanview mine, California, USA. W. Larson collection. M. Mauthner photo.

Quartz var. rose and smoky, 39.5 cm high. Berilo Branco mine, Minas Gerais, Brazil. Ex Hoppel collection. M. Mauthner photo; courtesy Heritage Auctions.



Opal, field of view 2 cm. Opal Butte, Oregon, USA. M. Mauthner photo; courtesy Bonhams & Butterfields.

Quartz var. citrine carving of dog's head; 7.5 cm high. M. Mauthner photo; courtesy of Bonhams & Butterfields.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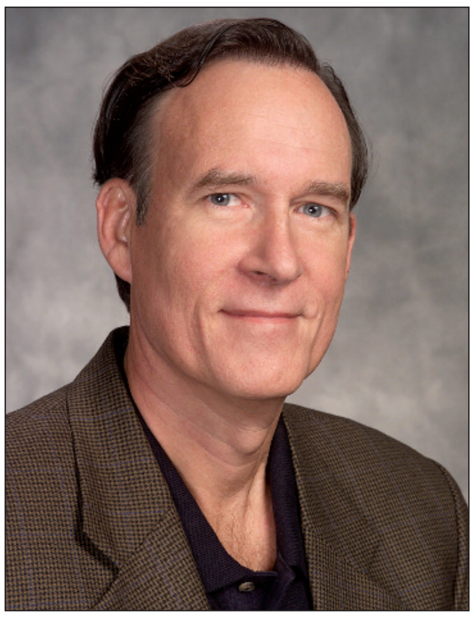
Wulfenite from Les Dalles, Mibladen, Morocco. 3.3 cm high.
Spirifer collection. J. Scovil photo.

Collector interview: Alex Schauss (USA)



Alexander Schauss – world famous thumbnail collector. K. McGowan photo.

This time in our *Collector Interview* series we have the pleasure of talking to Alexander Schauss, vice-president of Friends of Mineralogy, and one of the world's leading collectors of competition-quality thumbnails. Alex shares with us some of his family history, and talks about his career researching nutrition and botanical medicine, and how these disciplines relate to his passion for mineralogy.

Tomasz Praszkier (Minerals): *Alex, before we talk about minerals please tell us a little about the interesting history of your family and how you came to the USA?*

Young Alex with his grandpa in Hamburg in 1951, before his family moved to the USA.

Alex Schauss: I come from a long line of musicians, some quite famous, starting with my great-grandfather who was a German composer. My father was a concert pianist who taught piano at the Berlin Conservatory before World War II (WWII). My grandfather was the concertmaster of the Leipzig Gewandhaus Orchestra and Quartet from 1928 until he retired in 1962. Well known as one of the best violinists in the world, he began criticizing Adolf Hitler and the National Socialist Party in articles that appeared as early as 1933, and the family was frequently threatened by the SS for his outspoken comments. Once he learned that the Nazis were rounding up Jews, he assisted numerous Jewish members of the Leipzig Gewandhaus Orchestra financially and with letters of recommendation, which helped them find positions in American orchestras. I was shown many of these letters and documents by the orchestra's historian during a visit to Leipzig in 2011.

Alex, aged 7, looking for specimens; a budding mineralogist!

I was born in Hamburg, but 90% of the city was destroyed by the end of the war. Food was very scarce and there were no jobs for professionals such as my parents. Life was very difficult, especially for those who had opposed Hitler. Many Germans felt that those who had opposed the National Socialist Party had betrayed their country.

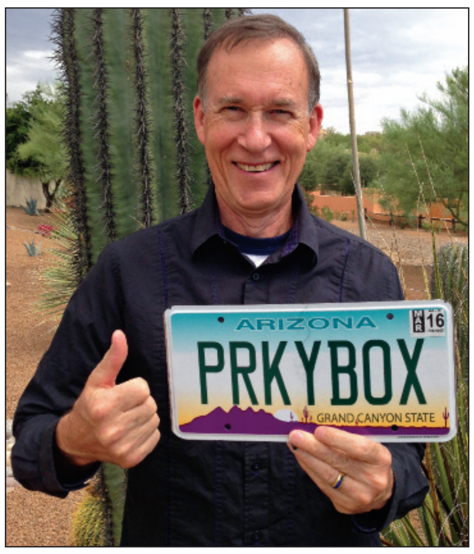
Chrysoberyl, var. alexandrite, 1.6 cm wide. Malyshevo, Russia. A. Schauss collection. J. Scovil photo.

So we came to America as immigrants in 1953 with just $24.00, and we lived in a gang-infested slum in the upper west side of Manhattan while learning English and trying to find work.

TP: *How did you start your adventure with minerals?*

AS: We soon became friends with a family that had just arrived from Puerto Rico; their son, Sammy, was seven, the same age as me. The two of us roamed around Manhattan, trying to stay away from the gangs and the violence in our own neighborhood.

One day we were walking along the Avenue of the Americas in mid-town Manhattan and we stopped to watch construction workers blow up the granitic gneiss bedrock with dynamite and haul the rock away. It was exciting stuff! We asked the truck drivers where they were taking the rocks and they told us the location near the northern tip of Manhattan Island. We headed home and we each borrowed a hammer and a small shovel from a kind gentleman who owned the local hardware store, and then we took the subway north to see what we could find.



Alex with his new Arizona automobile license plate reading "PRKYBOX" (Perky Box). L. Schauss photo.

Alex looking for minerals on Mt Rainier, WA, USA, in 2008. L. Schauss photo.

Ettringite, 2.7 cm. N'Chwaning II mine, Kalahari Manganese Field, South Africa. A. Schauss collection. J. Scovil photo.

We brought many "treasures" back with us, and took them to the mineralogy and geology department of the American Museum of Natural History, just a few blocks from our respective apartments. This is where I met Dr. Frederick Pough, who was rather amused by the rocks we brought him, since they were nothing more than samples of muscovite, orthoclase, and quartz, all commonly found in Manhattan's schists, pegmatites and gneisses.

One day I brought Dr. Pough a specimen with a vug which contained an exceptional dark crystal that turned out to be the largest columbite the museum had seen. He asked me if the museum could keep it, and I agreed that it could. When I returned a few weeks later with more rocks from another Manhattan site near the Williams Bridge, he showed me

Laura and Alex showing the Desautels and Best of Show master trophies, which they won at the 2010 Tucson Show.

