



THE GEOLOGICAL SOCIETY OF MINNESOTA

News

*Volunteer
opportunities,
field trips,
lectures, and
public service,
since 1938*

From the President's Desk...

We had a great lecture series for 2014-2015, thanks in great part to **Steve Erickson** who both decided on the topics and presenters, contacted everyone, and did all the other behind-the-scenes work needed to put our program together. Not counting the Spring Banquet, we had 1080 attendees over 15 lectures, averaging 72 per lecture. And at each lecture, we have had typically 3-10 new attendees; great to see some new faces in addition to the many reliables. This series we have been privileged to have four of our own members present to us: **Roger Benepe**, **Joel Renner**, **Steve Erickson**, and **Mark Ryan**. Thanks to all who have supplied the treats for our "cookie breaks" during lectures. Cookie break is a fun tradition that we are pleased to continue. And finally I want to thank each of you: your membership dues furnish the fees we pay our speakers.

As Steve recently showed us, he is well on his way to completing the 2015-2016 lecture series. But if you have a topic or speaker that you feel would interest us, do not hesitate to suggest it to Steve. He might use it to fill an open slot next year, or the following year. Our webmaster **Alan Smith** will post the schedule on our web site (www.gsmn.org) as soon as most of it has been determined.

The State Fair is now only weeks away, and our new State Fair Planning Chairperson **Dan Japuntich** is actively working to fill the schedule of volunteers to staff our booth. If you have volunteered in the past, you know that this is a fun assignment. If you have not previously volunteered, you'll find that it is a great opportunity to promote our Society and Earth Sciences in general to the public; no expertise in geology required!

Field trips: This past March, **Randy Strobel** and **Joanie Furlong**, with assistance from **Sherry Keesey**, planned and executed a great seven-day field trip to southern Nevada. Twenty-one GSM members participated. Elsewhere in this issue, our prolific reporter **Maria DeLaundreau** describes the first four days of this trip; **Dave McGill** will conclude the report in the August Newsletter. Upcoming, I am planning a trip to Michigan's Keweenaw Peninsula this July; more information elsewhere in this issue. And I am still trying to arrange further tours to St. Anthony Falls Lab. It is proving difficult, but I still hope they will happen over the next few months. We had great tours in December and April. (See the February 2015 Newsletter for a report.)

We are always looking for new field trip ideas. Is there some place of geological interest that you would like to visit, or have visited and would like to share with other members? Contact me and I'll put you in touch with someone who has experience organizing our field trips. Local field trips can be as short as a few hours, and often we can recruit a professional geologist as the technical leader.

As in the past, I encourage you to visit our web site (www.gsmn.org). It includes a wealth



GSM President, Dave Wilhelm

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of information about our organization and about geology in general. A feature of our web site that I would like to emphasize is our Contact page, through which anyone can ask questions. We average one or two questions a week, and **Theresa Tweet** volunteers her time to answer these. Often they are from Earth Science teachers looking for geology-major college students to give presentations. Theresa puts these teachers in touch with Macalester students who have offered to do such presentations. Thanks, Theresa! Our web site also has a page of Geological Links, to which you can navigate from the list on the left side of the home page. We have recently added a number of items to the Links page. A new one is for the International Sand Collectors Society, in which GSM member **Kate Clover** is active.

I'd like to invite any members who are interested to one of our Board meetings. The next meeting will be at **7:00 PM May 21**; see our website for all scheduled dates. We typically meet between 7:00 & 9:00 PM at the new Minnesota Geological Survey building (2609 Territorial Road in St. Paul, just west of Hwy 280). These meetings are open to all members of GSM. We will be looking for two new Board members prior to our Annual Meeting in September. Being a Board member does not take a great deal of your time, and is a great way to give back to GSM and to have your ideas for our Society made known. The best way to see how the Board operates is to attend a meeting.

I'll conclude by thanking our Newsletter editors, **Theresa Tweet, Mark, Ryan, Harvey Thorleifson** and **Rich Lively** for putting this issue together. They are always looking for articles. If you do or see something this summer that you feel would interest other GSM members, submit a short article to inform us. We'd love to hear from you.

