

Friends of Mineralogy Inc. Midwest Chapter Newsletter



Volume 41, Issue 2

March + April 2026

Mineral Corner—Pride from member collections.

Calcite from Pint's Quarry, Raymond, Black Hawk Co., Iowa

By Johan Maertens

Located in Raymond, just east of Waterloo, Iowa, Pint's dolomite-limestone quarry was originally developed by Harold Pint and still bears his name. Over the intervening years, five other operators have worked the pit, the last one Basic Materials Corporation. The quarry produced aggregate for the concrete and road construction industries, in addition to larger material for riprap. Workings were more than 30 meters (100 feet) deep. The quarry closed in the late 1990s. The pit is now filled with water, and the site is off limits to collecting.

Excavation at Pint's quarry exposed more than 30 meters of the Devonian Cedar Valley Formation. Included are 10 meters of the upper member (Coralville), 13 meters of the middle member (Rapid), and 9 meters of the lower member (Solon). The Solon Member is further exposed in the underground part of the workings. The most spectacular mineralization occurs in the Solon, which was first entered in 1964.

Mineralization at Pint's quarry has been studied and described by Garvin (1984). Mineralization resembles that of the Upper Mississippi Valley (UMV) zinc-lead deposits, with galena being very rare. Mineralization is most varied and abundant in the Solon due to its large amount of vugs and possibly the high organic content of that member.

Vug distribution appears to be determined by bedding plane fractures and by partially silicified corals (Garvin, 1984). Although many of the crystal-lined vugs in the Solon give no indication of their origin, a few do. These vugs have outer margins that are silicified, preserving the skeletal structures of various corals. After silicification of the outer parts of the corals, the remaining calcite skeletons were dissolved, producing voids.

Calcite from Pint's Quarry, Raymond, Black Hawk Co., Iowa
Johan Maertens image and collection ©.
Catalog 00QE



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Highlights

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From the Newsletter Editor

The winter season with limited above ground regional collecting opportunities is past us. FM completed two museum visits.

Indoors, I continued working on my rock work shop. This is a multi-year project. A first batch of calcite specimens was sorted in keep for study and dispose. The latter are keepers, yet doubles or no longer in my morphological interest. Decollecting in action.

Time to get out in the field: road cuts, quarries, construction sites, ...

I encourage you to share your discoveries with our community. Whether it's a new find, a memorable story, an event you attended, or even just a photo of your favorite specimen, we'd love to include it in our newsletter. Your contributions will help keep our collective passion for mineral collecting vi-

brant and engaging.

We look forward to hearing from you!

Johan Maertens and Joyce Kish at the Langsdon Mineral



Get Involved: Your Contribution Matters!

Inspired by the famous equation "E=MC²," we believe that our Existence as a thriving organization depends on Member-engagement and Two-Way Commitment. For this to work, we need your active involvement!

Commitment is key. We rely on members to stay connected with officers and committee chairs, while it's equally important that our leaders respond promptly to your inquiries. To keep things running smooth-

ly, we need members who are ready to answer the call for action and step up in leadership roles.

The Friends of Mineralogy needs fresh energy, new ideas, and passionate individuals to help us grow. There are several open leadership positions, and it's crucial that we fill them with dedicated volunteers like you. Just as a body needs all its parts to function—arms, legs, back, and heart—our organization thrives when we all contribute. Together,

we can build the resources we need, from insurance to training to credibility, that allow us to enjoy and advance our shared passion for mineralogy in ways no individual could do alone.

This is your opportunity to make a real difference. Help shape the future of the Friends of Mineralogy and take an active role in our community. Whether you have leadership experience or a passion for helping others, there's a place for

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Opinions expressed do not necessarily reflect the views and policies of the Friends of Mineralogy. We reserve the right to decline any submission judged to be inconsistent with FM-MW's purpose or not in keeping with the sensitivities of its membership.

Contributions of articles and photos are welcome: Articles may be edited for style, clarity, and length. The newsletter assumes no responsibility for lost mate-

rial. **SUBMISSION DEADLINES:** the 15th of every evenly numbered month, for each issue.

Guidelines for Newsletter Submissions: E-mail preferred (written material accepted); clearly state that the submission is intended for publication in the Newsletter; send photos as color, high resolution email attachments.

Send all submissions and suggestions to

newsletter@fommidwest.org

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Field Trips

Field trip details are communicated by email to members.

Inquiries with quarries are ongoing.

Field trips :

Sylvania Minerals (July 11)

[Hogg Mine \(Memorial Day Weekend\)](#): see details in this newsletter

To offer a field trip you can organize, contact the Field Trip Chairperson or a FM MW officer (see below).

For your education, watch Collector Safety Training videos by Scott Kell on YouTube. See [FM-MW newsletter Volume 39 Issue 2](#).

FM-MW Fieldtrip Requirements

1. Be a FM-MW Member in good standing to participate.
2. All field trips are weather dependent per decision of quarry supervisor.

pervisor.

3. Field collecting is physically demanding! All trips require at least an average level of physical fitness!

4. Quarry trips require members to be at least 18 years old, and fully comply with the FM-MW field trip guidelines posted on <https://www.fommidwest.org/field-trip-guidelines/>

Complete and sign the Waiver of liability and hold harmless agreement for activities (including field trips) of the Friends Of Mineralogy – Midwest Chapter Inc.

