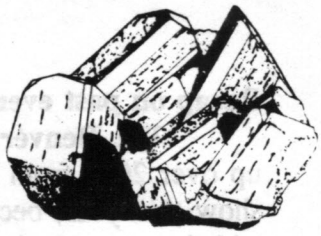
friends of mineralogy colorado chapter



Friends of Mineralogy - Colorado Chapter
Newsletter No. 6, October, 1993

October Meeting: 7:30 p.m., Thursday, Oct. 14, 1993
Denver Museum of Natural History
Ricketson (West) Auditorium
(enter directly into the auditorium, on the west side of the museum)

Program - Two Parts:

"The Discovery of Bazzite at Mount Antero and Mount White"
by Dale Denham

and

"What's New in Colorado Minerals"
by Jack Murphy

Dale Denham, FM member, will give a short talk and slide program about the very rare mineral bazzite ($Be_3(Sc,Al)_2Si_6O_{18}$, the scandium analog of beryl) and its discovery in 1984 on Mount Antero. Bazzite occurs as tiny (typically less than 1 mm) striated, blue hexagonal prisms, sometimes associated with bertrandite, phenakite, and etched beryl. It was found upon careful examination of loose "sand" from crystal pockets, collected on Mount Antero by Larry, Carmen, and Joe Pieckenbrock, identified by Dale Denham, and confirmed by SEM analysis by John Muntyan.

Jack Murphy, DMNH Geology Curator, will also give a short talk and slide show covering several topics relating to mineral occurrences in Colorado. This talk will be a version of the one Jack will be giving next month at the New Mexico Mineral Symposium.

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Recap on past events:

The **Denver Gem and Mineral Show** was a big success (paid attendance was about 11,000, up over 2000 from last year) and a great show. We were not expecting a very high profit from the show this year, because of the increased expenses connected with the expanded, 4-day show, and added space requirements for hosting the Rocky Mountain/American Federation conventions; but latest reports from the Show Committee indicate that the profit may, in fact, approach $16,000. This year, the profit will be split between the Rocky Mountain Federation and the Denver Council; the Denver Council, in turn, uses these funds to make donations to museums and other institutions. Sale of grab bags at the show raised an additional $3800 for a scholarship fund at Colorado School of Mines; a silent auction at the Saturday night show banquet raised about $1000 which will be donated to Rocks and Minerals Magazine, and an auction Wednesday night sponsored by the Colorado Mineral and Fossil Show at the Holiday Inn, raised approximately $3000 for the Colorado School of Mines Geology Museum and the Denver Museum of Natural History.

FMCC's contributions to the show included our mineral identification table, and the "Colorado Beryl" exhibit. Helpers at the identification table included Howard Bachman, Ray Berry, Bill Chirnside, Dwaine Edington, