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### Welcome to the e-RMS 2021!

Welcome to the 48th Rochester Mineralogical Symposium: the e-RMS 2021.

Once again we were unable to be together in person, due to the global coronavirus pandemic. However, we are thrilled that the spirit of the Rochester Symposium is alive and well, such that we could gather online for an afternoon of presentations.

If you missed the e-RMS 2021, the presentations set out in the Program are all included on the Rochester Mineralogical Symposium channel on YouTube. You can view them individually or the full symposium in a playlist at this link:

https://www.youtube.com/watch?v=o3mNbViLCIA&list=PL4AllrO7xkRdSoS-4iyXVUKHf98hn34pj

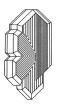
For all of you who participated, we're so grateful – thank you all! The RMS remains our springtime reunion of mineral friends – we look forward to it each year and it would absolutely not be the same without you. Again this year, it was great to see Rochester's spirit at the e-RMS, complete with humour, laughs, a raised glass and mineral songs.

We'll see what the future has in store for us all over the next year. We are sure planning to hold the Rochester Mineralogical Symposium in Rochester, NY, in 2022. We also expect to host a portion of the RMS online. Our tentative dates are April 7-10, 2022. Write it into your calendar!

We will communicate by email about future developments, so if we might not have your current email address, please let us know at <a href="mailto:com.">contactrms@hotmail.com</a>.

Please make sure you follow the Rochester Mineralogical Symposium on Facebook!

Stay well!



## $48^{th}$ Rochester Mineralogical Symposium: The ERMS 2021!

## **PROGRAM**

Saturday, April 17, 2021		
12:00 pm	Join Online Meeting	
12:05 pm	Opening - Raymond McDougall	
12:15 pm	World Premiere: Diggin' in a Hole (the video!) – David K. Joyce	
WHAT'S NEW IN MINERALS		
12:20 pm	What's New in Minerals - Jeff Scovil	
1:05 pm	What's New in Minerals II – John Betts, with Mark Jacobson, Raymond McDougall and Jim Nizamoff	
CONTRIBUTED PAPERS AND SHORT TALKS IN SPECIMEN MINERALOGY		
1:45 pm	The mineralogy of the gem-bearing pegmatites and hydrothermal veins at Phnom Bayong, Kirivong, Takeo province, Cambodia – <i>P. Piilonen</i> , <i>I. Lykova</i> , <i>G. Poirier and K. Shepherd</i>	
2:00 pm	A new spodumene-rich pegmatite from Plumbago Mountain, Oxford County, Maine – W.B. Simmons and A.U. Falster	
2:15 pm	Cyrilovite and kapundaite, two Na-Fe <sup>3+</sup> phosphate minerals from oxidizing environments in lithiophilite alteration assemblages in the Emmons Pegmatite, Uncle Rom Mountain, Greenwood, Oxford Co. Maine – A.U. Falster and W.B. Simmons	
2:30 pm	The White Rock Quarry, Clay Center, Ottawa County, Ohio – C.J. Stefano and J.K. Brizendine	
2:45 pm	Mineralogical characterization of Hicks Dome intrusion breccia core samples and related fluorite mineralization, southern Illinois – <i>M. Murchland</i> , <i>M. Rutherford</i> , <i>J.T. Freiburg</i> , and <i>J. Rakovan</i>	
3:00 pm	Blue hemimorphite crystals from the Ojuela Mine, Durango, Mexico 2020 – J. Rakovan	
3:15 pm	Simplified method for measuring specific gravity – J. Betts	

### CRYSTALLOGRAPHY TUTORIALS FOR COLLECTORS

3:30 pm	Crystal Systems – John Rakovan
3:50 pm	Miller Indices – Mackenzie (Ruthy) Rutherford
4:10 pm	Crystal Forms – R. Peter Richards
4:30 pm	GRAND FINALE
	Raise a Glass and Sing! – David K. Joyce

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Carl Miller - Registrar (804) 517-6709 <<u>contactrms@hotmail.com</u>>
John Rakovan - Online Host for the eRMS 2021
Sarah Hanson - Technical Session Coordinator <sarahhanson042@gmail.com>

SIMPLIFIED METHOD OF MEASURING SPECIFIC GRAVITY. <u>J. H. Betts</u>, 215 West 98 Street, New York, N.Y. 10025.

