Friends of Mineralogy
Pennsylvania Chapter

Fall Symposium, November 9, 2024
Field Trip, November 10, 2024

Green Minerals of Pennsylvania

Presented Online and In Person at
Heritage Hall, University of Pittsburgh - Johnstown, Pennsylvania

Banded malachite from the Jones Mine, Caernarvon Township, Berks County, Pennsylvania, 8.5 cm. Carnegie Museum of Natural History Collection, CM 4894. *Ronald A. Sloto photograph.*

Friends of Mineralogy

Dedicated to the advancement of serious interest in minerals and related activities

We are collectors, professionals, and curators who share a love of mineral specimens and the desire to promote understanding and appreciation of mineralogy.

FM's objectives are to promote, support, protect and expand the collection of mineral specimens and to further the recognition of the scientific, economic and aesthetic value of minerals and collecting mineral specimens.

National FM newsletters, links to other chapters, and much more can be found on their web site: **www.friendsofmineralogy.org**

Friends of Mineralogy - Pennsylvania Chapter

provides:

- the benefits of membership in the national organization
- an annual Symposium in November
- field trips
- quarterly illustrated Newsletter
- an extensive WWW site with news, downloadable books, and more
- **NEW!** Membership in EFMLS with its many benefits

Membership application forms are available on our web site

Please explore the FM-PA web site at
www.rasloto.com/FM/

Symposium Zoom information

The Zoom link is being sent via e-mail. The session opens at 8:00 a.m.

Please join promptly so that the Symposium can begin at 8:30 a.m.

Start by muting your microphone to avoid extraneous noises in the symposium.

Please submit questions via Chat (move cursor near bottom of screen to make line of icons appear).

Professional Geologists: Professional Development Hours

Certificate for 6 PDHs for full lecture attendance available on request.

Green Minerals of Pennsylvania

Friends of Mineralogy - Pennsylvania Chapter Fall Symposium
November 9 & 10, 2024 University of Pittsburgh - Johnstown

SCHEDULE of EVENTS **page**

Friday, November 8: informal MEET & GREET, Sleep Inn, 6:00 p.m.
Saturday, November 9: SHOW 8:30 - 6:00, free admission, Heritage Hall A
Saturday, November 9: SYMPOSIUM, Heritage Hall B, University of Pittsburgh-Johnstown

8:00 to 8:30 a.m. EST	Registration in Heritage Hall lobby	
8:30 to 8:40 a.m.	**Opening Remarks**	
8:40 to 9:30 a.m.	**Ryan J. Kerrigan, PhD, University of Pittsburgh - Johnstown** **Green Rocks of Northwest Portugal – Ultramafic correlations across the Galicia-Trás-os-Montes Zone (GTMZ)**	**4**
9:30 to 10:20 a.m.	**Ronald A. Sloto, PG, West Chester University** **Beryls of Pennsylvania**	**6**
10:20 to 10:30 a.m.	**FM-Pa Members: Chapter Membership Meeting ALSO**	
10:20 to 11:00 a.m.	BREAK- Check out the ***SILENT AUCTION*** and ***MINERAL SHOW***, and don't miss...	
ongoing	**Kyle Trostle, PhD, Snellius Minerals, LLC** **Macroscale Optical Mineralogy demonstration**	**9**
11:00 to 11:50 a.m.	**Robert J. Altamura, PhD, PG, Consulting Geologist, State College, PA** **Serpentine, an uncommon green rock-forming mineral, and its occurrences in the Appalachian Mountains with an emphasis on Pennsylvania**	**10**
11:50 a.m.-1:20 p.m.	LUNCH BREAK - lunch at UP-J cafeteria / student union, (no cash; debit or credit card only) or local restaurants Silent auction continues until 1:20 - Room open during lunch	
1:20 p.m.	Silent Auction ends	
1:35 to 2:15 p.m.	**Tomer Shapira** **Recent Discovery of Large Diopside Crystals from the Cascade Slide Area, Essex County, New York**	
2:15 to 2:50 p.m.	BREAK	
2:50 to 3:40 p.m.	**Ross D. Elliott, PG, Delaware Mineralogical Society (presenter)** **Pyromorphite- the Famous Phoenixville Lead-zinc Mines**	**12**
3:40 to 4:30 p.m.	**Bill Stephens, PG, Stephens Environmental, FM, FM-PA, & EFMLS** **Geology & Mineralogy of the now famous Wavellite Occurrence, National Limestone Quarry, Mount Pleasant Mills, Snyder County, PA**	**14**
4:30 to 4:50 p.m.	**Field Trip information**	**16**
4:50 to 5:00 p.m.	Distribution of Professional Development Hours certificates to PGs	

Sunday, November 10: FIELD TRIP to collect & learn: Mount Pleasant Mills Quarry: road map 20
10:00 a.m. to 4:00 p.m. **For Symposium Registrants Only.**
2.5 hour drive from Johnstown; meet at Quarry at 10:00 a.m.

Green Rocks of Northwest Portugal – Ultramafic correlations across the Galicia-Trás-os-Montes Zone (GTMZ)

Ryan J. Kerrigan, PG, PhD
Department of Geoscience and the Environment, University of Pittsburgh at Johnstown, 450 Schoolhouse Road, Johnstown, PA 15904