Have a safe, interesting, and fun summer.

GSM President, Dave Wilhelm

GSM News

Officers:

Dave Wilhelm, President
 Mary Helen Inskip, Treasurer
 Rebecca Galkiewicz, Secretary

Board Members: Deb Preece; Ruth Jensen; John Jensen; John Grams; Mark Ryan; Roger Benepe; and Dan Japuntich

Editors: Theresa Tweet; Mark Ryan; Katy Paul; Harvey Thorleifson; Rich Lively

The Geological Society of Minnesota is a 501(c)3 nonprofit organization. The purpose of this newsletter is to inform members and friends of activities of interest to the Geological Society of Minnesota.

Send all GSM membership dues, change of address cards, and renewals to:
 Joanie Furlong
 GSM Membership Chair
 P.O. Box 390555
 Edina, MN 55439-0555

Membership dues are: \$10 Full-time students; \$20 Individuals; \$30 Families

GSM News is published four times a year: **February 15, May 15, August 15, and November 15**. Deadline for article submission is the first of the month, before the date of publication.

Newsletter contributions welcomed

Of interest to our GSM enthusiasts: While out and about enjoying your vacation time – when you visit a site that you find interesting, please consider sharing your experiences with us by writing up a few words and sending it to Theresa Tweet at phoenix8185@gmail.com. Thank you in advance!

New Members!

Vladimir B. Zivkovic, Brainerd
 Patrick McCarthy, Stacy
 Roger Korf, Stanchfield

from the archives: Sagamore crushing and drying plant, Cuyuna Range, 1940.



Spring Banquet and Silent Auction

The Spring Banquet and Silent Auction marked an end to our 2014-21015 lecture season. The event was held on May 4th, 2015, at the U-Garden Restaurant on University in Minneapolis. More than a fundraiser, it was a chance to get together with other GSM enthusiasts, enjoy a lecture and recognize some of the volunteers for their contributions to the GSM.

Estwing donated two engraved rock hammers to the Spring Banquet. One was presented to David Wilhelm, the President of the Geological Society of Minnesota and organizer extraordinaire. A second hammer went to Rich Lively of the Minnesota Geological Survey for his many years as a volunteer formatting and preparing the GSM Newsletter which keeps our GSM membership connected and up to date with our current events. This year at the February board meeting, it was also agreed to give Randy Strobel a similar hammer for all of his work in field trip planning. Add to this list of recipients, Bill Robbins for his expertise in email communications for the past several years, and Steve Erickson for the countless hours putting together the lecture series for the past eleven years.

Our good friend Tom Cody had not quite finished all of the mugs that he had intended to make before his untimely death in 2013. The mugs that were missing were for Allan Bowles and Tom Schoenecker. Allan was recognized for his excellent work on the Marker project, years as a Secretary, and for his Spring Banquet help. Tom was recognized for his work as our longtime State Fair Chair. These two gentlemen received pewter mugs with the GSM logo attached to them, a little late, but nonetheless still deserved.



At the February Lab at Macalester, a necklace containing several semiprecious stones was used as a specimen in the spectrometer. This piece of jewelry was presented to Janet Hopper for the many years of service that she has given the GSM for contributions as President and Vice-President. She has also worked on the Field Trip Committee and at the State Fair, as well

as the Banquet, making Janet both a team leader and player.

I would like to thank Mark Ryan for his talk “Como Bluff, Brontosaurus, and Beyond: William Harlow Reed and the Rise of American Vertebrate Paleontology”, he was enthusiastic and knowledgeable. I would also like to thank Huy Ung of the U Garden for allowing us the use of their establishment in Minneapolis, Harvey Thorleifson of the Minnesota Geological Survey for the donation of the antique plaster relief plaques, Estwing



for the engraved rock hammers, Lisa Peters for her book donation, “Fractured Land”, Costigan’s for mineral samples, ZRS Fossils and Gifts for the partial trilobite fossils and scrapper, Tom Higgins for the Roadside Geology of Wisconsin book, Roger Benepe for the green canvas JW Hulme bottle guard, Sherry Keesey for the San Andreas Fault book and miscellaneous shells and minerals, Mountain Press for the Roadside Geology of Minnesota and 101 American GEO-SITES books, and Mark Ryan for his fossil Valentine box and assorted rocks and minerals. Thanks are also given to Doug Zbikowski, Kate Clover, Norman Riger, Ted Chura and Dick Bottenberg for numerous rock and mineral samples.