Alex (right) and Jim Houran working on the display of African thumbnails for the special exhibit at the 2012 Munich show. B. Cairncross photo.

the Manhattan mineral display in the main hall, where he pointed out the specimen I had given the museum in the case. Talk about cool!

Since I had given the museum that mineral he offered to give me a specimen from its collection in return.

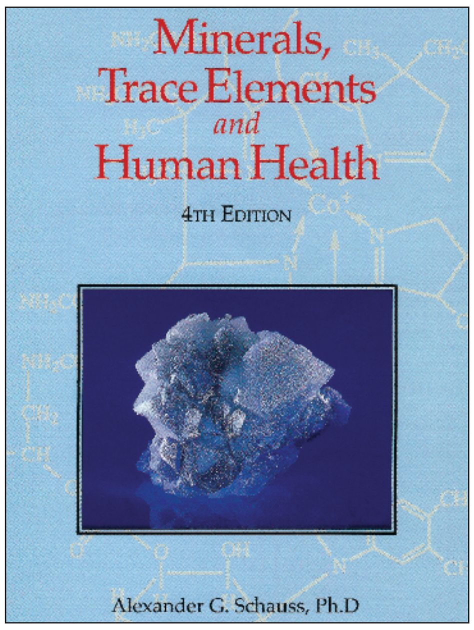
He took me to the rear section of the main hall where one could see stunning cabinet-sized specimens of fluorite and galena. He opened a drawer below a display case with a superb galena from

Alex working with his collection. M. Mauthner photo.

Joplin, Missouri, and asked me to choose from one of the two "extra" galenas that were "taking up too much room". I picked one, which he agreed was the best, and carefully wrapped it up in a sack. "*You picked the best of the two, Alex, you just might make a good mineralogist some day*". Talk about encouragement!

Spessartine from Broken Hill, Australia, collected by Alex in 1980, 2 cm wide. A. Schauss collection. M. Mauthner photo.

Needless to say, I returned repeatedly to help him in any way I could in the curator's office until he allowed me to handle hundreds, and eventually thousands of specimens. This continued into my junior high school years. I was fortunate that my junior high school was located just across the street from the museum.



The cover of one of Alex's books, illustrated with a specimen of fluorite from Laura's collection.

TP: *Can you tell us about your attempt to "rediscover" the Levison chrysoberyl locality in Manhattan?*

AS: During one of our visits to the American Museum of Natural History, Dr. Pough showed Sammy and me a map of where one of the finest (classic V-twinned) chrysoberyl crystals in America was found, in Manhattan Island, no less!

It was discovered on June 16, 1893, on the north side of 88th Street and Amsterdam Avenue, at the excavation site for a five-story tenement building

Storage for Alex's thumbnail specimens. Note that each box is individually labelled. M. Mauthner photo.

that, purely by coincidence, was the apartment building we lived in (from 1955-1968) on the 4th floor. The specimen is known as the "Levison Chrysoberyl". It was discovered by Wallace Goold Levison (1846-1924), one of the most prolific collectors of New York City minerals, and a member of the New York Mineralogical Club. He was also the first editor of the *American Mineralogist* (founded in 1916).

Well, foolishly, Sammy and I went home and broke through the concrete pad at the back side of the apartment building and began digging for chrysoberyl crystals. The building superintendent discovered what we were doing and chased us off, yelling and screaming. We told our parents what we had done. My dad went to see him with me in tow and had me apologize. He then paid the superintendent the money to replace the broken concrete. I also had to help him take the garbage cans out for a month and I was grounded from leaving the neighborhood. It took me over a year and a half to reimburse Dad for the cost of that concrete.

TP: *Do you think that if you hadn't been lucky to meet Dr. Pough your mineral passion would have evolved in the same way?*

Gypsum, 3.1 cm high. Las Salinas, Peru. A. Schauss collection. J. Scovil photo.

AS: It's hard to know, but there is no question that he taught me so much, especially about crystallography and how to recognize a world-class specimen. I had no idea of the status of the collection at the American Museum until

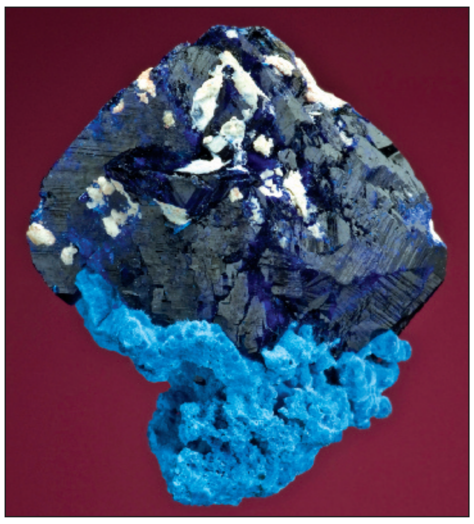
Alex and his thumbnail collection, with each specimen mounted in a "Perky" box. M. Mauthner photo.

many years later, when people in the field of mineralogy helped me realize how fortunate I was to have been befriended and trusted by him to handle minerals and to be a junior volunteer. Of course, I was very fortunate in living so close to the museum.

TP: *Did your parents support your hobby?*

Alex (middle) with miners at the Rowley mine, Arizona, USA. L. Schauss photo

Alex at age 65, digging for minerals at Swan Creek, WA, USA. L. Schauss photo.



Azurite on plancheite, 2.8 cm high. Milpillas mine, Mexico. A. Schauss collection. J. Scovil photo.

My mother was particularly supportive of my mineral collection as it grew over the years because her father, who had two PhD's in engineering (one from the Sorbonne University in Paris, the other from the University of Petersburg in Russia), had collected gems and minerals from the Ural Mountains. He was very wealthy, since he owned a large engineering firm that took on major construction jobs in Russia and Eastern Europe.

My mother had been about to start medical school in Belgrade when the Nazis invaded Yugoslavia. They destroyed her medical school and took over the family's mansion as some kind of headquarters just outside of Belgrade. Mom joined the underground and used her wealth, including her father's collection of rubies, emeralds, alexandrites, *etc.*, to smuggle Jews out of the country. I didn't know about this until many years later when I visited Israel and learned

Cobaltoan calcite, 3 cm wide. Kolwezi, Congo. A. Schauss collection. M. Mauthner photo.

of her bravery. When I came home and asked her why she had never told me about her heroism, she responded, "*It was what anyone would have done*", and told me not to bring up the subject again.