The specific gravity of a mineral is the relative "heft" of the mineral and is equivalent to the density of the mineral. Mineral density is measured in mass per unit volume and is expressed in g/cm³. Specific gravity is expressed without units and is the ratio of the mineral weight in air divided by the weight of water of the same volume (the weight of the water displaced by the mineral). The density of water equals 1 g/cm³. A mineral with a specific gravity of 2.00 would be twice as dense as water and also have a density of 2.00 g/cm³.

Specific gravity is a useful diagnostic attribute when identifying an unknown mineral specimen. But textbooks usually describe testing specific gravity using a laboratory balance scale that few collectors own. With the standard technique the mineral is weighed dry, and then weighed suspended in water. Subtracting the wet sample weight from the dry sample weight yields the weight of the displaced water. Dividing the weight of the displaced water into the weight of the dry sample yields the specific gravity.

The proposed simplified method requires only a few ordinary items and a common digital scale of the type found in housewares stores. The mineral is weighed dry, and then the scale is used to measure the increased weight of the water while the same mineral is suspended in it, resulting in a direct measure of the weight of the displaced water, which is then divided into the dry weight for the final result. This process is illustrated at: http://www.johnbetts-fineminerals.com/jhbnyc/articles/specific\_gravity.htm

Using this method collectors are able to quickly measure specific gravity in under a minute. No laboratory balance scale required, two easy measurements, one simple division of the two measurements.

CYRILOVITE AND KAPUNDAITE, TWO Na-Fe<sup>3+</sup> PHOSPHATE MINERALS FROM OXIDIZING ENVIRONMENTS IN LITHIOPHILITE ALTERATION ASSEMBLAGES IN THE EMMONS PEGMATITE, UNCLE TOM MOUNTAIN, GREENWOOD, OXFORD CO., MAINE. <u>A.U. Falster</u> and W.B. Simmons, MP<sup>2</sup> Research Group, Maine Mineral & Gem Museum, 99 Main Street, Bethel, Maine 04217.

Bright yellow crystals of cyrilovite (NaFe<sup>3+</sup><sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>(OH)<sub>4</sub>·2H<sub>2</sub>O) (cyrilovite forms a solid solution series with wardite, NaAl<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>(OH)<sub>4</sub>·2H<sub>2</sub>O) and kapundaite (NaCaFe<sup>3+</sup><sub>4</sub>(PO<sub>4</sub>)<sub>4</sub>(OH)<sub>3</sub>·5 H<sub>2</sub>O) were recently discovered in the secondary phosphate assemblages derived from the alteration of lithiophilite from the Emmons pegmatite, Uncle Tom Mountain, Greenwood, Oxford Co., Maine. The crystals are all under 1 mm in maximum dimension and occur in a mineral assemblage dominated by Fe<sup>3+</sup>-rich mineral species of strunzite, jahnsite-group members, kryzhanovskite, laueite, pseudolaueite, stewartite, beraunite mitridatite, bermanite, and strengite. In some cases, manganese oxide species are the dominant matrix mineral. Even though the primary lithiophilite only contains 10-30 % of the triphylite component, the highly oxidized species are almost Mn-free. These two mineral species have likely formed under oxidizing conditions between 300-100 °C from primary phosphate (lithiophilite-triphylite series) involving Na-addition combined with hydroxylation and hydration (Simmons et al. 2003). The presence of hydrate water indicates that formation was-near the lower end of the temperature range. These species are typical of the Quensel-Mason sequence described as having undergone alkali leaching (notably Li) and oxidation of Fe and Mn (Baijot et al. 2012). Initially, numerous species containing both Fe<sup>3+</sup> and Mn<sup>2+</sup> occur (for example

strunzite, stewartite) but eventually the assemblages transform to essentially Mn-free hydrated/hydroxylated species such as strengite, and phosphosiderite or species containing the alkali ions Na or K, such as cyrilovite, leucophosphite, or kapundaite (Fransolet et al. 2000, Simmons et al. 2003). The alkali ions are likely derived from the alteration of feldspars. Under low-temperature oxidizing conditions, Mn may form Mn-oxide species with Mn<sup>3+</sup> or Mn<sup>4+</sup> (Fransolet et al., 2000).