Also, thank you to Daniel Japuntich, Ed and Sandy Steffner, and Justin Tweet for helping out with the sales and auction tables, and Ted and Grace Chura, Randy Strobel, and Joanie Furlong for helping with the set up. I would also like to thank Dick Bottenberg and Jerry Tweet for helping with the pricing of the items, and Mary Helen Inskeep for working with the money. Additionally, I want to thank David Wilhelm, Jerry Tweet, and Justin Tweet and a host of others for helping to clean and box things up at the end of the night.

This was our 4th Silent Auction event, and needless to say, it still gives me great pleasure to recognize those individuals who put forth their best efforts to ensure that the GSM will continue well into the coming years set on a solid foundation with like-minded, caring individuals.

Theresa Tweet



**Volunteer at the 2015 GSM
MN State Fair Booth!**

Our most important source of funding for GSM comes from new membership generated from our State Fair Booth! Please show your enthusiasm for our GSM Organization at the Great Minnesota Get Together! We are in our 77th Year and are very proud to be Supporting and Promoting Public Interest in the Geological Sciences since 1938!

Dan Japuntich will be happy to sign you up at a GSM event, or please email your choice: danjap7@yahoo.com or leave a voicemail at 651-216-6678.

State Fair Info:

-Volunteers hand out our 2015-2016 Lecture Series handouts and chat about our Lectures, our Field Trips, and our "MN Rocks".

-You do not need to know geology to volunteer. Instructions will be provided!

-The State Fair dates are Thursday, August 27 to Labor Day, September 7.

-We need 2 people for each of the 3 four-hour shifts per day.

-Shift times are 9 AM- 1 PM, 1 PM- 5 PM and 5 PM- 9 PM in the Education Building.

-You get to eat cheese curds, milkshakes and footlongs on your way to the booth!!

**Fossil Hunting Update from the
City of St. Paul**

Reprinted from the Minnesota Mineral Club Rock Rustler's News

As many of you may know, the City of St. Paul has been working to upgrade and stabilize the fossil bed areas in Lilydale Regional Park. That work is on-going and will not be completed until later this year. Below is an update outlining the current status of that work. Unfortunately for fossil hunters, permits will not be issued until at least fall (see the last bullet point below).

**Lilydale Regional Park
Current Status**

Current status of the Brickyard area:

The stormwater management and slope-stability study has been completed (see documents posted under "Stormwater Management and Slope-Stability Study" below)

The Brickyard area remains closed while a series of action steps can be taken in response to a series of recommendations outlined in the study

The action steps will result in a portion of the Brickyard being able to be re-opened, largely focused around the Brickyard trail

Based on the findings of the study, ice climbing permits will no longer be issued in the Brickyard and access to various areas of the Brickyard will now be restricted

Based on weather and estimated time it will take to complete the series of action steps, it is expected the portion of Brickyard that can be re-opened will be re-opened in late spring/early summer

Fossil hunting permits will not be issued until at least fall 2015, and will only be issued for "fossil site #1" - updated fossil permits with additional details and maps are in the process of being developed and will be posted when available

Source: City of St. Paul website (<http://www.stpaul.gov/index.aspx?nid=2693>) April 23, 2015.

NOTES FROM THE PAST

From the March 1948 issue of the Minnesota Geologist: Official Bulletin of the Geological Society of Minnesota

"...the announcement has been made by two of the major oil companies, acting jointly, of the successful completion of a 900 barrel per day well producing at 1700 feet, located 10 miles off the Louisiana Coast. This is the first producing well drilled out of sight of land.

The drilling was conducted from a steel “Island” built on piling at the location.”