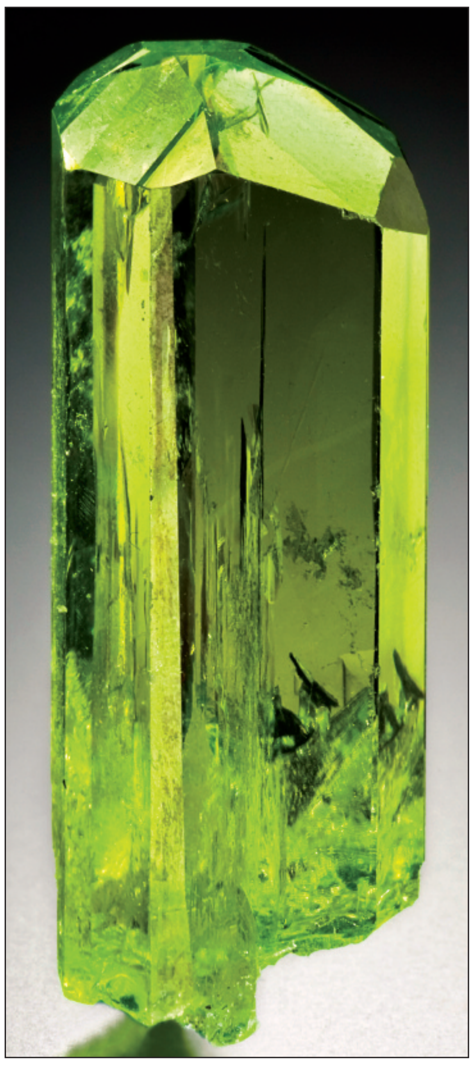
Rhodochrosite, 2.7 cm high. N'Chwaning I mine, South Africa. A. Schauss collection. J. Scovil photo.

TP: *When did you start becoming seriously involved in the mineral collecting community; going field collecting and visiting mineral shows?*

AS: Well, I can't really think of a time in my life when I didn't find myself digging holes and taking an interest in mineralogy.

When I was in high school, my girlfriend lived in Little Falls, New York. We spent quite a bit of time digging for Herkimer "diamonds" not far from her family's home.

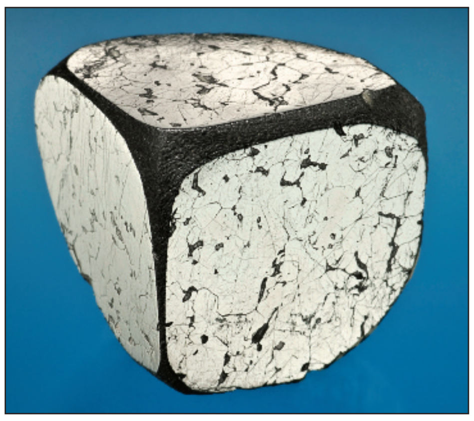
One summer I attended Western New Mexico University in Silver City and



Diopside, 3.4 cm high. Merelani, Tanzania. A. Schauss collection. J. Scovil photo.

dated the daughter of the superintendent of the Chino Mine which, at that time, was the largest open pit copper mine in the world. When I asked him if I could collect specimens in the mine, he found it hard to say "no" to his daughter's boyfriend.

It is worth mentioning Dr. Pough's influence when I first met Ed McDole. I arrived in New Mexico to attend university in 1966 and joined the Albuquerque Gem and Mineral Club. The Club's president, Dean Wise, also known as "*the dean of mineralogy*", encouraged me to visit the Tucson Gem and Mineral Society (TGMS) show in February 1967, which I did.



Jacobsite, 2.5 cm wide. Jakobsberg mine, Sweden. J. Scovil photo.

Unique, skeletal crystal of diamond, 1.5 cm wide. Orapa mine, Botswana. A. Schauss collection. J. Scovil photo.

At the time the TGMS show was held in a large tent near the Tucson Airport. Miscalculating the starting date of the show, I arrived a few days early. A man in a white shirt, black pants and black shoes, and with the stub of a cigar in his mouth, came up to me and noticed that I looked lost. I told him I was looking for the TGMS show, whereupon he invited me to look at a few "rocks" in the trunk of his black Lincoln Continental. My eyebrows immediately went up, after which I told him what each specimen was, where it came from and, in some cases, the year it was probably found in. He took the cigar out of his mouth and asked me how old I was. "*Eighteen, sir*". He replied: "*How is it possible that you know so much about these minerals?*". I told him about my years at the American Museum and the knowledge I had gained from Dr. Pough. He said: "*That explains everything*". Clearly, he knew Dr Pough; then he introduced himself as

Twinned calcite, 2.7 cm high. Sambava, Madagascar. A. Schauss collection. J. Scovil photo.

Ed McDole. I was honored to meet him. Even though I had just a few dollars to buy specimens, he introduced me to people around the show floor, saying something about my being one of "Pough's kids" from the American Museum; always with a cigar in the corner of his mouth.

Twinned pyroxmangite, 1.8 cm high. Broken Hill, Australia. A. Schauss collection. J. Scovil photo.

Ed died in 1970 and, given this background, you can imagine how pleased I was to win the Ed McDole Trophy several years later at the 1989 TGMS show for the best mineral case (of thumbnails, no less).

TP: *What was your first specimen and your first "serious" specimen?*

AS: My first specimen was a piece of gneiss, 15cm by 8cm, from Manhattan Island (New York City). I still have it, but it's not an attractive specimen!

Cronstedtite, 2.3 cm high. Herja mine, Romania. A. Schauss collection. J. Scovil photo.

The first serious specimens were all self-collected in New Mexico. They included a 90 cm by 60 cm block of botryoidal smithsonite collected in 1967 from the Kelly Mine. I sold it the same year for $100, and I gave $50 to the owner of the mine. The mineral dealer I sold it to in Albuquerque wanted me to break it in half so that it would fit in a "beer flat". He travelled to many rock and mineral

Smithsonite, 1.6 cm high. Abenab mine, Namibia. A. Schauss collection. J. Scovil photo.

shows in the western United States in his van and had all of his specimens in beer flats. Since the specimen was too large, he didn't want to buy it unless I cut it or broke it in half. I was shocked that he would take this specimen which took me several hours to get out of the mine undamaged, and want to break it in half. I don't know whether he broke it in half, but I certainly didn't

Selling the Kelly mine smithsonite was not an easy decision. Yet $100 was a lot of money for a student at the time. Also, there was no place to store it in the dormitory room shared with another student. In today's market, that specimen would probably sell for over $250,000.