The geology of the northwest Iberia includes of a series of thrusted massifs that have been isolated from each other by erosion (allochthonous klippes) and are collectively known as the Galicia-Trás-os-Montes Zone (GTMZ). The GTMZ comprises five main massifs: Malpica-Tuy in western Iberia; Cabo Ortegal and Órdenes massifs in northwest Spain; and Bragança and Morais in northeast Portugal. Mineral assemblages reveal a polycyclic metamorphism that has imprinted evidence of several tectonic collisions. Precambrian signatures are overprinted by at least two high-grade metamorphic episodes. The units present in the GTMZ show evidence of a burial-exhumation cycle during the Cambrian-Ordovician (500-480 Ma) in a subduction arc on the edge of Gondwana. More recent signatures represent terrane accretion and continental collisions between Gondwana and Laurussia during the Variscan Orogeny (400-370 Ma). Tectonic collisions resulted in the creation of large nappe folds, which transported allochthonous units onto the Gondwanan margin (now Iberia). Subsequent uplift and erosion have exhumed the massifs to reveal tectonically dismembered "islands" of allochthonous material resting atop the autochthonous country rock. Despite dismemberment and geographical separation (spanning ~260 km), the massifs of the GTMZ appear to have relatively consistent stratigraphy and assemblages. Most studies in the region have included aspects of geodynamic modeling and tectonic reconstructions. However, few studies have quantitatively connected the units across the GTMZ using petrogenetic diagrams and normalized multi-element variation diagrams. The following study has examined the three main units of the GTMZ (i.e., Lower Allochthonous Thrust Complex; the Northern Ophiolitic Terrane, and Upper Allochthonous Terrane) and their associated subunits to quantitatively link petrologic fingerprints found in trace element geochemistry. Correlations across the GTMZ will provide clearer regional tectonics.

Biography

Dr. Ryan Kerrigan graduated from Bridgewater State University with a B.S. in Geology and B.A. in Chemistry before attending the University of Minnesota for his M.S. in mineralogy/petrology. Dr. Kerrigan moved to the University of Maryland to complete his Ph.D. in experimental petrology. After his Ph.D., Dr. Kerrigan spent four years in the private sector completing environmental site assessments and remediation projects where he earned his Professional Geologist's license. In the Fall of 2014 Dr. Kerrigan joined the faculty at University of Pittsburgh at Johnstown and is now an Associate Professor and Chair of the Department of Energy and Earth Resources. In 2023 Dr. Kerrigan was the recipient of a Fulbright Scholar Award to support his sabbatical at the University of Lisbon in Portugal. Dr. Kerrigan's current research interests include: hydrothermal alteration of ultramafic/mafic rocks, the petrogenesis of granitic and pegmatitic bodies, provenance of orogenic emplacement formations, geology of the central Appalachian Piedmont, and pedagogy in the geological sciences.

Folded green rocks (peridotites)!!! of the upper allochthonous terranes, SW of Carrazedo, NE Portugal

Me at Sintra, west of Lisbon, Portugal

Beryls of Pennsylvania

Ronald A. Sloto, PG
West Chester University

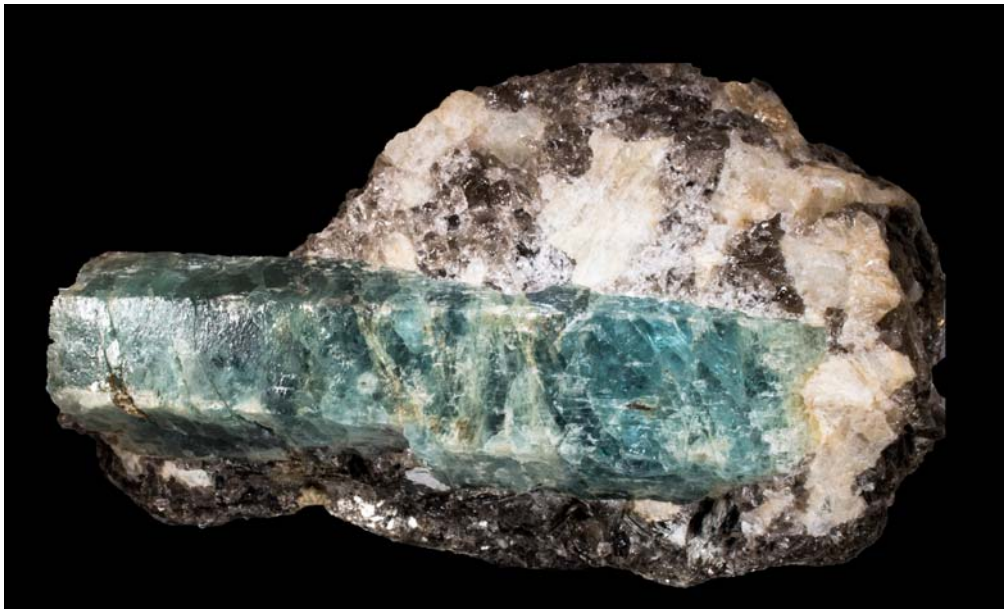
Beryl from Deshong's Quarry, Leiperville, Ridley Township, Delaware County, Pennsylvania. 4.9 cm. Bryn Mawr College Vaux collection V5151.

Beryl, a beryllium aluminum silicate, is a rare and much sought after mineral in Pennsylvania. It occurs only in the southeastern part of the state. Beryl is found in pegmatites in Proterozoic rocks south of the Mesozoic Basin. It has been collected from pegmatite outcrops and pegmatite dikes encountered in quarries. Beryl forms hexagonal crystals in various shades of green, yellow, and brown. Several occurrences are described in Chester, Delaware, and Montgomery counties. Beryl also has been found in the City of Philadelphia. The most famous beryl localities include the Leaper and Dehong Leiperville quarries, the Avondale (Delaware County) quarries, and the Boothwyn area, all in Delaware County.

Biography

Ron Sloto is on the research faculty of West Chester University. He serves as the curator for the mineral collection at the University, and is the Director of the WCU Geology Museum. He conducts research on the mineralogy of southeastern Pennsylvania. Ron Sloto retired from the U.S. Geological Survey in January 2015 after a 41-year career that included publication of over 80 reports, journal articles, and abstracts. The HYSEP hydrograph-separation computer program he developed is in worldwide use. Ron has been a mineral collector since the age of 5 and also has a keen interest in history. He has published books on the mining history and mineralogy of Chester County ("The Mines and Minerals of Chester County, Pennsylvania"), Berks County ("The Mines and Minerals of Berks County, Pennsylvania"), Montgomery County ("The Mines and Minerals of Montgomery County, Pennsylvania"), Bucks County ("The Mines and Minerals of Bucks County, Pennsylvania"), and recently, Delaware County ("The Mines and Minerals of Delaware County, Pennsylvania"). He is currently working on a similar effort on Philadelphia County mining history and mineralogy. He is a frequent contributor to the Friends of Mineralogy Pennsylvania Chapter and FM National newsletters. His most recent publication is "Phosphate Minerals from Lime Ridge, Snyder County, Pennsylvania" in the September-October 2022 issue of The Mineralogical Record.