#### REFERENCES

- Baijot, M., F. Hatert, A.-M. Fransolet, and S. Philippo. 2012. Geochemical evolution of phosphates and silicates in the Sapucaia pegmatite, Minas Gerais, Brazil: implications for the genesis of the pegmatite. *Canadian Mineralogist*, 50:1531-1554.
- Fransolet, A.-M., M.A. Cooper, P. Černý, F.C. Hawthorne, R. Chapman, and J.D. Grice. 2000. The Tanco pegmatite at Bernic Lake, Southeastern Manitoba, XV. Ercitite, NaMn³+PO₄(OH)(H₂O)₂, a new phosphate mineral species. *Canadian Mineralogist*, 38:893-898
- Simmons, W. B., K.L. Webber, A.U. Falster, and J.W. Nizamoff. 2003. Pegmatology: Pegmatite Mineralogy Petrology and Petrogenesis. Rubellite Press. 176 p.

MINERALOGICAL CHARACTERIZATION OF HICKS DOME INTRUSION BRECCIA CORE SAMPLES AND RELATED FLUORITE MINERALIZATION, SOUTHERN ILLINOIS. M. Murchland<sup>1</sup>, M. Rutherford<sup>1</sup>, J.T. Freiburg<sup>2</sup>, and J. Rakovan<sup>1</sup>, Dept. of Geology and Environmental Earth Science, Miami University, Oxford, OH 45056; <sup>2</sup>University of Illinois, Urbana-Champaign, Prairie Research Institute, Illinois State Geological Survey, Champaign, IL 61820.

Mississippi Valley-Type (MVT) deposits are low-temperature lead-zinc ore deposits formed by hydrothermal fluids. Dominant minerals include sphalerite and galena, the ore minerals that give these deposits economic value, along with gangue mineralization of quartz, calcite, dolomite, barite, fluorite, and celestine. MVTs can be divided into subtypes based on differences in mineral abundances. In the fluoritic subtype, MVTs host significant fluorite mineralization such that it becomes an ore phase. A world class example of this is the Southern Illinois-Kentucky Fluorspar District (IKFD), which is known for producing both the majority of fluorite mined as ore in the United States in the twentieth century and renowned specimen-grade material (fig. 1).

Typically, MVTs lack contribution from and do not occur near igneous activity, as they are epigenetic in sedimentary basins. However, the northwestern portion of the IKFD hosts Hicks Dome, a cryptoexplosive feature created by the release of volatiles dissolved in the alkalic intrusion over which it is situated (Bradbury and Baxter, 1992). Surrounding the dome are numerous mafic and ultramafic igneous intrusions, most of which have undergone at least one episode of brecciation—the breccias are classified on the basis of geometry and mineralogy by Bradbury and Baxter (1992) into three types: shatter, vent, and carbonatitic. The area is set apart from the larger IKFD due to its radioactivity, which prompted searches for rare earth minerals and eventually the coring of several intrusions. Thin sections of hydrothermal mineralization from cores of the breccias (fig. 2) have been studied by powder X-ray diffraction (PXRD), cathodoluminescence (CL) microscopy, optical petrography, and semi-quantitative Rietveld analysis. These techniques have shown there to be a variety of different lithic fragments and unique mineralization in the cement of the breccias, with quartz, calcite, fluorite, and dolomite

making up the dominant phases. Fluorapatite, barite, bertrandite, brockite, xenotime, pyrochlore, and ilmenorutile have also been identified as accessory phases.

Notably, the major phases of the hydrothermal mineralization associated with the intrusions are the same as the gangue phases for the hydrothermal mineralization of the MVT deposits above. This implies a potential genetic link among the intrusions, the breccias and the MVT deposits. The origin of fluorine in fluoritic MVTs is an outstanding question, and degassing of mantle-derived magmas has been suggested as a possible fluorine source (Fisher, Lillie, and Rakovan, 2013). The abundant fluorite and elevated REE mineralization in the breccia cement, and their intimate association with the alkaline igneous rocks, thought to be of mantle origin, suggests that the Hicks Dome intrusions are the source of F and REEs in the deep hydrothermal mineralization. The intrusions may have also been a source of heat for the hydrothermal fluids that ultimately mineralized the breccias. Mineralogical and geochemical comparison of the deep igneous associated breccias and the shallow MVTs, focusing on the fluorite and REEs, may ultimately provide evidence that asthenospheric (mantle derived) fluorine is also present in the IKFD.