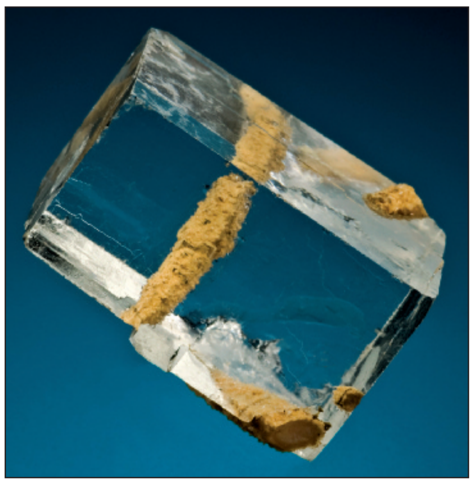
Legrandite, 3 cm high. Ojuela mine, Mexico. A. Schauss collection. J. Scovil photo.

TP: *Your plan was to study geology but finally you ended up as a nutrition/food scientist. How did this happen?*

AS: I would have majored in geology had I not taken a trip to southern New Mexico, where I literally stumbled onto the location of a "lost" Indian tribe that disappeared around 1500 A.D., that archeologists had been searching for.

While traveling along a remote dirt road, I decided to stop and take a look at a map and figure out where I was. I spotted a butterfly in the middle of the desert and followed it for a few hundred yards. All of a sudden there was a spring and next to the water were shards of Indian pots that looked like some pottery a professor in the history department had shown us. I took a few pieces back to the university. A few days later the professor told me I might have found the lost tribe of Mimbres Indians everyone had been searching for. For this discovery, I was inducted as a sophomore into Phi Alpha Theta, the national honorary society in history, which motivated me to major in history, rather than geology.

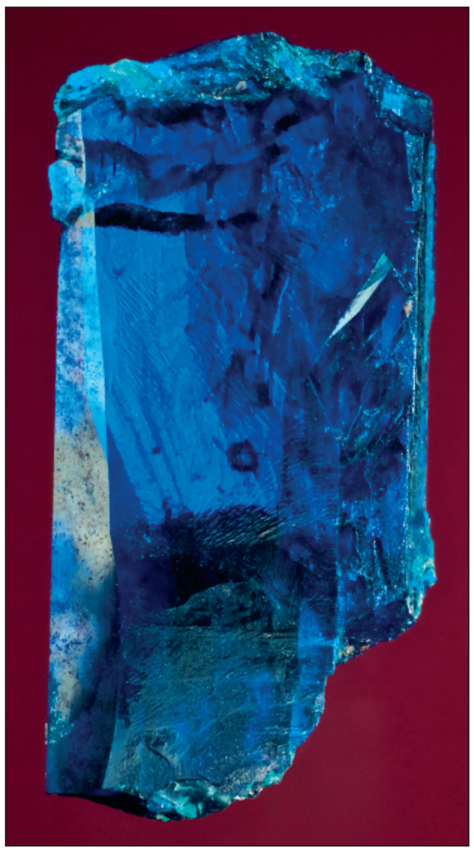
Grossular garnet, 2.6 cm high. Jeffrey mine, Asbestos, Canada. A. Schauss collection. J. Scovil photo.



Fluorite with quartz inclusions, 2.1 cm wide. Dalnegorsk, Russia. A. Schauss collection. J. Scovil photo.

My interest in the effect of nutrition on brain function and behavior, which became my career, began in 1970 when I worked for the Second Judicial District Court of New Mexico as a probation and parole officer, which also required my being a deputy sheriff. The case histories that influenced the realization of how important diet could be to human health and behavior are discussed in the first two books I authored in 1978 and 1980, *Orthomolecular Treatment of Criminal Offenders*, and *Diet, Crime and Delinquency*, respectively. The first book had the signature of two-time Nobel laureate, Dr. Linus Pauling on the cover, which attracted a lot of attention. It was the first of 23 books that I've authored or co-authored on nutrition and botanical medicine.

When I moved to South Dakota in 1975, I saw dramatic effects of diet in rehabilitating adolescent criminal offenders. This confirmed my earliest suspicions that this was a fertile field for research.



Linarite, 1.9 cm high. Grand Reef mine, Arizona, USA. A. Schauss collection. J. Scovil photo.

Marcasite, 3.5 cm high. Sparta, IL, USA. A. Schauss collection. J. Scovil photo.

TP: *Your scientific work is somehow connected with minerals and chemistry. The title of one of your many*

Thorianite, 1.9 cm high. Fort Dauphin area, Madagascar. A. Schauss collection. M. Mauthner photo.

books is "Minerals, Trace Elements and Human Health". Can you tell us about your scientific work?

AS: Studying minerals both from a mineralogist's perspective and in terms of my interest in the effects minerals can have on human health has exposed me to a wealth of scientific data. Occasionally, the information has direct applicability to problems experienced by miners exposed to toxic metals such as lead, cadmium, and arsenic.

A good example occurred in 2013. A group of miners had been working in an old base metal mine, collecting specimens of wulfenite, mimetite, barite, *etc.*, leading to excessive absorption of heavy metals. After failing to respond to conventional methods to remove them, they were informed that a dietary supplement that had been submitted for a safety review by the FDA (Food and Drug Administration) might help them. This natural product has been known for decades for its ability to remove heavy metals. Heavy metals can cause inflammation and act as pro-oxidants damaging cells, including neurons in the brain and central nervous system, which is why they are referred to as neurotoxic. The miners were also advised of a fruit whose pulp has been demonstrated in experimental studies by the USDA (U.S. Department of Agriculture) to exhibit potent anti-inflammatory and anti-oxidant bioactivity.

Calcite with dioptase inclusions, 2.8 cm high. Tsumeb, Namibia. A. Schauss collection. J. Scovil photo.

Cuprite in calcite, on copper, 3.3 cm high. Quincy mine, Michigan, USA. A. Schauss collection. M. Mauthner photo.

Cubanite, 2.5 cm high. Henderson No. 2 mine, Canada. A. Schauss collection. M. Mauthner photo.