Beryl from Leiper Quarry at Avondale, Springfield Township, Delaware County, Pennsylvania. Larger crystal is 1.7 cm. Sloto collection 1057.



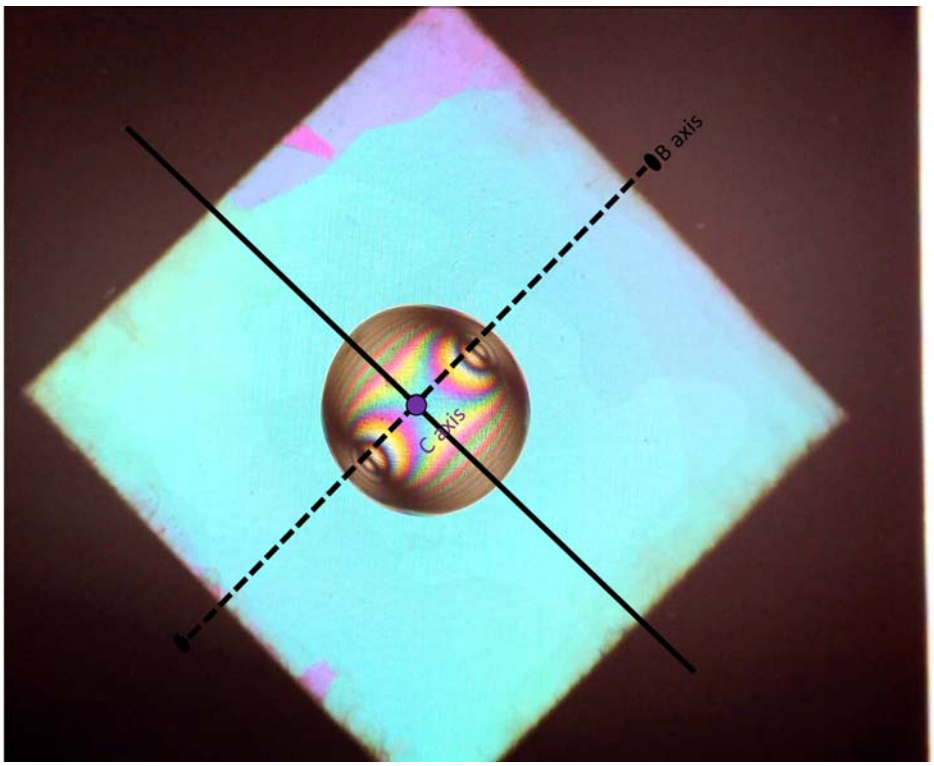
Beryl from Leiperville, Ridley Township, Delaware County, Pennsylvania. 4.5 cm. Carnegie Museum of Natural History collection CM34183 (Academy of Natural Science of Philadelphia collection 7355).

– NOTES --

Macroscale Optical Mineralogy

Kyle Trostle Ph.D.
Snellius Minerals LLC

Snellius Minerals LLC seeks to make educational teaching aids to help students and educators understand optical mineralogy while demonstrating yet another way that minerals can surprise and delight! I have found that the hardest part of a mineralogy course tends to be the optical mineralogy section, where so many three dimensional concepts need to be brought together (mineral structure, symmetry, and optical properties). Many mineralogy courses use a polarized light microscope along with oriented thin sections and grain mounts to teach optical mineralogy. However, using a polariscope along with oriented mineral cubes, slices, and plates allows for direct three dimensional manipulation of samples and a better understanding of how mineral structure, symmetry, and optical properties relate. A polariscope and oriented mineral specimens are also inexpensive comparatively, making this technique accessible to everyone while also being visually striking. If you would like to see a demonstration of mineral optics or you have your own transparent crystals that you want to examine with a polariscope, stop by!



Oriented Image of Muscovite Plate with Crossed Polarizers and Converging Lens

Serpentine, an uncommon green rock-forming mineral, and its occurrences in the Appalachian Mountains with an emphasis on Pennsylvania

Robert J. Altamura, PhD, PG, Consulting Geologist, State College, PA

Serpentine forms from the alteration of magnesium-rich olivine and pyroxene. Serpentine is a mineral composed (in an idealized case) of magnesium, silicon, oxygen and hydroxyl ($Mg_3Si_2O_5(OH)_4$). Serpentine's physical properties include a predominant green color but may be yellow and rarely purple. Common habits include a massive appearance or a relatively coarse columnar or threadlike appearance (see figures 1-3). Other useful physical properties that can help with field identification are a greasy, waxy, or silky luster; a fracture that can be uneven, somewhat conchoidal, and/or splintery (picrolite and chrysotile); yellow variety of serpentine may fluoresce a cream-white color under shortwave UV light (Kerr, 1977). Serpentine has three polymorphs (antigorite, lizardite, and chrysotile) that may require X-ray diffraction (XRD) analysis (preferred), scanning electron microscopy (SEM), or optical mineralogical study to distinguish.

Figure 1. Serpentine: Antigorite polymorph. H&K Penn/MD Quarry, Peach Bottom, PA. D. Glick sample.

Figure 2. Serpentine: Antigorite polymorph, columnar variety referred to as 'picrolite.' H&K Penn/MD Quarry, Peach Bottom, PA. Approx. 4 inches across. D. Glick sample.