After receiving the announcement, sign up for the field trip by email to the acting Field Trip Coordinator.



MSHA Hazard Training

ALWAYS bring your **certificate of training Mining Safety and Hazard** with you to all quarry field trips.

If you did not complete Hazard training, or you lost your certificate or if you are new to the club, then you can **take the online safety training course**.

To sign up and receive instructions about the online course, contact Craig Kramer at craigwkramer@gmail.com with the following information in your email:

- club affiliation
- full name
- address
- telephone number

Website for test : <https://edpuzzle.com>

If you have taken the class before online .go to test website. Top right click Log In. Select **I'm a student**

Rock and Mineral Shows, Clubs, Rock Shops, Mineral Museums can be found using the Internet www.rockandmineralshows.com;

<https://xpopress.com/show/exposearch>;

<https://www.mindat.org/museums/>;

https://www.mindat.org/shows.php?frm_id=searcher&cform_is_valid=1¤t=1&country=1&su

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Continued from page 1—**Pint's Quarry, Raymond, Black Hawk Co., Iowa**

Subsequent mineralization of the pockets often occurred directly on the silicified coral.

Almost all significant mineralization occurs in vugs, rather than in joints. Even though jointing is prominent in the host rock, the joints usually carry only an iron oxide stain.

Pint's quarry produced collectable specimens - found in the lower levels of the quarry in the Solon Member of the Cedar Valley Formation - of fluorite, marcasite, pyrite and calcite, with sphalerite and barite often providing additional interest. It is not uncommon to find four well-crystallized species on a single miniature.

Calcite is the most abundant mineral in the vugs and occurs as rhombohedrons, white "dog tooth" scalenohedrons and a combination of scalenohedron and prism.

A high percentage of pockets in the quarry are completely lined with calcite crystals, which in turn are dotted with crystals of other species. The calcite at Pint's quarry is usually colorless to white, with occasional pale amber-colored crystals or massive pieces. Infrequently, an entire vug of calcite will be covered with a thin dark brown film that gives an appearance of iridescence. Because the vug size ranges up to half a meter, some large calcite crystals occur. While rare, perfectly-formed calcites up to 25 cm in length, commonly with included sulfides, have been found.

Pale-amber to brown and rarely clear fluorite associated with calcite and pyrite occurs in vugs in the Cedar Valley Limestone (Horick, 1974).

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Stinchfield, Rick, Anderson, Wayne (1989) Pint's Quarry, Black Hawk County, Iowa. The Mineralogical Record, 20 (6) 473-479

Thank you Ed Clopton for reviewing this article.

To share a pride of your collection, share pictures with specimen and locality descriptions with Johan Maertens.

2026 Dues

Annual dues currently are \$20.

Dues are for calendar year January 1st through December 31st

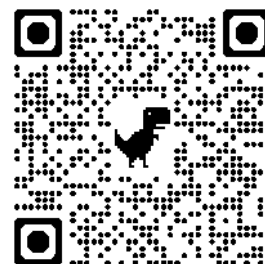
Dues should be paid by January 15th

Dues must be current to participate on FM MW activities.

To register for membership you have 2 options for payment.

1. You may print the form and mail it with your \$20.00 payment
2. You may pay on-line (\$21.00) through our website with a credit/debit card or PayPal. You do not need a PayPal account to use a credit card. Our website has received security verification and certification.

Membership information with [this link](#) or use QR



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Image edits by Johan Maertens.



Calcite. Pint's Quarry, Raymond, Black Hawk County, Iowa, USA. Largest Crystal Size: 28 mm
Doubly-terminated crystal of calcite lying on a calcite-lined vug surface.
Collected June 1986 by Ed Clopton.



Calcite. Pint's Quarry, Raymond, Black Hawk County, Iowa, USA. Largest Crystal Size: 45 mm
Large scalenohedral crystal of calcite 4.5 cm tall. The crystal nearly contacted the opposite wall of the vug.
Collected April 1988 by Ed Clopton



Fluorite with Calcite. Pint's Quarry, Raymond, Black Hawk County, Iowa, USA. 48 mm
Roy Hurlbut collection. Self-collected 1985
Jeff Scovil photo. Reproduce with permission.

Mushrooming Chisels

BY JOHAN MAERTENS

Mushrooming is a common and hazardous condition that affects the heads of masonry chisels after prolonged use.

As the chisel's head is repeatedly struck, the metal deforms and begins to flare outward, resembling a mushroom cap—hence the name. While it may seem like a minor issue, **mushrooming poses serious safety risks** and should not be ignored.

Grind the head or get a new chisel.

Rock Collecting Tools

How and When to Use Them

BY TIM RANEY

From The Collecting Bag, Richmond Gem & Mineral Society, Richmond, VA 7/2024 + 8/2024

Collecting minerals in the field can be hard, fun and rewarding work. Knowing the tools to take with you will make your trip more productive. Depending on the kind of mineral you are going after, you might need something like a garden scratcher tool, a shovel, or pry bar. Sieves, buckets, gloves, boxes, hardhats, and a cushion to sit on can be handy also. Here are the standard items that go with us to the field:

Hand lens A good hand lens, or magnifier, is an essential tool for anyone who wants to look at small crystals. When you buy one, you get what you pay for. Any in the price range from about \$10 to \$35 are good. A cheap one is not worth having. If you are buying a hand lens for the 1st time, get one with 10 magnification (10X).