Boleite, 2.4 cm wide. Amelia mine, Mexico. A. Schauss collection. M. Mauthner photo.

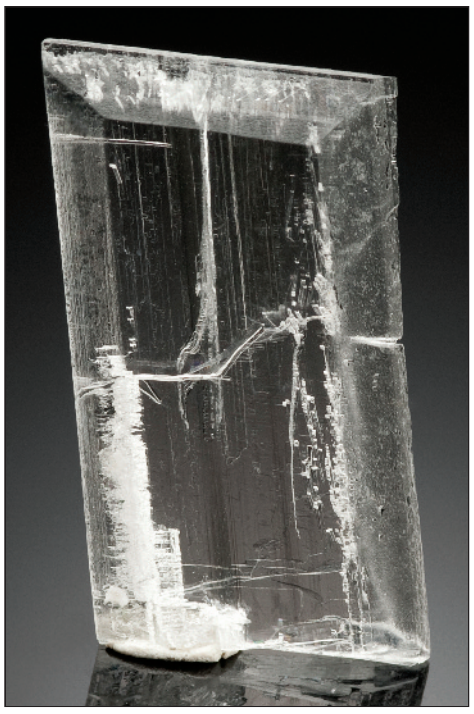
In just a few months the combination of these two natural compounds resulted in a dramatic reduction in the miners' blood levels of heavy metals; soon afterwards they were back in the mine.

It is important to understand the relationships between metals to appreciate how they can work together or against each other. For example, selenium can protect against mercury exposure, zinc against cadmium, calcium against lead, etc. Such relationships and other information about nearly 30 minerals essential to human health are discussed in my book, *"Minerals, Trace Elements and Human Health"*.

Strontianite, 2.3 cm high. Oberdorf an der Laming, Austria. A. Schauss collection. J. Scovil photo.

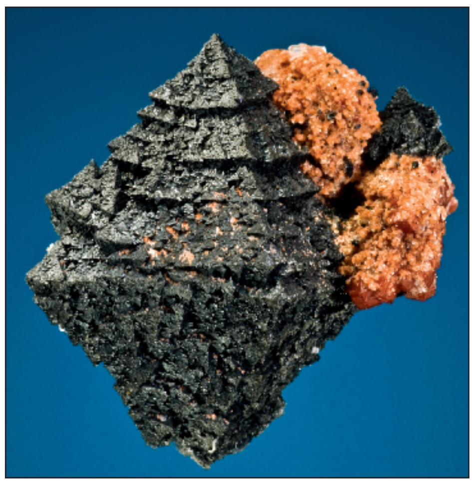
TP: *We talked a little about your time in New Mexico, but you've also lived in South Dakota and, more recently, in Washington state. What collecting opportunities have you had there?*

AS: While in South Dakota I was fortunate to learn about some superb, gemmy, golden barites found in concretions in the Pierre Shale in Elk Creek, Mead County. I quickly learned how to extract the best barite specimens, and filled over a dozen flats with fine, gemmy examples during several visits. I took them to Tucson a few years later and traded them at the Old Desert Inn for some very fine thumbnail specimens from Tsumeb, Mont St. Hilaire, and Broken Hill.



Strontioginorite, 2.3 cm high. Kahnstein, Thuringia, Germany. A. Schauss collection. M. Mauthner photo.

In 1977, I moved to Washington State and bought a house near Tacoma. This was an ideal location to go up and down the Cascade Mountains looking for minerals. I met Bart Cannon from Seattle, who gave me permission to dig for garnets on Vesper Peak. Anything I found I could keep, and this provided me with valuable trading material at the Old Desert Inn in Tucson each year. The state geologist, Raymond Lasmanis, learned that I had a large group of kids from the Puyallup Gem and Mineral Club wanting to learn more about the geology of the state. He would call me whenever a forest road was being built in the Cascades and promising minerals had been located. On some of these trips the kids would find world-class zeolites, some of which I donated to overseas museums as my research on nutrition carried me to countries all over the world.



Hausmannite, with andradite, 2.7 cm high. N'Chwaning II mine, South Africa. A. Schauss collection. J. Scovil photo.

Fluorite on quartz, 2.8 cm high. Erongo, Namibia. A. Schauss collection. J. Scovil photo.

TP: *So presumably your overseas travels also afforded you some interesting collecting and trading opportunities?*

Rhodonite, 3.3 cm high. San Martin mine, Chiurucu, Peru. A. Schauss collection. M. Mauthner photo.

Euclase, 3.7 cm high. Ouro Preto, Minas Gerais, Brazil. A. Schauss collection. J. Scovil photo.

AS: In 1983, I was invited to lectures given on the campuses of universities around South Africa. This allowed me to visit the Kalahari Manganese Field, and to meet with mineral collectors around the country, including Desmond Sacco. He kindly invited me to dinner at his house, after which he showed me his remarkable mineral collection. While I was visiting a rock shop in Cape Town, a miner from the Kalahari manganese mines appeared with nearly 20 flats of some strange new minerals none of us had ever seen before. Later we learned that these were ettringites, charlesites and sturmanites. I was fortunate to have the pick of these, and they proved to be highly sought after specimens in Denver and Tucson that allowed me to trade for some rare Tsumeb specimens.

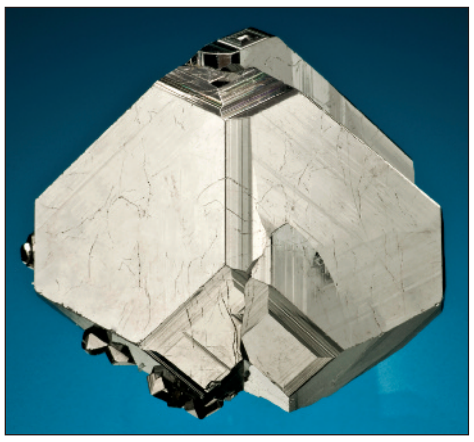
Pyrite, 2.7 cm high. Groundhog mine, Battle Mountain, Gilman District, Eagle County, Colorado, USA. A. Schauss collection. M. Mauthner photo.

In 1980, I was invited to give a lecture at the University of New South Wales, in Sydney, Australia. The next day I went to visit the famous Australian mineral collector, Albert Chapman, at his house just outside of the city. Albert encouraged me to visit Broken Hill, one of the locations on my bucket list, which I did. This is where I found one of my favorite garnets, a superb, red, twinned spessartine crystal, just lying on the ground; it was included in the case that won the 1989 Ed McDole Trophy at the TGMS show.