And in a caption below a map of the Gulf coast in the same newsletter:

“The shelf is part of the land mass of the continent and has all the characteristics of the continental surface, although it is generally low-lying. Thus, on the Texas shelf, geophysical explorations indicate that there are salt domes, as there are throughout East Texas, as well as other structural “highs”, which may have resulted in accumulations of petroleum. Much work is being done here by the oil companies and their hopes are high. Legal title to the shelf has been claimed by both the States and the Federal Government. It is all very intriguing, and it invites your further study. Watch this area.”

And a photo from a 1947 field trip to the Black Hills, S.D.



GSM Field Trip to the Keweenaw Peninsula, July 2015

On Monday, April 27, **Dr. Bill Rose and Erika Vye** traveled from Michigan Technological University in Houghton, MI to present a lecture to GSM titled “The Geoheritage of Michigan’s Keweenaw Peninsula”. Before and after the lecture members of the GSM Board had a lively discussion with Bill and Erika on geoheritage and on GSM’s mission, especially outreach. The lecture and our discussion also involved a GSM field trip to the Keweenaw Peninsula that I am planning and for which Bill & Erika would be the local leaders. Based on their lecture, it is obvious that Bill and Erika have a deep knowledge of what the Keweenaw has to offer visitors, and that they are eager to show their backyard to us. We will get a true insider’s view.

As most of you know, I took a survey of interest in this field trip some weeks ago. Over 50 persons expressed



Bill Rose and Erika Vye, Keweenaw Geoheritage talk 4/27

interest, assuming the dates met their schedules. Given the strong interest, we have decided to continue planning. The trip will be 4 days long, running from Wednesday, July 22 through Saturday, July 25. We decided to end the trip on a Saturday, as this allows participants to travel back home on Sunday and return to work on Monday, should that be a consideration. Part of this trip will be done on the MTU research vessel, the Agassiz. Note that the Agassiz is limited to 17 passengers, while we expect double that number or more to participate in this field trip. We will handle this by splitting the participants into 2 groups: one will tour by land and the other by boat. The following day we will swap. Cost for the Agassiz is \$1000/day, which is around \$60/day/person. Costs for the other days should be nominal. Lodging options include hotels, camping, and MTU dorm rooms, which Bill & Erika can arrange for us.

To get a feel for what we will see, visit the Keweenaw Heritage website (<http://www.geo.mtu.edu/KeweenawGeoheritage/KeweenawGeoheritage/Welcome.html>). (You can get to this from the Links page of the www.gsmn.org web site.) In particular, scroll down to the link titled “**July 2014 Keweenaw Tours**” to see the stops on last year’s trips. Our excursions will be similar but will be customized to what interests us most.

Associated with the Keweenaw trip, **Randy Strobel** is planning for those who are interested a pre-trip to cover other parts of the UP, including Pictured Rocks National Seashore and the Soo Locks.

Bill Robbins is sending email updates with more details and asking for further information from you. Please reply by the dates listed.

Dave Wilhelm

GSM Archives now at MNHS

The Geological Society of Minnesota has been in existence since 1938, and has amassed a sizeable collection of records. Previously, these records were stored at the Minnesota Geological Survey. With the recent relocation of the geological survey, there was an opportunity to move these records to a more ideal storage area. It was decided to ask the Minnesota Historical Society (MNHS) to accept the records, and they agreed. Beautifully organized by Harvey Thorleifson with help from GSM volunteers and MGS staff, the records have been condensed down to five bankers' boxes of the key archival materials, such as newsletters, minutes, programs, and photos. Previously, all newsletters had been scanned and placed on the web.



Behind the scenes at the Mn History Center

In association with the acceptance, Duane Swanson, MNHS Curator of Manuscripts, offered a "behind-the-scenes-tour" that allowed GSM Board members to see what happens with collections after they have been turned over to the MNHS. The records are cataloged, listed online, and stored for the use of researchers. The hard copies are stored below ground in vaults. The records are then available for use in the reading room, with digital and paper copying available for a fee. Also,

most of the records can be photographed using a patron's personal cameras (no flash). Thus, the MNHS now provides the GSM organization with an alternative, very secure form of storage that is also available to the public.