To use a hand lens, you need two things, adequate light and a clean lens! Sunlight is the best. Use a soft cotton cloth, like an old T-shirt to clean the lens. You will find that the lens needs to be equal distance from your eye and from the mineral you want to see. It takes a little practice to get used to holding the lens only an inch or so from your eye and the specimen up close, but pretty quickly you can learn to use one like a geologist.

Hammers You will need several. Different sizes and types are used for different purposes. Don't forget to use eye protection when using any hammer!

Note: pink paint. I take some ribbing about my paint, but I rarely lose any of my tools! Tools are easy to leave behind on the outcrop, but not so if you paint them with fluorescent paint.

Sledge An 8-pound long handled sledge is used for breaking big rocks into smaller, more manageable pieces. You have to be big and strong enough to use a sledge without hurting yourself.

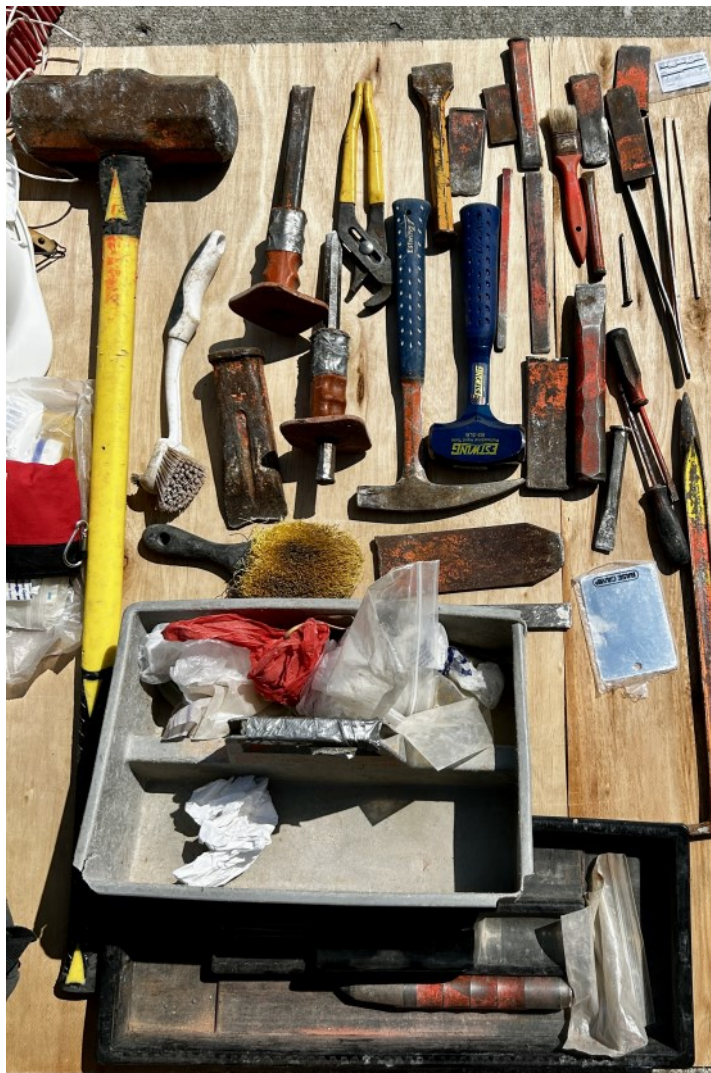
Crack hammer A 4-pound or 2-pound crack hammer is handy for breaking medium-sized samples or driving chisels.

A **geologist's hammer** is handy for prying rocks apart or out of the ground because it has a pick on one end. Do not use the pick end when trying to break a rock! You will only dull it.

Brick layer's (splitting) hammer A similar specialty hammer is called a bricklayer's hammer. Instead of a pick end, it has a chisel on one end. It is very handy for splitting friable rock when looking for fossils and can be driven with a crack hammer like a chisel. The brick layer's hammer may be driven, like a chisel in rock fractures, then used to pry out samples.

When using any hammer to strike rock or another steel tool, wear some glasses for eye protection. No specimen is worth the value of an eye!

An unusual hammer I sometimes use has a pick on one end and a chisel on the other. You may also



want a small hammer for light trimming of specimens. I recommend you buy Estwing products. They are expensive, but should last many years if you do not lose them. Any good type of large sledge will do. If you buy one with a wooden handle, be sure and carry an extra handle with you to the field in case you split the original.

Chisels and gad points You need a good set of these. Some are available with plastic coating on the sides. I buy Craftsman from Sears so if they break, I can get a free replacement. You will need several sizes and lengths, depending on the conditions of the rocks you are working. Various sizes are handy for different jobs. Note very long slender chisel for getting way back into narrow pockets. Sometimes I can work someone's abandoned pocket and get good micromount or thumbnail specimens due to that one chisel.

Last, but not least, is some **personal protection equipment**. Safety glasses have saved many an eye. Leather and cloth gloves will protect your hands from flying rock chips and help prevent blisters. Don't forget some **boxes, flats, or buckets** for your samples and tools, along with wrapping paper for your treasures!