Beryl, 2.9 cm high. Resplendor, Brazil. A. Schauss collection. J. Scovil photo.

TP: *Over a number of years you have created one of the world's best thumbnail collections. How and why did you start to collect thumbnails? How long did it take to build your collection?*

AS: By 1968, I had traded most of the specimens Dr. Pough gave me, so that I could start building a serious thumbnail collection. My income as a college student, and then working for the government for ten years, only allowed me a budget sufficient to buy a few specimens a year at best, so I had to be very selective about what I purchased. The rest of the collection, built over many years, was acquired by trading specimens or by field collecting.



Carrolite, 2.8 cm wide. South Kamoya mine, Katanga, DR Congo. A. Schauss collection. J. Scovil photo.

Exceptional specimens, even of very rare minerals, that are thumbnail-sized are relatively affordable compared to larger pieces. Many minerals rarely, if ever, get any larger than thumbnail-size, so those minerals became particular targets for acquisition. Thumbnails are also easy to store and they take up far less space than larger specimens.

Fluorapatite, 1.9 cm high. Paraiba mine, Brazil. A. Schauss collection. M. Mauthner photo.

During the formative years of my collection, finding exceptional specimens was not easy for two reasons. I didn't have the money that many well-to-do collectors had and, often, there weren't many exceptional specimens available to acquire. With perseverance and luck, being at the right place at the right time, and by attending scores of mineral shows over the years, a quality collection emerged. Entering a case of 35 minerals and/or 25 specialized thumbnail-sized minerals at regional and national

Fluorapophyllite, 2.8 cm wide. Nasik area, India. A. Schauss collection. J. Scovil photo.

Vesuvianite, 3.2 cm high. Jeffrey mine, Asbestos, Canada. A. Schauss collection. J. Scovil photo.

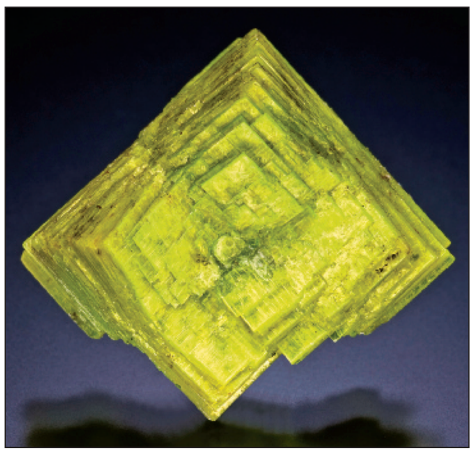
American Federation of Mineralogical Societies (AFMS) competitions helped me learn from judges, collectors, and dealers, which minerals were outstanding, and why.

By 1980 I was a member of the San Diego Gem and Mineral Society, and I scored just a few points less than Jim and Dawn Minette's thumbnail case at a California AFMS competition. The Minettes had a world-class collection of thumbnails, so I was very pleased with that result. Competing in AFMS-sponsored regional and national competitions allowed me to gauge my progress compared to other advanced collectors year-to-year.

Anglesite, 2.5 cm high. Touissit, Morocco. A. Schauss collection. M. Mauthner photo.

TP: *I've heard that your first thumbnail collection was stolen?*

AS: In 1984, I won my first trophy for thumbnails at the TGMS show. However, I still needed just two more exceptional thumbnails of rare species from the Tsumeb mine to be able to enter a



Uranocircite, 2.3 cm wide. Sao Pedro mine, Brazil. A. Schauss collection. J. Scovil photo.

Tsumeb-only case into competition. To preview the Tsumeb-only concept, along with a case of some 60 other thumbnails from worldwide localities, I took the collection to the 1985 Pacific Northwest Friends of Mineralogy (FM) meeting in Washington State. It was held in what was then my hometown of Tacoma. Unfortunately, while registering for the meeting, two vans and my car where broken into and all of my minerals stolen, in less than ten minutes! The theft literally wiped out my collection, including 20 rare minerals from Tsumeb, acquired over many years.

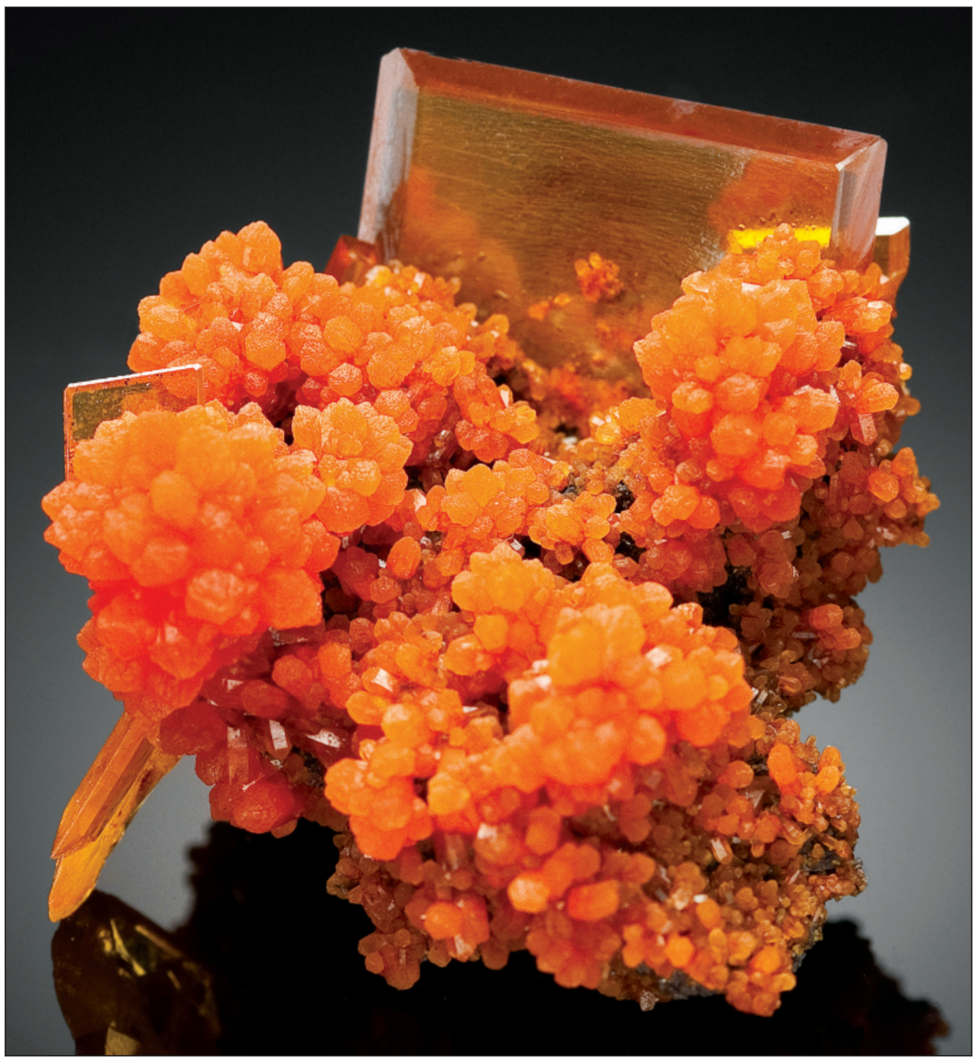
The theft of the collection was more than personal; it was a loss to the mineralogical community since we, as individuals, are merely the custodians of the specimens. Having failed to protect the collection, I decided to quit collecting minerals altogether. The loss was very depressing. However, my wife persuaded me not to give up, and I will always be thankful to Laura for her persistent encouragement and support.