The history of our Geological Society of Minnesota is now officially part of a much larger collection, the History of the state of Minnesota!

Geological Society of Minnesota Trip to Las Vegas – Part I

In March, a segment of the GSM went on a field trip led by Randy and Joanie Furlong to the southwest. Our sightseeing focused on the geology of Nevada. I left the group early, so I will tell you about the first part of the trip that centered on the Las Vegas area.

Red Rock Canyon National Conservation Area, just west of Las Vegas, was the first stop on our trip. The red rock the park is named for is the Aztec sandstone that consists of petrified sand dunes that formed during the Jurassic Period. A crosshatching pattern occurs in some places because we are actually seeing a cross section of the sand dunes, a unique perspective! In other locations, we saw a more typical view of the sand dunes with tiered sides. Randy told us that the orientation of the petrified dunes can be used to study changes in the Jurassic climate by showing prevailing wind patterns.

We also found cream-colored sandstone in the park, not far from the petrified sand dunes. A quarry used to be in this park - one of the first industries to open in the Las Vegas area - and it profited from this high quality



Petrified sand dunes

sandstone. They carved the stone into blocks, with the biggest weighing 10 tons. Eventually, the quarry stopped being profitable, so it was closed in 1906. They left big blocks that visitors today can enjoy climbing on. We took advantage of this.

In our outdoor classroom we could look up from the scattered succulents and see the Keystone Fault. Randy pointed toward the horizon where above the red



DeLaundreau sisters on sandstone block

Jurassic sandstone we could see the older gray Paleozoic limestone. This configuration has a complicated explanation. Basically, an oceanic plate began subducting the western edge of the North American Plate, causing the intrusion of the Sierra Nevada granite batholith, which compressed the earth's crust and thrust the Paleozoic limestone east and over the red sandstone.

We hiked out of the wilderness section of the park to see petroglyphs and pictographs. Petroglyphs were carved into "desert varnish," a blackish coating on the surface of rocks made up of oxidized manganese. The end result is



Randy in the wilderness

a yellow carved figure on a black background. Pictographs used iron oxide as the pigment in the red paint they put over the yellow rock. The art's meaning and significance was difficult to decipher, but it was a

treat to get so close!

Our next stop was Valley of Fire State Park. Here, we got



Big horn sheep

to see more of the Aztec sandstone. As we set off to the White Domes Loop Trail, we saw big horn sheep



Scenery on the White Dome trail

climbing! It was a fantastic start to our tour of the park. The White Domes path was incredible. All of the folding



Fantastic shapes sculpted by wind and water



*Hiking through a canyon ,
White Dome trail*



Frank and Roxy relaxing



Valley of Fire iconic wave



Petroglyphs, Valley of Fire State Park



Green screen group photo, Hoover Dam



and faulting of the rock layers led to parallel vertical joints, which eroded and created amazing narrow canyons that were highlighted on this trail. On these eroded ridges there were examples of another form of erosion that left cubbies of many sizes within the rock, including some that were extensive enough to create windows and arches!

On another hike we got to see the park's iconic "Wave," a pattern in the rock formed by erosion and differences in the coloring of the rock.

Elsewhere in the Valley of Fire we saw more petroglyphs fashioned in the desert varnish. There were many more here than what we had seen previously at Red Rock Canyon, and there are still many mysteries surrounding what these figures may have been communicating.

At the Lost City Museum we learned that other evidence of historic Native American presence in this region was lost when the Hoover Dam was constructed. The dam forced water levels behind its thick walls to rise, submerging many known and undiscovered Native American sites.

Another stop on our journey was Hoover Dam. This structure is 726 feet tall. At its base, it is as wide as two football fields are long and at the top is 45 feet wide. A highway was built on top of the dam connecting Arizona and Nevada. There is enough concrete in the dam to make a sidewalk around the entire equator. When running at full capacity, the dam creates enough power for a city of 750,000 people. The dam was built for four main reasons: to control floods, create a stable water supply, allow the water to purify as sediment filters out

Arch on the White Dome trail of the

standing water, and to generate power. Our tour guide surprised me by saying that generating power was not



Generators in Hoover Dam

one of the top 3 reasons for its construction, as I had thought.