Friends of Mineralogy Midwest visits the Langsdon Collection March 2026

BY JOHAN MAERTENS

The Langsdon Rock and Mineral Collection in Celina, Ohio represents a significant lithological and mineralogical repository within the Midwest, characterized by its transition from a private to a publicly accessible educational asset.

The mineralogical diversity is anchored by significant sulfide and silicate species, including pyrite, galena, iridescent bornite, and garnet. Regional minerals are interspersed in the exhibits. From a crystallographic perspective, the collection demonstrates varied ex-



ternal morphological habits of minerals. The fluorescence exhibit provides an opportunity for the observation of luminescence in minerals, although currently limited by low-intensity ultraviolet excitation. The collection is a vital resource for introductory and intermediate geological education.

The experience of the Langsdon Collection begins not in a traditional museum hall, but within the quiet, studious atmosphere of the Mercer County District Library. This setting reinforces the collection's mission as an educational resource. The accessible exhibit on the ground floor, consists of 21 custom-built wooden cases, crafted by a local woodworker specifically to integrate the geological sciences in the library's daily function.

The collection is the product of decades of dedicated field collecting and curation by Ron and Ruth Lang-



sdon, who resided in St. Marys. Originally intended for their local community, the collection was donated to the Mercer County District Library in 2006 when the library demonstrated the capacity to maintain and showcase the 900+ specimens. Their vision was to inspire future generations and support earth science education across the state of Ohio.

Visitors can attend a hands-on free educational and fun introductory rocks and minerals session provided by a trainer.

Options include a program on minerals or fossils which we can adapt to any grade level and standard. The Langsdon educators can bring minerals and fossils to classrooms for the students to examine or offer an in-house program at the library where the students can view the extensive collection. The program time is flexible within a range of 45-90 minutes.

The specimens provide a global narrative of mineral extraction, featuring minerals from every continent except Antarctica. Of note are the samples from late

20th and early 21st-century mines in India and China, which are presented alongside specimens from historic mining districts that are now permanently closed to collectors. This juxtaposition allows visitors to observe temporal changes in mineral availability and quality.

The diversity of the Langsdon specimens caters to both introductory observers and advanced collectors.

A specialized section of the collection is dedicated to fluorescent minerals. The regular display lights can be deactivated to allow the use of short-wave and long-wave ultraviolet lamps. While the current illumination for the fluorescence display is underpowered, it remains a critical part of the tour, revealing the vibrant, hidden colors of minerals such as calcite or fluorite that result from electronic transitions in impurity activators.

The collection is organized via a printed catalog system, allowing specimens to be located by mineral name or locality. Each specimen is assigned a catalog number and a Case and Shelf code, with case numbers conveniently listed in the top frames of the cabinetry. As this is a working library environment, visitors are encouraged to maintain a hushed tone while exploring the narrow aisles at their own pace.

The advanced collector can be mildly concerned about misidentified minerals or misspelled or wrong locality information. Some adjacent specimens have labels switched or are exhibited in reverse.

[Langsdon Minerals and Rock Collection](#)

Hogg Mine 2026 Memorial Day Weekend Machine Dig Field Trip

BY BILL STEPHENS

The registration form is on the FM National website and registration is open for the Memorial Weekend Machine Dig at the Hogg Mine in Lagrange, Troup County, Georgia, Friday May 22 - Sunday May 24, 2026. Attendance is restricted to members of FM National, FM Chapters. Attendance is capped at 30 and we need 20 to make it work. Dig for beryl (aquamarine), tourmaline, and rose quartz. If you would like to attend, register soon.

REGISTER AT

<https://www.friendsofmineralogy.org/hogg-mine-memorial-day-weekend-field-trip/>

About: <https://hoggmine.com/> and

<https://www.mindat.org/loc-222793.html>



Hogg Mine in Lagrange, Troup County, Georgia



Hogg Mine in Lagrange, Troup County, Georgia
Minerals

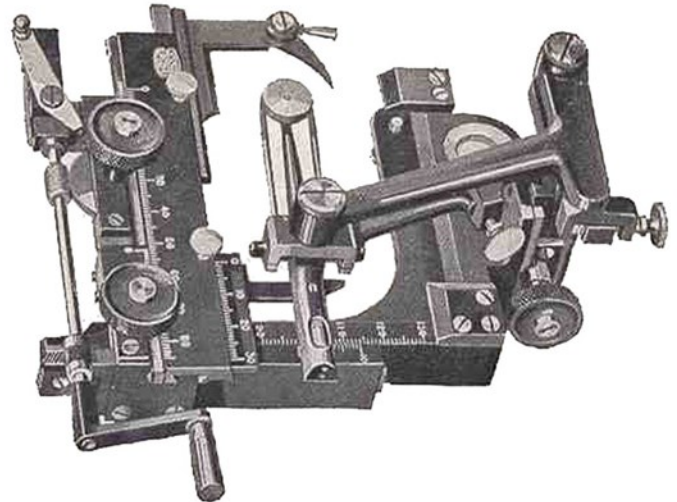
Bierbaum Microcharacter Sclerometer

BY CLYDE SPENCER

A sclerometer - (from the Ancient Greek σκληρος meaning "hard") - is a specialized instrument used in mineralogical research to measure the scratch hardness of minerals . It provides a quantitative, "absolute" hardness measurement, distinguishing it from the qualitative, relative Mohs scale.