By 1988-1989, I was able to put together a strong enough collection to win nine regional and national AFMS trophies at the Masters level, the Richard M. Pearl Trophy for the best mineral species at the Denver Gem and Mineral Show in 1988 (a gold specimen from Venezuela), as well as the cherished Ed McDole Trophy at Tucson in 1989 for best mineral case.

Spessartine garnet on albite, 2.8 cm high. Shengus, Pakistan. A. Schauss collection. J. Scovil photo.

Fluorite, 3.2 cm high. Penfield Quarry, New York, USA. A. Schauss collection. J. Scovil photo.

In 2012, Jim Houran, a consummate Texas-based thumbnail collector, and I traveled to Munich to display five cases with a total of 188 thumbnail specimens for the African Minerals special exhibit organized by The Munich Show. The collection included many of the world's best African thumbnails loaned for the exhibit by collectors around the world. We were surprised and delighted by the response the exhibit received, evidenced by the thousands of people that spent time looking at those cases. It was the first time in the 49-year history of The Munich Show that a special exhibit of thumbnail-sized specimens had been displayed.



Wulfenite with mimetite, 2.8 cm high. San Francisco mine, Sonora, Mexico. A. Schauss collection. M. Mauthner photo.

Gyrolite on calcite, with okenite, 2.9 high. Malad, Mumbay, India. A. Schauss collection. J. Scovil photo.

Rhodonite, 2.6 cm high. San Martin mine, Chiurucu, Peru. A. Schauss collection. J. Scovil photo.

TP: *Your collection has won many prizes. Which one is the most important for you?*

AS: They all are. Each represents a milestone that contributed to the quality and range of specimens in the collection today. The awards also remind me of the pleasure derived from watching people see the specimens at various mineral shows, as well as the social interactions it affords to learn more about mineralogy and to make friends and see other collections.

Colemanite with calcite, 2.4 cm wide. Boron Open Pit, CA, USA. A. Schauss collection. J. Scovil photo.

The Ed McDole Trophy earned in Tucson is particularly meaningful since I had a chance to meet and get to know Ed before he passed away in 1970. Receiving the 2010 Paul Desautels Trophy for best mineral case in Tucson was another milestone since both the Ed McDole and Paul Desautels trophies were won with thumbnail specimens.

Phosphophyllite, 2 cm high. Unificada mine, Bolivia. A. Schauss collection. J. Scovil photo.

Wulfenite with mimetite, 2.8 cm high. Rowley mine, Arizona, USA. A. Schauss collection. J. Scovil photo.

TP: *Are you very strict about specimen size? Why collect according to size, rather than by locality, or by species? How many specimens do you have?*

AS: Selecting thumbnails that meet regulation size has proven a way to acquire exceptional specimens on a limited budget.

Twinned cerussite, 2.4 cm high. Tsumeb mine, Namibia. A. Schauss collection. J. Scovil photo.

It is well known that collecting thumbnails is a North American thing, as both the U.S.A. and Canada have encouraged competitive cases to be entered and exhibited at major mineral shows for many decades.

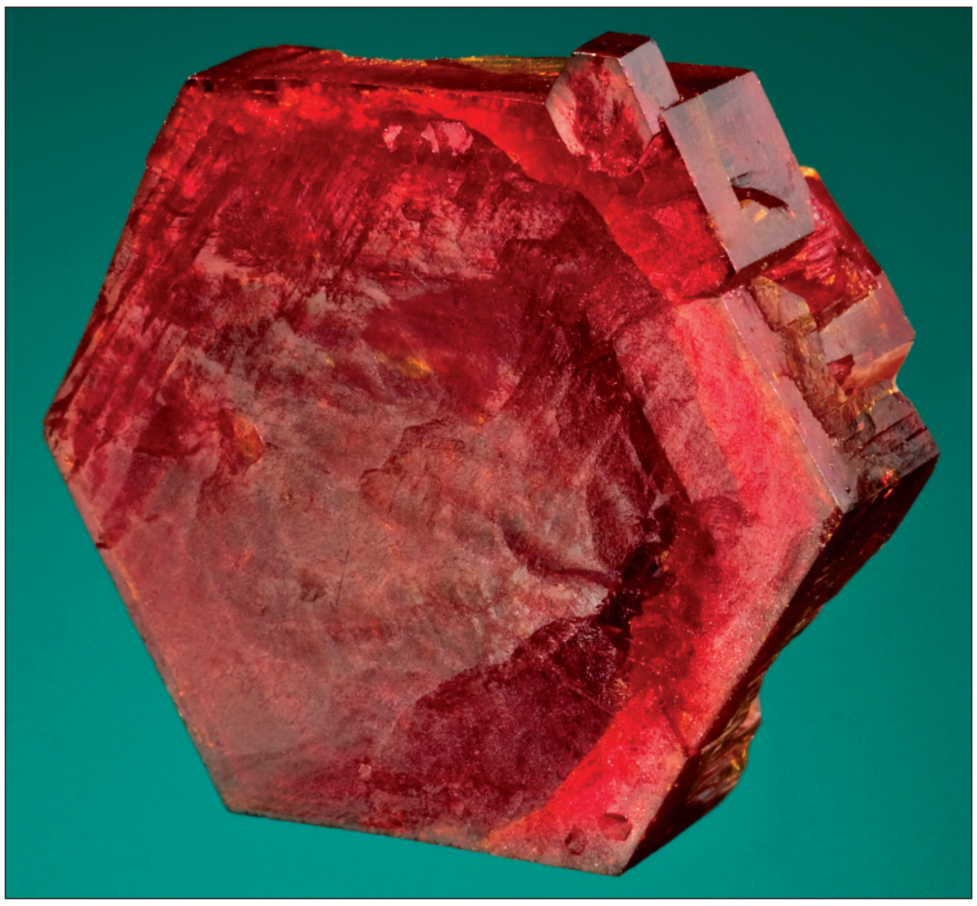
Since it is not possible to acquire or trade for an exceptional thumbnail each year, I made the decision years ago to maintain a sub-collection of the best thumbnail-sized calcites, hematites, and pyrites, with the balance of the collection covering all species and with a worldwide scope. Currently 17 specimens are on display at the University of Arizona's mineral museum.