Figure 3. Serpentine: Chrysotile polymorph, Brazil. Scale unknown. *Photo: Eurico Zimbres (https://commons.wikimedia.org/wiki/File:Chrysotile_1.jpg),"Chrysotile 1", https://creativecommons.org/licenses/by-sa/2.5/legalcode*

As a silicate, serpentine's crystal structure is made up of silica tetrahedra (SiO_4) that serve as building blocks for essentially all silicate minerals. In the case of serpentine, silica tetrahedra are arranged in sheets where basal oxygen atoms are bonded in a repeating array of 6-member rings. Silicate sheets (T layers) are bonded to octahedral (O) layers comprised of a metal ion coordinated to oxygens and hydroxyl radicals (6 anions in total). Silicates with this basic structure are referred to as phyllosilicates, and include numerous clay mineral species (e.g., kaolinite, montmorillonite) and members of the mica group (e.g., muscovite, biotite). Some clay minerals, including serpentine, are referred to as **T-O** phyllosilicates, as the T-O unit cell repeats along the c- crystallographic axis (see Figure 4).

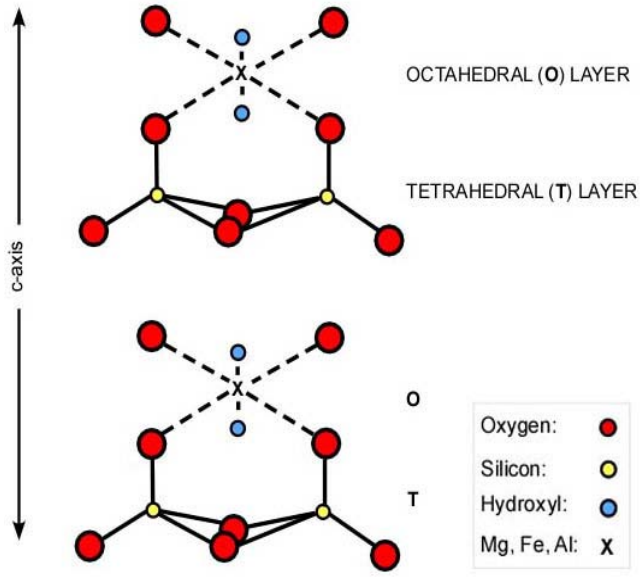


Figure 4. Crystallographic model of kaolinite-serpentine group minerals.

Serpentine has been grouped with kaolinite by the International Mineralogical Association Commission on New Minerals, Nomenclature and Classification (IMA-CNMNC) because they share the same crystal structure. Although mineral species in the kaolinite-serpentine group share this common T-O structure, they may vary in chemical composition or crystal form. Some clay minerals and members of the mica group have a crystal structure that is characterized by **T-O-T** layering packages which also repeat along the c-axis (Figure 5).

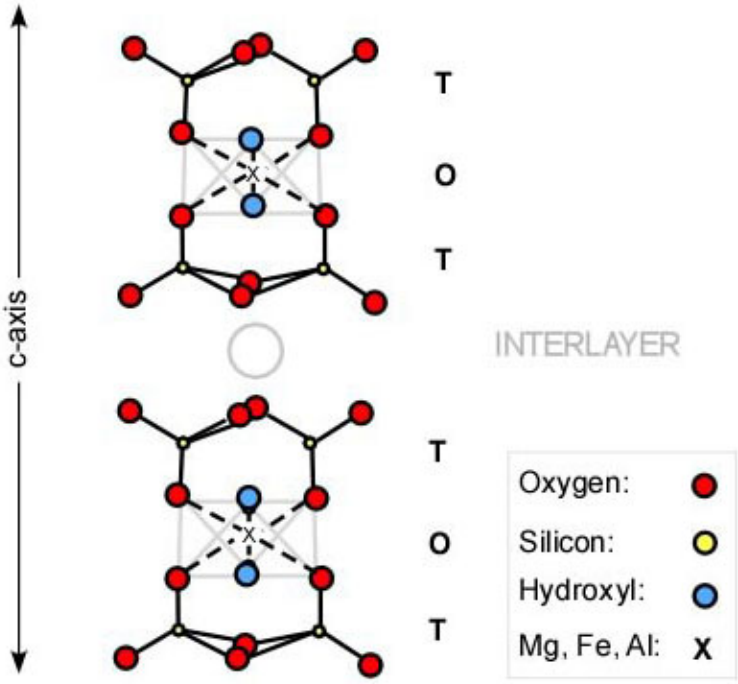


Figure 5. Crystallographic model showing TOT layering characterizing many clay minerals and mica-group minerals.

The geological occurrences of serpentine rocks are alteration of primitive ultramafic rocks (e.g., peridotite and pyroxenite) that accumulated by fractionation of complex magma by crystal settling - or that were derived from the upper mantle by partial melting and would represent the refractory residue of such a process. Such rocks might be emplaced in the solid state or in a semi-solid state. With the advance of the mechanism of seafloor spreading at divergent plate boundaries by Harry Hess (1962), partial melting of mantle material to generate peridotites in this way could be envisioned more clearly. And with the further evolution of plate tectonic theory later during the 1960s, a convergent model for the emplacement of intrusive peridotites into the Appalachians (including the PA-MD state line serpentinites) and into other mountain belts of the world, could logically attempt to explain alpine-type occurrences of serpentine rocks.

References cited

Hess, H., 1962, History of ocean basins, *in* Engel, A.E, James, H. and Leonard, B.F., editors., Petrologic Studies: A Volume to Honor A. Buddington, Geological Society of America, p. 599-620.

Kerr, P.F., 1977, Optical mineralogy: McGraw-Hill, Inc., New York, 492 pages.

Biography

Robert Altamura, a Ph.D. graduate of the College of Earth & Mineral Sciences at Penn State, arrived in central Pennsylvania from Middletown, Connecticut, as a graduate of Wesleyan University and as a freelance consultant to the Connecticut Geological Survey as well as several New England mining companies. He has been a professor at several universities in the northeast and in California. He is a licensed professional geologist and has authored approximately 100 publications. He is semi-retired and currently teaches for OLLI at Penn State. He has been studying the geology of Pennsylvania for more than 30 years. His recent publications and current research focus involve active tectonics in New England and offshore.