The sclerometer allows making repeatable, quantitative measurements of the width of a scratch engraved in a polished surface, which is a measure of resistance to scratching of the polished material. The Bierbaum *Microcharacter* instrument is a sclerometer, formerly sold by American Optical from 1924 through circa mid-1950s(?).

A background on scratch hardness and its measurement can be found in Burchard (2004).



BIERBAUM MICROCHARACTER

This is a precision instrument for determining the hardness of small areas, particles, and microscopic constituents in metals. A highly polished specimen is moved beneath an accurately ground diamond point. The pressure is precisely controlled so that hardness can be determined by the width of the resulting cut under the microscope.



Figures 1A and 1B. Vintage advertisements for the Bierbaum AO Microcharacter sclerometer.

The device has some deficiencies that must be noted if one plans to use one. It requires a conversion of measured microcut widths to unique hardness values that are of the same magnitude as Vickers Hardness Numbers (VHN); however, they are not the same. As a very rough approximation, one can assume that the Vickers Hardness Number (VHN) is about one-half of the Microcharacter Microhardness Number (k). It is notably highly non-linear at the low end of the hardness range; the two lowest Mohs Hardness values have microcut widths an order of magnitude wider than the other Mohs hardness values. These are probably the primary reasons that it was never widely accepted, although manufactured for several years.

One should keep in mind that the resistance to scratching and indentation are different properties. Therefore, it is remarkable that the quality of the fits provided here is as high as it is. Tabor (1956) remarks:

“In the scratching and indentation of brittle solids such as minerals it is shown that the high hydrostatic pressures developed around the deformed region are often sufficient to inhibit brittle fracture. Under these conditions, the deformation is primarily plastic. For this reason there is fairly good correlation between indentation and scratch hardness since both are essentially a measure of the plastic and not the brittle properties of the solid. From this approach it is possible to provide a physical basis for Mohs' scratch-hardness scale and to show that, excluding diamond, there is a reasonable "equality of intervals" between each number on the scale.”

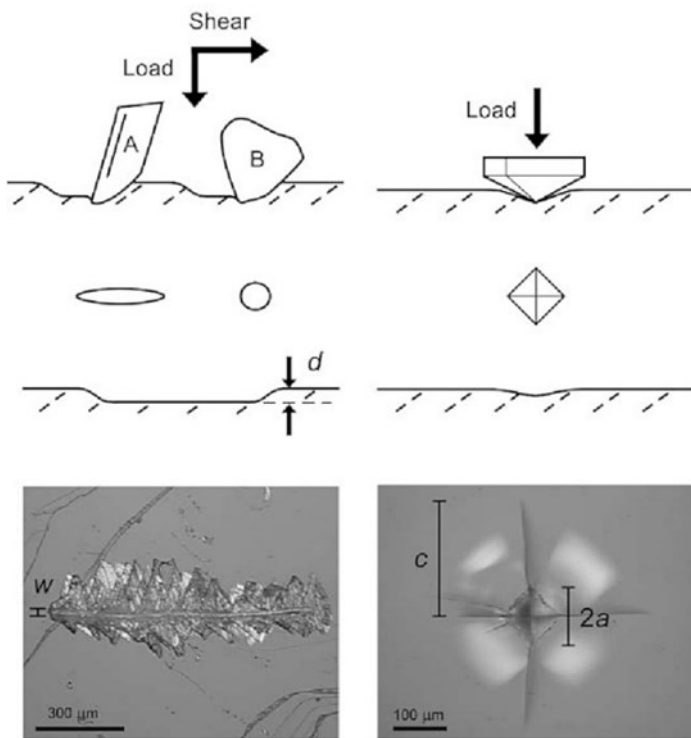


Figure 2. Scratch Hardness versus Indentation Hardness

(<https://ar.inspiredpencil.com/pictures-2023/mineral-hardness-scratch-test>)

However, I have derived a conversion to VHN, which means that if one wants to use this, there will be better correspondence to reference VHNs than the original recommended conversion from microcut widths. Note that while this device provides a unique *Microcharacter* scratch hardness (k), for this description I have adopted the same terminology as the manufacturer, *i.e.* microcut.

While this patented device was intended for metallurgy, it is adapted easily for determining the hardness of minerals. A sclerometer offers an advantage over point hardness-instruments, such as Vickers, for doing a quick survey of a polished ore specimen, because one can look for minerals of anomalous hardness that might be of similar appearance to the dominant mineral(s). That is, it provides a synoptic view of the range of hardness in a polished rock sample such as might be obtained from a potentially mineable, poly-mineralic ore deposit. It might also reveal changes in the chemical composition across a single crystal resulting from solid-solutions. Also, sclerometers are much smaller than a typical Wilson-Tukon indentation tester commonly used to determine VHN.

For additional information, read the detailed description and history by Sobel B., de Groot J. (2019) Hardness tester for use with microscope. Another source of information that I used for deriving the calibration curves is by Hodge (1934): The "microhardness" of minerals comprising the Mohs scale. The later reference provided me with the information on converting the microcut widths to *Microcharacter* hardness, and the equivalence of the *Microcharacter* hardness and Mohs scratch hardness.