#### REFERENCES

Bradbury, J.C. and J.W. Baxter. 1992. Intrusive Breccias at Hicks Dome. *Illinois State Geological Survey Circular 550*.

Fisher, J., R. Lillie, and J. Rakovan. 2013. Fluorite in Mississippi Valley-Type Deposits. *Rocks & Minerals* 88:20-47.



Figure 1. Fluorite, strontianite and sphalerite, Minerva #1 Mine, Cavein-Rock district, Hardin CO., Illinois. 10 cm tall. Jim Gebel specimen. Jeff Scovil photo.

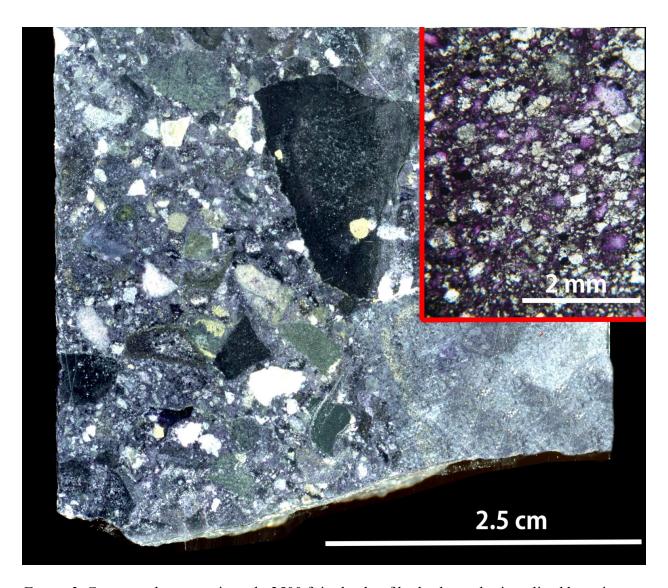


Figure 2. Core sample, approximately 2500 ft in depth, of hydrothermal mineralized breccia at top of Hicks Dome intrusion. Purple color is due to fine-grained fluorite. Inset in upper right shows a thin-section of core with purple fluorite and colorless dolomite in plane-polarized light.

THE MINERALOGY OF THE GEM-BEARING PEGMATITES AND HYDROTHERMAL VEINS AT PHNOM BAYONG, KIRIVONG, TAKEO PROVINCE, CAMBODIA. *P.C. Piilonen, I. Lykova, G. Poirier, and K. Shepherd*, Research & Collections Division, Canadian Museum of Nature, Ottawa, Ontario, K1P 6P4, Canada.

Cambodia, along with Laos, southern parts of Vietnam, and the eastern part of Thailand, is part of a larger tectonic unit called the Indochina Block. This block of continental crust, which includes sediments, igneous intrusions and gem-bearing Cenozoic basalts, has remained intact and stable since the end of the Indosinian orogeny (~210 Ma). Phnom Bayong is a 71 Ma granodiorite intrusion located approximately 120 km south of Phnom Penh, Cambodia, close to the Vietnam border. The locality is well known among locals as a source for gem pale blue and colourless, euhedral topaz up to 8 cm (fig. 1), aquamarine up to 8 cm, smoky quartz up to 1 m,

and green fluorite, and has been mined by artisanal methods for more than a decade. Field work at Phnom Bayong has revealed the gem minerals to occur in pegmatitic pockets, elongate or lobate pegmatite lenses, and, in the case of the gem fluorite, in massive subparallel veins 20 cm wide. Aplitic units are common on the edges of the lenses and pockets, along with graphic granite (fig. 2). The dominant pocket mineralogy mimics that of the host rock – predominantly quartz, alkali feldspar and albite, along with a primary Li-Mn mica and a second generation of muscovite. Accessory phases include black tourmaline (sprays up to 10 cm) in massive quartz veins, subhedral cassiterite (0.5 cm), pyrite (as inclusions in quartz), molybdenite, sphalerite, arsenopyrite and secondary amphibole.



Figure 1. Rough (left -3.5 cm, right -2 cm) and cut (24 carats) topaz from Kirivong, Takeo.