We got to raft downriver of the dam in the Black Canyon Wilderness. From this perspective we could see the spillways used to divert water when Lake Mead is so high it threatens to overtop the dam. This has not been a problem, but it was great to see their disaster plan.

Along the canyon walls were hot springs with water at a temperature of 145 degrees Fahrenheit. The spring water carries salt, which gave parts of the canyon a whitish coloration that stood out against the darker rock. Our guide was quick to point out other parts of the canyon that were whitewashed due birds and their bodily functions. Spring migration was starting so there were a lot of contributing birds!

Next, our tour went to Frenchman Mountain. The exposed rock layers here used to be horizontal, but over time they have been tilted. This area is being pulled toward the west, causing the crust to fault and break as they travel. As this happens, rocks that had been pulled westward are falling back toward the east, resulting in the tilting that we see today. Between two of these tilted layers we see something that makes this site very significant: the Great Unconformity. The Great Unconformity is where Cambrian sandstone meets Precambrian granite and schist. Hundreds of millions of



Jenny touching the Great Unconformity

years' worth of rock strata are missing. It was awesome to see and a great ending to the trip for me.

Check out the next newsletter to hear about part two from David McGill!

Most photographs are courtesy of Dave Wilhelm. If you would like to see many more of his photos from this trip, visit <https://picasaweb.google.com/dewilhelm53> and select the "GSM 2015 March Nevada" albums (there will eventually be eight).

Maria DeLaundreau

February 2015 GSM Lab at Macalester: Using Electrons and X-rays to Investigate Geologic Unknowns

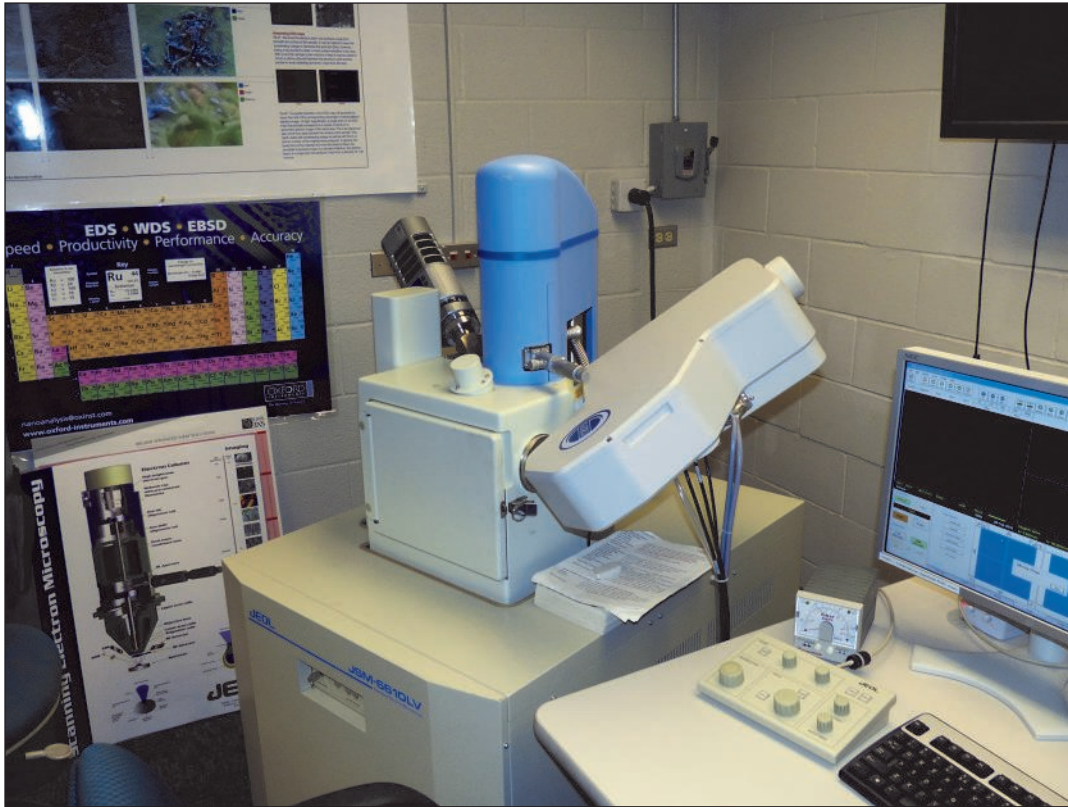
Have you ever wondered about the content of a rock or mineral collected on a field trip, or been curious to know the composition of a piece of jewelry? Then the Macalester College Campus was the place to be on