I had previously attempted to produce a transformation using a different data set for a \log_{10} - \log_{10} plot and only obtained a 0.82 R^2 value (R =correlation coefficient). Other researchers [e.g. Bowie and Simpson (1971); Young and Millman (1964)] have recommended a log-log relationship without providing quantitative information on the goodness of fit; the slope and intercept of their transforms were of the same magnitude as mine, but different enough to raise concerns about using any linear log-log transform. Therefore, I am satisfied that the transformation I have derived is quite acceptable for a conversion of Mohs hardness to VHN.

To convert *Microcharacter* hardness (k) or microcut width (λ) to VHN, it is first necessary to convert Mohs Hardness to VHN. The two hardness scales are fundamentally measuring similar, but still different mechanical properties. Mohs is measuring a resistance to scratching, which is primarily a function of tensile strength or cohesion, while VHN is a resistance to inelastic compressive deformation.

Surprisingly, using 4 different data sets (68 data points total) comparing Mohs hardness to VHN, I was able to get a 2nd-order polynomial ordinary least-squares (OLS) regression fit with an R^2 value of 0.985, which is higher than an OLS linear regression fit to a \log_{10} - \log_{10} plot ($R^2 = 0.936$), on the same data sets. There was a data point for

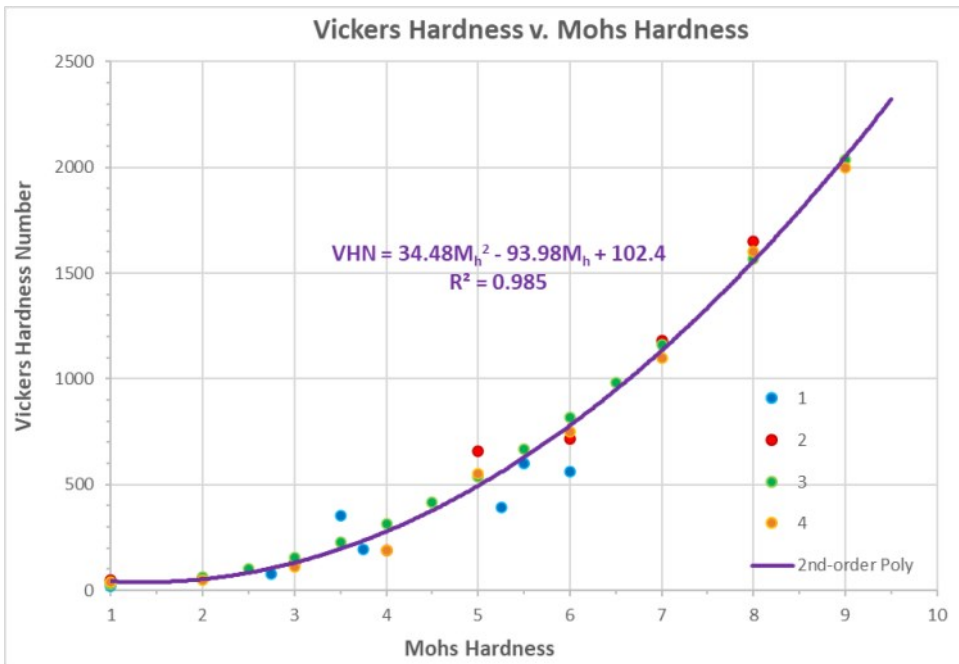


Figure 3 Relationship between Vickers Hardness Number and Mohs hardness.

- 1 Galopin, R. and Henry, N. F. M., (1975), Microscopic study of opaque minerals, McCrone Research Assoc. Ltd., London, p. 190
- 2 Taylor R. W. (1949), Correlation of the Mohs's scale of hardness with the Vickers's Hardness Numbers, Mineralogical Magazine; September 1949 v. 28; no. 206; p. 721
- 3 Mineral Hardness Conversion Chart. <https://web.archive.org/web/20170517124028/https://www.cidraprecisionservices.com/mohs-conversion.html>
- 4 Hutchison C. S., (1974), Laboratory handbook of petrographic techniques, John Wiley & Sons, New York, p. 40

Mohs hardness 9 (Taylor, 1949) that I judged was so high as clearly to be an outlier; I did not use that point.

The numbers compare favorably with the table presented by Hutchison (1974). See Figure 3 for the graph of the data.

The Empirical Rule in statistics states that for normally distributed data, conservatively, the standard deviation should be about 1/4th of the range. For a mid-range Mohs hardness sample of 5-5.25, that would be about 67 VHN units on the above graph, or about 64 VHN units for Mohs 6. Alternatively, an R² value of 0.985 means that about 98.5% of the variance of the dependent variable (VHN) is predicted by the independent variable (Mohs hardness). Conversely, if the residual 1.5% is random error, that means the nominal VHN value for a Mohs hardness of ≈5 is ±30 VHN for the range of 1 to 9 Mohs hardness.

However, because of the poor linearity in the calibration data for the *Microcharacter* instrument, obtaining a good fit with VHN, for either microcut width (μ) or

the derived *Microcharacter* hardness (K), is more challenging.

As stated, there are two approaches to obtaining an estimate of equivalent VHN: 1) convert directly from the measured microcut width (μ), or 2) derive the *Microcharacter* hardness number first, and then convert to VHN.