*Figure 2*. Lenticular pegmatite body showing quartz core and graphic texture in monzogranite, Kirovong, Takeo, Cambodia.

**BLUE HEMIMORPHITE CRYSTALS FROM THE OJUELA MINE, DURANGO, MEXICO 2020.** *J. Rakovan*<sup>1</sup>, *A.J. Sommer*<sup>2</sup>, *and D. Trinchillo*<sup>3</sup>, <sup>1</sup>Dept. of Geology and Environmental Earth Sciences, Miami University, Oxford, OH, 45056; <sup>2</sup>Department of Chemistry and Biochemistry, Miami University, Oxford, OH, 45056; <sup>3</sup>Fine Minerals International, 11 Progress St., Edison, NJ 08820.

In the late summer of 2020 a remarkable find of intense blue hemimorphite crystals from the Ojuela Mine, Durango, Mexico appeared on the market (fig. 1A). The primary public debut of these specimens was at the satellite shows associated with the 2020 Denver Gem and Mineral Society show (which itself was canceled because of COVID-19). Although vivid blue hemimorphite is known to occur elsewhere, all previously recognized specimens are of very fine-grained, polycrystalline crusts. Large single crystals with this intensity of color are new, engendering interest in the cause of the blue color. A dozen samples, acquired in Denver were sent to Miami University for analysis. Confocal Raman spectroscopy (using a 633 nm wavelength laser on a Renishaw In-Via Raman microscope), scanning electron microscopy (SEM) with energy-dispersive X-ray spectroscopy (EDS), powder X-ray diffraction (PXRD) and optical microscopy were used for examination of the samples. Although many of the hemimorphite crystals appear to have an even color, numerous crystals show an uneven distribution of a blue surface coating (film). On larger crystals the coating appears to concentrate

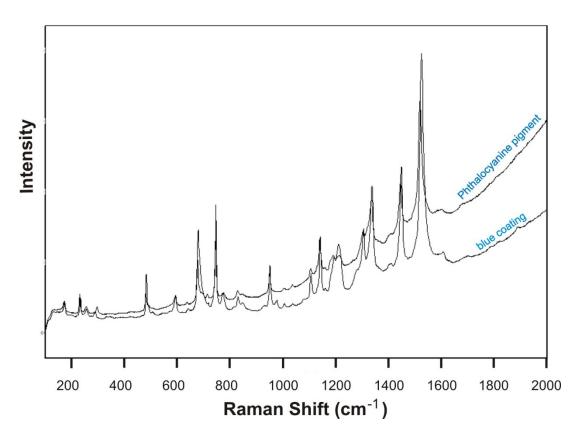
in crystal surface depressions, e.g. striation troughs and around the edges of intergrown crystals (fig. 1B). In some places the coating is much thicker. It is these areas of thicker coating that were analyzed most closely. Several complete crystals with a thicker than typical coating were powdered for PXRD. Both areas of thick coating and seemingly clean portions of hemimorphite were analyzed by Raman spectroscopy.

The PXRD data show only the presence of hemimorphite. This may be the result of the low concentration of the blue coating material or lack of crystallinity. Given the amount of hemimorphite relative to the coating, the former is suspected. Chemical analyses via EDS in the SEM were taken on multiple spots over representative crystals. Where the coating was most concentrated, Cu in addition to the main constituents of hemimorphite (Zn, Si, O) was detected. Raman spectra, collected with a 50 µm laser spot size, allowed signal acquisition from just the

coating in concentrated areas. The Raman pattern from the blue film shows a perfect match with the synthetic pigment Phthalocyanine Blue BN. Interestingly, the strongest Raman bands from Phthalocyanine Blue BN are observed in the data collected on the white portion of the same crystal (i.e. where the film is not visible) suggesting a small amount of residual Phthalocyanine Blue BN remains. This pigment is known for its resistance to the effects of alkalis and acids, and is insoluble in most solvents including water, alcohol, and acetone. Raman spectra collected by others (shared with the authors) on homogeneous areas of blue color also exhibit peaks characteristic of Phthalocyanine Blue BN as well as hemimorphite. Because Phthalocyanine Blue BN does not occur naturally we interpret the blue color of these hemimorphite specimens to be anthropogenic. By some means these hemimorphite specimens have been coated and colored by this pigment.