Pyromorphite - the Famous Phoenixville Lead-zinc Mines

Presented by: **Ross D. Elliott PG; VP Delaware Mineralogical Society**

Prepared by: **Bill Stephens, PG, Stephens Environmental, President; FM-PA Chapter President; FM-National President; EFMLS Region IV & V RVP**

With Contributions from: **Ronald A. Sloto, PG, West Chester University**

Abstract

This talk delves into the fascinating world of pyromorphite, a unique lead phosphate mineral renowned for its striking green hues and intricate crystal formations. We will explore its chemical composition, formation processes, and distinguishing features that make it a sought-after specimen among mineral collectors. Our journey will take us to the historic Wheatley-Chester Lead Mine district, located in Phoenixville, Pennsylvania, representing a significant and unique site of historical and geological interest in the context of 19th-century mining practices in the Eastern United States. By examining both the mineral and its historical backdrop, attendees will gain a deeper appreciation for pyromorphite as a natural wonder and its role in the legacy of mining in south east Pennsylvania.

Summary

The famous Phoenixville District orebodies yielding world class pyromorphite specimens were initially discovered by Charles Pickering who arrived here from England with William Penn. Charles Pickering thought he had discovered silver ore, in the sands of Pickering Creek while exploring up the Schuylkill River. In 1682 he obtained a grant of 5,358 acres known as Pickering or Mine Hole Tract. Returning with a miner named Tinker, at a place now called 'Tinker Hill' they mined enough ore for eight flour barrels and shipped them for assay, which may not have been favorable as mining never commenced until 170 years later (Sloto, 2009).

R. Sloto photograph

In 1850 Charles Wheatley, manager of the Perkiomen mines, found an abundant lead vein around Tinker Hill, including pyromorphite, while prospecting on the John Williams farm. Afterward he leased 46 acres, and mining progressed in the district until the company declared bankruptcy in the Panic of 1857 (Sloto, 2009). The Wheatley mine was the most extensive and productive of the mines in the area. The lead mining boom of the 1850s produced "some of the finest lead minerals the world had ever seen. Especially notable, and best known to collectors is the bright green pyromorphite from the Wheatley Mine." (Sloto, 1989). In Exhibition at the Crystal Palace at the New York exhibition of 1853, Wheatley's collection from his mines was described as the most magnificent in the world and unequal to anything we have seen in Europe and was awarded the highest medal (Sloto, 2009).

Afterward mining in the district renewed during the Civil War. Mining operated under the New York and Boston Silver Lead Company, with Wheatley as manger, but records of operation are non-existent after 1865, and mining have ceased completely in the 1870's when Wheatley fell ill in 1870 and declared bankrupt shortly after. The mines were not operated for several decades until activity briefly resumed from 1917-1920, and the shaft was re-timbered at the Wheatley lode under the Eastern Mining and Milling Company (Sloto, 2009). No mining activity has occurred since then.

The Wheatley Lode was re-evaluated as part of the US Bureau of Mines strategic assessment of mineral deposits following WW II, and 2,280 ft of core hole were drilled, and described by Reed (1949, p. 7-11), as containing no significant lead and zinc mineralization, but one hole penetrated 4.5 ft of open stope, and 5.5 ft of vein rock at approximately 208 feet below ground surface, and below this about 13 ft penetrated a 6-inch vein of massive sphalerite. Smith (1977, p. 269-270) believed the drill holes may not have been located well enough and may not have reached the vein if the vein dipped more steeply than believed.

Beneath the gossan zone at the surface, shallow zones of pyromorphite constituted the majority of the lead ore, which may account for the abundance of pyromorphite in the dumps. Many superior specimens of pyromorphite from the Phoenixville District reside in world class private and museum collections around the world. Today, the Wheatley dumps are on private property and are closed to collecting. The Brookdale and Chester mines reside on a golf course which does allow collecting. The Brookdale dumps around the old steam engine stack are picked over, but still produce micros. The Chester dumps, if one can find them, still produce nice thumbnail to small cabinet size specimens.

References

Reed, D. F., 1949, Investigation of Pickering Creek lead-zinc deposits, Chester County, Pennsylvania: U. S. Bur. Mines Rept. Inv. 4451.

Sloto, Ronald A., 1989, The Phoenixville Lead-silver Mines, Chester County, Pennsylvania: Mineralogical Record, v. 20, September-October 1989, p. 369-386.

Sloto, Ronald A., 2009, The Mines and Minerals of Chester County, Pennsylvania. [The definitive work on the subject matter for the County. Available from Amazon.com along with a supplement containing color photographs]

Smith, Robert C. II, 1977, Zinc and Lead Occurrences in Pennsylvania: PA Geol. Survey 4th Series, Mineral Resource Report 72 (M 72), 318 p. [Contains essential maps included herein and used to georeference the old mine locations]

Note: Other resources, particularly for photographs of significant specimens, can be found on the web on sites such as MinDat. [PA Geol. Surv. G-33 is out of print and unavailable]

Biography

Ross D. Elliott, PG, is a licensed Professional Geologist and for the past ten years has worked as a hydrologist for the State of Delaware Department of Natural Resources and Environmental Control Waste and Hazardous Substance Remediation Section, specializing in groundwater remediation and petroleum cleanup. Ross served as the EPA Region III representative for the Association of State and Territorial Solid Waste Management Officials Tank Leaking Underground Storage Tank work group. In addition to these duties, Ross manages the States Heating Fuel Underground Storage Tank Assistance Program.

Ross studied geological sciences at the University of Delaware with a bachelor's in Geological and Earth Geosciences and a minor in coastal and marine geomorphology. Ross is a licensed Professional Geologist in Delaware. Before working for the State, he was a field geologist for the environmental engineering firm Environmental Alliance Inc. Previously, he worked at the Delaware Geologic Survey as a research assistant for the State Map Program publishing the Geologic Map of Millington, Claymont and Smyrna Quadrangles, Delaware. In addition, for the past ten years he has served as the Vice President for the Delaware Mineralogical Society and serves as chair of field trips for DMS and FM-PA.