In the first case, curve fitting behaves poorly at Mohs hardness 1 and 2 (λ > 9μ); therefore, I deleted those points. The best calibration curve I was able to obtain uses a power function and has an equation as shown in Figure 4.

I suggest using either Figure 4 to read the VHN directly, or if you desire to calculate it, round down a little and use the simplified formula: $VHN = 3000\lambda^{-1.2}$. It will probably provide a more accurate result than using the plot and regression line. If the microcut width (λ) is greater than 9μ (microns), assume that VHN is less than 100, and the corresponding Mohs hardness is less than about 2.5. This method has the advantage of one conversion for each measurement.

For the second case, the first step is to convert the microcut width λ (measured to the nearest 0.1 micron) to the *Microcharacter* hardness. The formula for that is: $K = 10^4/\lambda^2$

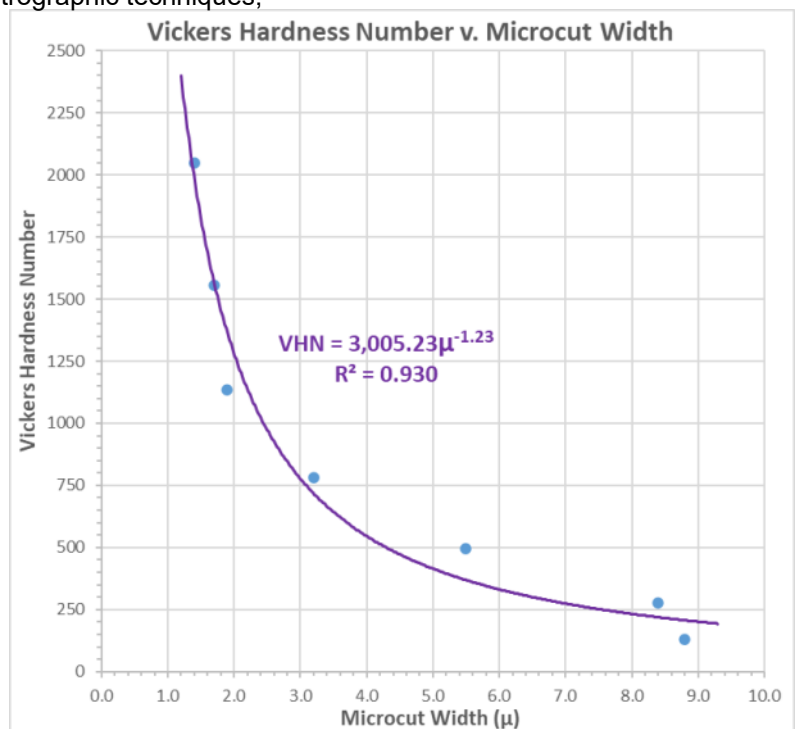


Figure 4. Vickers Hardness Number obtained from the measured microcut width in microns.

Alternatively, one could use the table from Figure 5 that was included with the instruments:

that K explains almost 97 percent of the variance in VHN. The R^2 value can be improved slightly by going to a 3rd-order polynomial (light-blue dot-dash line); however, that is probably overfitting the data. The original calibration was based on the nine common minerals making up the Mohs relative scratch hardness scale (diamond excluded) and it is not obvious whether the non-linearity is real or experimental error. I advise using the linear regression fit for conversions. That is, $VHN = 0.354K + 266$, or use the purple line to find the corresponding dependent variable (VHN) directly from the graph.

MICROHARDNESS NUMBERS

STANDARD 3-GRAM WEIGHT

$$\kappa = \lambda^{-2} 10^4 = \text{Microhardness}$$

λ = Width of Microcut in Terms of μ

μ	κ	μ	κ	μ	κ	μ	κ
100.0	1.0	14.5	47.6	9.0	123	3.7	730
76.0	1.7	14.0	51.0	8.8	129	3.6	772
64.0	2.4	13.5	54.8	8.6	135	3.5	816
56.0	3.2	13.0	59.2	8.4	142	3.4	865
50.0	4.0	12.8	61.0	8.2	149	3.3	918
47.5	4.4	12.6	63.0	8.0	156	3.2	977
45.0	4.9	12.4	65.0	7.8	164	3.1	1041
42.5	5.5	12.2	67.2	7.6	173	3.0	1111
40.0	6.3	12.0	69.5	7.4	183	2.9	1189
37.5	7.1	11.8	71.8	7.2	193	2.8	1276
35.0	8.2	11.6	74.3	7.0	204	2.7	1372
32.5	9.5	11.4	76.9	6.8	216	2.6	1479
30.0	11.1	11.2	79.7	6.6	230	2.5	1600
28.0	12.8	11.0	82.6	6.4	244	2.4	1736
26.0	14.8	10.8	85.8	6.2	260	2.3	1891
24.0	17.4	10.6	89.0	6.0	278	2.2	2066
22.0	20.7	10.4	92.5	5.8	297	2.1	2268
20.0	25.0	10.2	96.2	5.6	319	2.0	2500
19.5	26.3	10.0	100	5.4	343	1.9	2770
19.0	27.7	9.9	102	5.2	370	1.8	3087
18.5	29.2	9.8	104	5.0	400	1.7	3460
18.0	30.9	9.7	106	4.8	434	1.6	3906
17.5	32.7	9.6	109	4.6	473	1.5	4444
17.0	34.6	9.5	111	4.4	517	1.4	5102
16.5	36.7	9.4	113	4.2	567	1.3	5917
16.0	39.1	9.3	116	4.0	625	1.2	6944
15.5	41.6	9.2	118	3.9	657	1.1	8264
15.0	44.4	9.1	121	3.8	692	1.0	10000