February 28th 2015. In a GSM Lab conducted by Jeff Thole, M.Sc., we were given both the time and the expertise to explore these and other everyday curiosities through the use of a Scanning Electron Microscope (SEM), Energy-Dispersive X-ray Spectroscopy (EDS), and X-ray Diffraction (XRD). The microscope was operated remotely from a different room, thus allowing the pinpoint accuracies to be visible during the entire process.



The gist: Sample unknowns are selected for analysis and, if needed, coated with a thin layer of carbon to allow the collection of nice images and prevent "charging". The chamber of the microscope is then pumped down to high vacuum to allow the easy transmission of electrons and



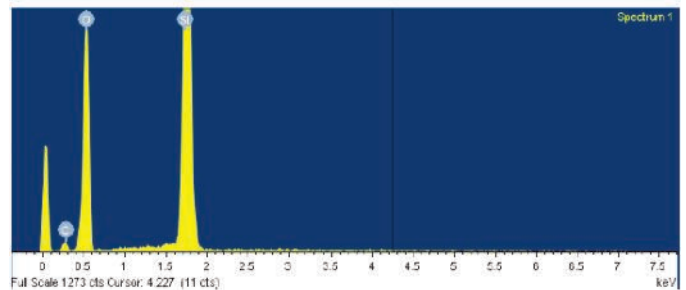
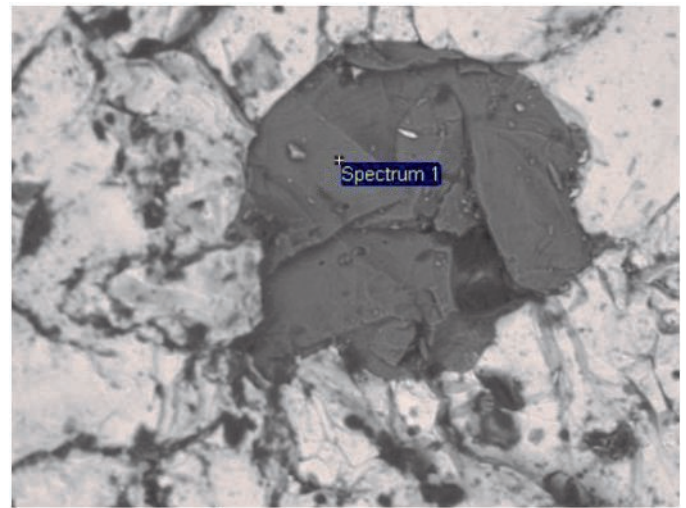
the analyst. X-rays are then reflected (or diffracted) to the detector at specific angles depending on that mineral's particular structure (actually they represent a specific "d-spacing", or distance between lattice planes within a crystal—a solution to the famous Bragg equation). The resulting pattern (or diffractogram) is essentially a fingerprint of that substance. The pattern can then be compared to a data set of reference patterns to find the best match.

This was incredibly interesting – thank-you, Jeff!

Theresa Tweet

x-rays. Once the sample is in position, the electron beam is turned on and a location for analysis is chosen. Once the electrons hit the sample, x-rays are produced which are displayed on a spectrum. The positions and heights of the peaks are generally unique to a specific element or mineral, a fingerprint if you will.