Figure 1. A) Typical specimen of blue hemimorphite crystals from the 2020 find at the Ojuela Mine, Durango, Mexico. 8 cm tall. B) Magnified image of a single hemimorphite crystal with a distinct heterogeneous blue coating that is more concentrated at the contacts where preexisting crystals have been removed. Field of view about 6 mm across. John Rakovan photos.





*Figure 2.* Comparison of the Raman spectra collected from the blue coating seen in figure 1B (lower spectrum) and that of the common synthetic pigment Phthalocyanine Blue BN (upper spectrum).

**A NEW SPODUMENE-RICH PEGMATITE FROM PLUMBAGO MOUNTAIN, OXFORD COUNTY, MAINE.** *W.B. Simmons and A.U. Falster,* MP<sup>2</sup> Research Group, Maine Mineral & Gem Museum, 99 Main Street, Bethel, Maine 04217.

Excavations and core-drilling by Freeman Resources, LLC. has exposed a new albite-quartz-spodumene pegmatite, the Plumbago North pegmatite. The site is in a remote area on the north side of Plumbago mountain, about one mile west of the famous Dunton gem tourmaline pegmatite. It is spodumene-rich with over 50% spodumene in some of the upper portions of the pegmatite. The exposed portion of the pegmatite is composed principally of quartz, albite, muscovite, and spodumene. Microcline is sparse and occurs in the spodumene zone and rare miarolitic cavities. Montebrasite, beryl, cassiterite, almandine-spessartine series garnets, fluorapatite, and columbite group species are also present. Schorl, lepidolite, and pollucite are very rare. Columbite-group minerals include ferrocolumbite, manganocolumbite, and ferrotapiolite. Triphylite pods up to 50 cm in diameter with associated Fe-dominant secondary phosphate species are scattered across the spodumene-rich zone. Muscovite is enriched in Li and Rb with K/Rb ratios approaching those found in Tanco micas. Notably, spodumene and montebrasite occur in gigantic crystals (figs. 1 and 2). One spodumene crystal exceeded 11 meters in length and crystals over 2 meters in length are common. Montebrasite also occurs in very large single crystal masses. Some exceed 1.5 meters across. These spodumene and

montebrasite crystals are comparable in size to the famous crystals from the Etta and Hugo pegmatites in South Dakota, where 14-meter spodumene crystals and 7-meter amblygonite (likely montebrasite) occur (Rickwood, 1981). These behemoth crystals from Plumbago North rank among the world's largest crystals of their species.

#### **REFERENCES**

Rickwood, P.C. 1981. The largest crystals. *American Mineralogist*, 66:885–908.

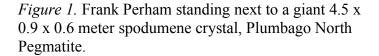






Figure 2. Large 1.5 x 1.5 x 1.5 meter montebrasite crystal, Plumbago North Pegmatite.

THE WHITE ROCK QUARRY, CLAY CENTER, OTTAWA COUNTY, OHIO. <u>C.J.</u>
<u>Stefano<sup>1</sup> and J.K. Brizendine<sup>2</sup>, <sup>1</sup>The Mineralogical Record, 6354 N. Camino los Mochis, Tucson, AZ 85718. <sup>2</sup>20999 West Byron Road, Shaker Heights, Ohio 44122.</u>

The White Rock quarry at Clay Center, Ohio is easily Ohio's most famous and prolific mineral locality. Best known for dark brown "root beer" fluorite crystals, the White Rock quarry has also produced fine cubic fluorite crystals in shades of yellow and brown, often with interesting phantoms. Fluorite from the locality is almost invariably fluorescent with a bluish-white color that is typical of hydrocarbons. Clay Center has also produced fine, white blades of celestine, often in association with the fluorite and/or pale yellow rhombohedral calcite crystals. Although uncommon, twinned tetrahedral orange-red sphalerite crystals from Clay Center are among the better examples of the species in the eastern United States. Increased collector interest in fine fluorite specimens in recent years combined with a significant find by Gail Deck and associates has elevated the locality's visibility in the international mineral collecting community. We have recently honored this classic midwestern locality with an article in volume 51-5 (September-October, 2020) of *The Mineralogical Record*. This short lecture will summarize the history and collector significance of Clay Center which was presented in the article.