It is problematic which approach is better. Considering the Mohs units as calibration reference points (Figure 3), using the microcut widths, 3 out of 7 times the predicted VHN is too low and 2 out of 7 times too high; the VHN at Mohs 7 ($\mu=1.9$) has the greatest absolute residual error. Using the Microhardness Number (k), 3 out of 7 samples (Figure 6), the linear prediction for VHN is too low.

Something to consider is that Vickers hardness is used most for relatively soft ore minerals. Therefore, one should probably use the conversion process that appears most accurate for the hardness region of interest.

Figure 5 Table for converting microcut width λ to Microhardness Number (K)

Having obtained the *Microcharacter* Microhardness Number (K), the next step is to use the graph Figure 6 to convert to VHN.

Figure 6, showing the OLS linear regression line (solid purple), gives a respectable R^2 value of 0.969, meaning

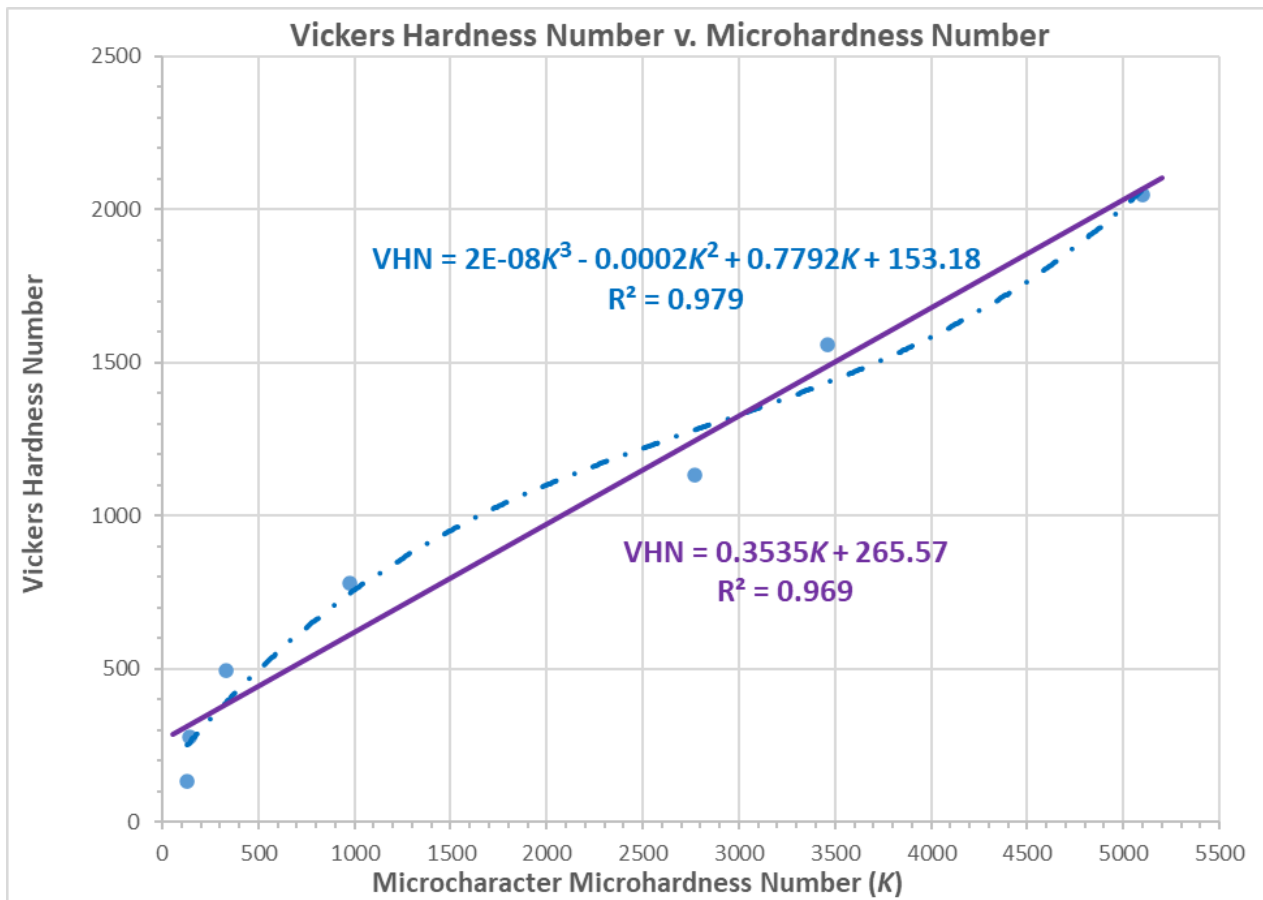


Figure 6. Vickers Hardness Number obtained from Microhardness Number.

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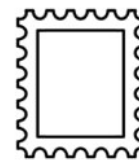
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