Geology & Mineralogy of the now famous Wavellite Occurrence, National Limestone Quarry, Mount Pleasant Mills, Snyder County, PA

by Bill Stephens, PG, President
Stephens Environmental Consulting, Inc.
FM-PA Chapter President & FM-National President
EFMLS Region IV & V RVP

Many of you are aware of the Wavellite deposit at the National Limestone Quarry at Mount Pleasant Mills (NLQ-MPM), Pennsylvania, located approximately 40 minutes north of Harrisburg in Snyder County, PA. This quarry mines limestone mainly of the Keyser and Tonoloway Formations that occur within Lime Ridge. Like many quarries exploiting these formations, minerals such as calcite, dolomite, strontianite, celestite and fluorite are found at this quarry and have been of interest to collectors for decades. The discovery of wavellite in 2000 by the owner has piqued interest in this particular location.

Many of you have seen my PowerPoint presentations on wavellite at least once ☺. For those of you that haven't and by way of refresher for those that have, "green" was discovered by the Mount Pleasant Mills quarry owner Eric Stahl in the early 2000's while clearing a perimeter roadway on the upper bench of the quarry along the southerly property line. He invited a local rockhound/expert collector or two to investigate, they did some digging and confirmed the species to be wavellite. They mined a bit, word got out and clubs began asking permission to come and dig.

Wavellite and associated species identified (and confirmed by laboratory testing by Ron Sloto) at the site including planerite, turquoise, variscite, vauxite and cacoxenite, all of which are phosphates, largely of mineralogical interest. Although non-specimen grade wavellite had been mined around the turn of the 20th century at another site in Pennsylvania to make matches, that small processing facility blew up and that was that! (Stefanic, Michael, Master's Thesis) These phosphates occur in siliciclastic rocks of the Ridgeley member of the Old Port Formation, which is younger than the Keyser Formation it overlies. The beds of the Ridgeley that contain wavellite occur in a relatively narrow zone of near vertical dipping beds that run roughly parallel to the perimeter road along the southern quarry boundary.

The type and classic locality for specimen quality wavellite in the US is in Arkansas, and pretty much any mineralogy/mineral book you pick up that has example photographs of wavellite will show a color specimen from Arkansas. What we now realize is that specimens from NLQ-MPM rival any from Arkansas in size and quality, and the deposit is just being explored. MPM wavellite was not documented in the literature beyond an abstract two paragraphs long in a proceedings book (Rochester I believe) from the mid-2000's until Ron Sloto published his article on the Phosphate Minerals of Lime Ridge in a recent issue of the Mineralogical Record (Vol. 53, September - October, 2022).

I first visited this site in 2015 (I think) and had great success. I went back several times as the first time the adit was open and we were able to get at the veins in solid rock, not spoils. I and others got some killer specimens. I prepared my first PowerPoint presentation that year and have updated and amended it almost every year since. Our understanding of the deposit has been greatly enhanced by two machine digs I conducted, the first in March of 2022 with Ryan Klockner of Geology365 and current President of FM-NJ Chapter, and the second in March of this year (2024) with Tommy Greene (a.k.a. "The Craft Miner") of the North Jersey Club.

During the 2022 dig, machine-assisted excavation and documentation of wavellite veins was conducted 5 days over a period of about a month, with other geologic work ongoing.

Mapping of the entire quarry was accomplished by drone mapping mission following the 2022 machine dig, with surveyed ground control points employed to constrain the 3D model and orthomosaic. There were some problems with the model due to the relief and some contours are off a few feet, but the mission was largely a success and yielded very high-resolution color orthomosaic and snapshot of the quarry just before the latest shot.

Following the 2022 dig, additional structural data including strike and dip measurements on bedding, joints and fractures were taken remotely by Total Station and calculated using a spreadsheet developed by Oneida University and modified by myself for field application. This "proof of method concept" was also applied at the New Paris Quarry with great success and demonstrates how structural measurements can be taken with the corresponding position coordinates for those areas inaccessible for direct measurement. The structural analysis is ongoing, but what has become clear, and what we will show, is that mineralization of collectible crystals in both the quarry and the Ridgeley member of the Old Port Formation is controlled by brittle

deformation events. Phosphate mineralization appears to be a post-Alleghenian epigenetic event, associated with renewed tectonism of undetermined age.

The 2024 machine dig moved from the easterly limits of the west pit approximately 35 feet east and as much as 20 feet below the level of the road. Mr. Andrew "Rockhound" Eppig took off all week to video document the mining effort. Hundreds of specimens were recovered. Of particular note was the general shift in exterior color from dark green to yellow. Though Ryan's 1 inch yellow ball matrix specimen remains the largest free standing individual crystal, many others were discovered and yellow became the dominant color in a zone we refer to as the "Lemon Drop" zone. That zone was completely dug out during the 2024 machine dig, and the eastern adit was reopened and producing wavellite at the end of our dig. The 2024 machine dig was followed by an exclusive joint field trip hosted by FM-PA and CPRMC, also attended by the Franklin club the first Saturday in April. Approximately 125 individuals were in attendance and many fine specimens were recovered along with a trilobite.

This presentation has been prepared and amended to accommodate this field trip and future field trips to this locality, and to aid in an understanding of the collectible minerals at this quarry. Check out the display case in the atrium hall. The reader is referred to the aforementioned article on the Phosphate Minerals of Lime Ridge by Ron Sloto for phosphate mineralogy as the most current and definitive lab testing and confirmation of phosphate mineral species. Also, on your next visit to the quarry, be sure to check out my poster and all the mineral specimens at the Middleburg Quarry, particularly the large and handsome celestite specimen collected in 2023. Thanks to Eric Stahl for his incredible generosity allowing rockhounds access to this quarry for collecting. Now that access to many locations has been restricted or permanently terminated, Mr. Stahl's singular generosity stands out.

Biography

Bill Stephens is a licensed Professional Geologist (DE, GA, (MS) NC, PA, SC, UT, VA), current President of FM-PA Chapter and FM National, Immediate Past President of the Eastern Federation of Mineralogical and Lapidary Societies, Inc. (EFMLS, 2022-2024) and President of Stephens Environmental Consulting, Inc., a full-service environmental consulting, engineering, and surveying company serving in the Mid-Atlantic Region since 1995. Bill is also the current EFMLS Region IV & V RVP, and a past VP of Programs for the Delaware Mineralogical Society.