TP: *Which specimen in your collection do you consider the best one and why? Which one is your favorite?*

AS: That's like asking a parent which son or daughter is their favorite. In 2013, the Mineralogical Record published an Arizona Collector's Supplement. I was honored to be included. Several of my specimens were photographed for that issue and some of them are shown in this article.

Twinned cerussite, 2.5 cm high. Tsumeb mine, Namibia. A. Schauss collection. J. Scovil photo.

Some favorites would include a 2.8 cm group of dioptase included in calcite rhombs from the Tsumeb mine, Namibia; a "killer" 2.5 cm cubanite twin from the Henderson No 2. Mine, Chibougamau, Quebec, Canada; a fire-red 2.5 cm transparent rhondonite from the San Martin mine, Chiuricu, Huallanca, Ancash Department, Peru; and, a 3.1 cm single veszelyite crystal from the Black Pine mine, Phillipsburg, Montana.



Vanadinite, 2.4 cm high. ACF, Mibladen, Morocco. A. Schauss collection. J. Scovil photo.

TP: *Recently you and Laura moved to Tucson, Arizona - the mineral collectors' Mecca - and you immediately got involved in exhibitions, collectors meetings etc. You've also had the opportunity to collect in some of the mines in the Tucson area. Can you tell us more about this most recent chapter of your collecting history? What are your plans for the future?*

Twinned rutile, 2.5 cm high. Diamantina, Brazil. A. Schauss collection. M. Mauthner photo.

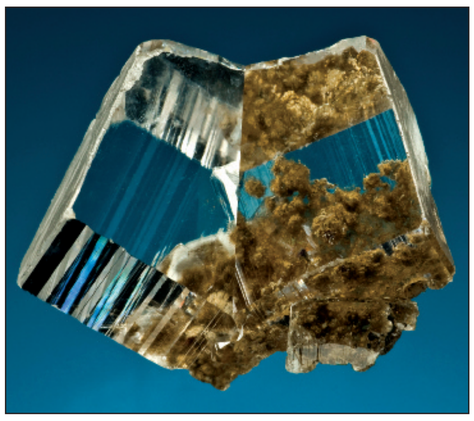
AS: Talk about busy, since moving to Arizona. One of the first contributions was to work with Jim Houran on displaying a collection of Chinese thumbnail specimens as part of a Special Exhibit of Chinese Minerals at the University of Arizona's mineral museum.

As soon as we moved to Tucson we joined the Tucson Gem and Mineral Society (which manages the TGMS Show each year). We were invited to join the Arizona Mineral Minions group, and the Mineral Enthusiasts of the Tucson Area (META) group. It has been a great pleasure to meet many of the Mineral Minions and META members throughout the state and to see their collections. We've been attending monthly meetings of TGMS during which time many superb presentations have been given on mineralogy

Linarite, 2.7 cm high. Grand Reef mine, Arizona, USA. A. Schauss collection. J. Scovil photo.

I've also had a chance to meet many miners around the state now in their 70s and 80s, and listen to fascinating stories about their experiences working in the mining industry, and as collectors. Some have impressive mineral collections acquired over a lifetime.

Mineralogy has given so much to me during my life that finding ways to give something back is important. In 2014, I was elected Vice President of Friends of Mineralogy (FM), a group every mineral enthusiast should join, with chapters throughout the United States. These chapters put on regional shows, and organize outstanding educational events, exhibits and socials. FM promotes, supports, protects and expands the collecting of mineral specimens and furthers the recognition of the scientific, economic and aesthetic value of minerals and mineral collections. If elected as president in 2015, I hope to do my part in further promoting the organization's objectives. This year we will be working more closely with Mindat.com to optimize its benefits for the mineralogical community.



Twinned calcite with inclusions, 3 cm wide. Zhao Tong mine, China. A. Schauss collection. J. Scovil photo.

It did not take me long after arriving in Arizona to get my hard hat on and head underground. I have MSHA (Mine Safety and Health Administration) certification, which allows me to go underground to collect specimens when invited, or simply help out other miners and collectors with mucking-out or with safety issues. The most recent visits have been to the Rowley Mine in Maricopa County, which recently located the world-class wulfenites with 1.0-1.5 cm fire-red mimetite balls that were available at the 2014 TGMS show. I'll probably be digging for specimens at mine dumps around the state and visiting mines in Colorado, New Mexico, and Nevada over the next few years.

Jim Houran, a fellow thumbnail collector, inspired me to continue the tradition he started with Rich Olsen to promote thumbnail collecting. It has been a delight to work with both of them and other collectors to create invited theme exhibits focusing on thumbnails displayed at major mineral shows such as Munich and Tucson.

We wish you many more collecting adventures as well as many new small specimens for your collection!

Eosphorite, 2.6 cm high. Golconda mine, Minas Gerais, Brazil. A. Schauss collection. M. Mauthner photo.

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Cerussite, hemimorphite and mimetite on willemite, 5.5 cm high, from M'fouati, DR Congo . Spirifer collection. J. Scovil photo.