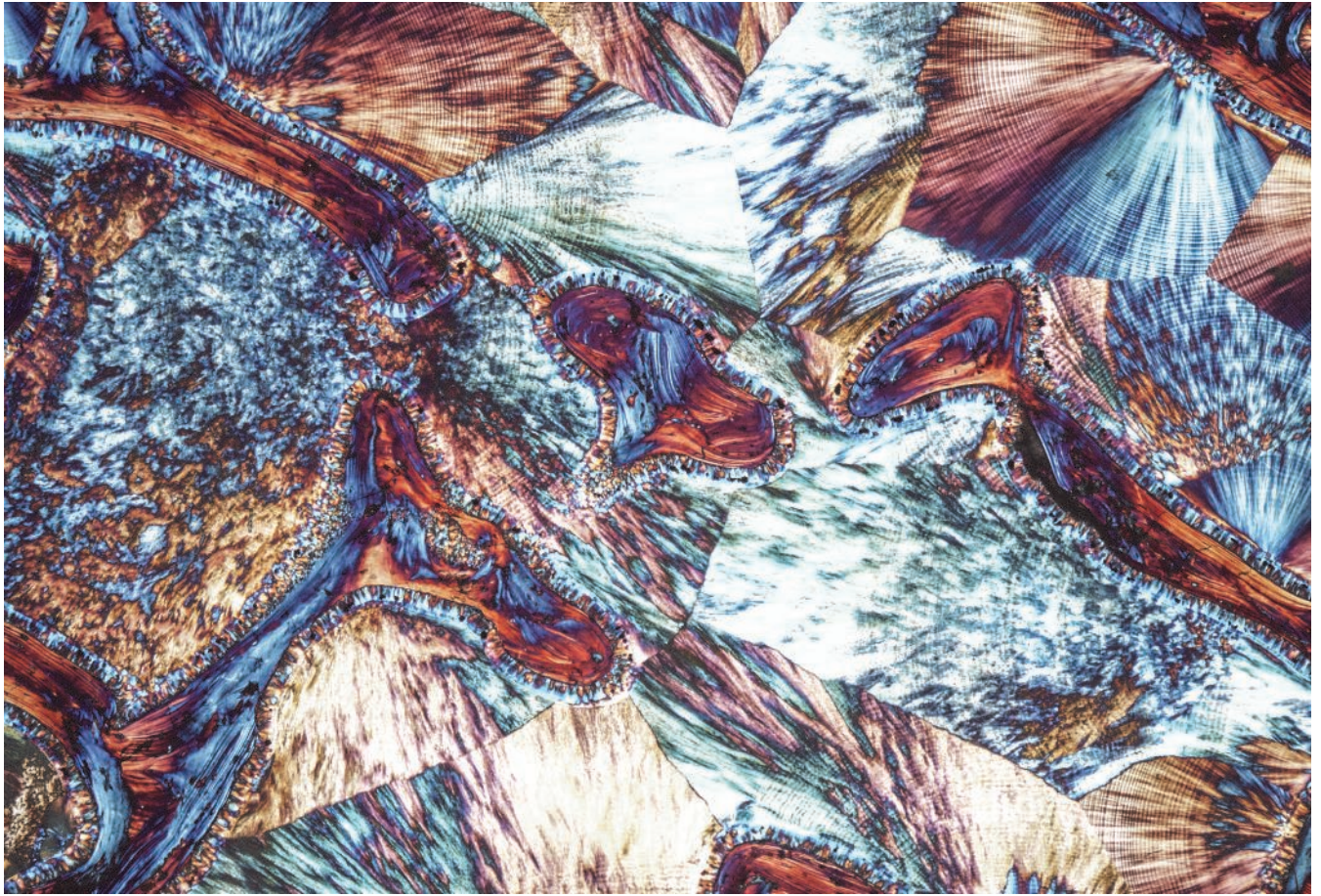
The x-ray diffractometer uses x-ray to determine the structure of crystalline materials like minerals. A sample is prepared by grinding it into a powder and placing it in an appropriate holder. The sample is then placed in the instrument and bombarded with x-rays while the x-ray source and detector move simultaneously in an arc on either side of the sample, on an angular range set up by



Comment: Quartz inclusion in hematite **Inca**

image courtesy of Ted Chura





Agate, February Microscopy Lab, Macalester College



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