Bill holds a BS and MS in Geology from the University of Pittsburgh main campus (1982, 1988). Bill did his master's thesis in northwestern Sonora, Mexico, producing a first generation 1:50,000 scale map of part of the Cucurpe quadrangle. Rocks mapped within Basin and Range faults blocks included 1.1 billion year old pink micrographic granite and older crystalline rocks over brittle deformed clastic and marine rocks of late Jurassic to early Cretaceous age, exposed in a window through Tertiary volcaniclastic and extrusive rocks. Bill has contributed to scholarly articles on his thesis findings as well as other important work, including but not limited to publications on Fort Hollingsworth, a War of 1812 fort in Elkton, MD; periglacial features on the Delmarva Peninsula; and has recently co-authored a privately published book on the discovery of world class "Herkimer Diamond" quartz crystals. Bill has become a sought-after speaker for many clubs as well as providing professional development seminars for the Professional Geologist community and the Maryland Society of Surveyors at their annual conventions.

Bill started collecting about age 11, after being inspired by a National Geographic article on gems of the Eastern Appalachians. Family and later college buddy collecting trips focused on collecting mainly in North Carolina, with incidental trips to southeastern PA locations including Phoenixville, French Creek and Cornwall. More recently Bill has developed a passion for "machine digs", including Diamond Hill, Hogg Mine, sites in Herkimer, and two machine digs for wavellite at Mount Pleasant Mills. Machine digs provide the opportunity to acquire meaningful understanding of these deposits and mining history. Bill has done extensive mapping at Mohawk Valley Mineral Mining in Sprakers, NY and "Area 52" in Canajoharie, both newly opened private Herkimer Diamond mines. Bill has mapped the now regionally famous wavellite occurrence at the National Limestone Quarry at Mount Pleasant Mills, Snyder County PA. Bill uses his resources, including geological knowledge, GIS skills, survey equipment, and drones to develop programs designed to inspire others and help them to be more successful in their collecting adventures.

Photograph 1: View looking easterly at the conclusion of the limited 2022 Machine-Assisted Geologic Exploration of the Westerly (Upper) Wavellite Adit/Pit. Previously existing spoils that were used to build up and berm the road. New spoils that do contain specimens of wavellite overlooked during the exploration. The active workings extend below the cardboard box easterly into the wall. The westerly side of the pit contains no wavellite. Wavellite extends from the lower left (westerly, exposed) shoulder of the excavation to 3 feet off the southerly wall (road), down about 16 feet and easterly toward the easterly pit.

Extent of excavation near the end of the 2024 machine dig. Tommy Greene pointing out wavellite crystals in the breccia zone which is quite soft and crumbly at this depth (fault gouge, weathering).

In addition to the 2024 “lemon drop,” check out some of these pictures of 2022 dig specimens that have only been pressure washed.

Top specimen from the "Lemon Drop" zone, breccia zone, 2024 dig; larger sphere 0.8" diameter.

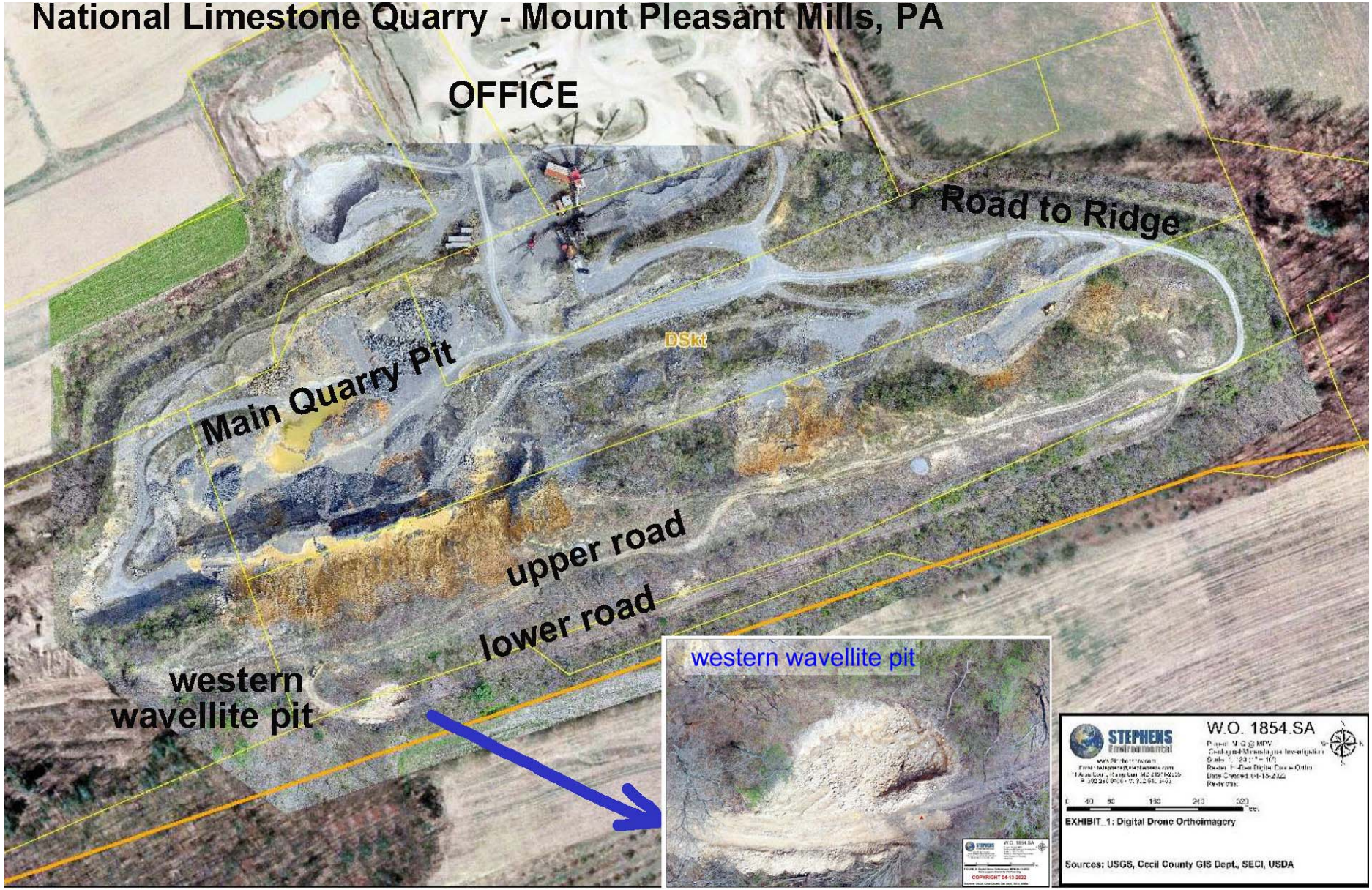
Needs some cleaning but greening. Love the shimmer.

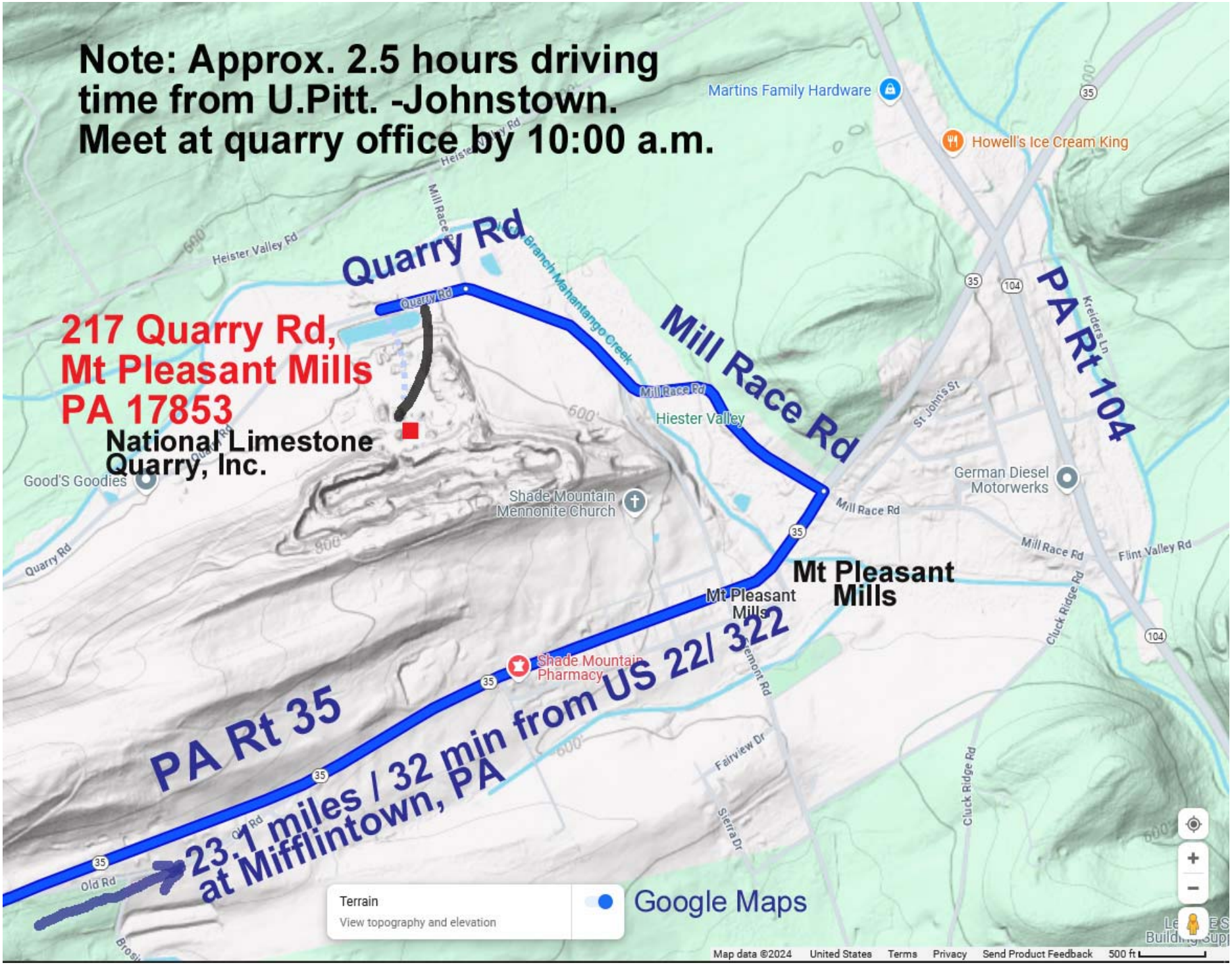
Wavellite “Astroturf”

“Pina Colada”

“Peas Popping”

– NOTES --


National Limestone Quarry - Mount Pleasant Mills, PA
OFFICE
Road to Ridge
DSkt
Main Quarry Pit
upper road
lower road
western wavellite pit
western wavellite pit
STEPHENS
W.O. 1854.SA
EXHIBIT_1: Digital Drone Orthoimagery
Sources: USGS, Cecil County GIS Dept., SECI, USDA


Note: Approx. 2.5 hours driving time from U.Pitt. -Johnstown.
Meet at quarry office by 10:00 a.m.
217 Quarry Rd,
Mt Pleasant Mills
PA 17853
National Limestone Quarry, Inc.
Quarry Rd
Mill Race Rd
PA Rt 104
PA Rt 35
23.1 miles / 32 min from US 22/ 322 at Mifflintown, PA
Mt Pleasant Mills
Martins Family Hardware
Howell's Ice Cream King
German Diesel Motorwerks
Shade Mountain Mennonite Church
Shade Mountain Pharmacy
Good'S Goodies
Hiester Valley
Heister Valley Rd
Branch Mahantango Creek
Flint Valley Rd
Cluck Ridge Rd
Fairview Dr
Sierra Dr
Old Rd
Terrain
View topography and elevation
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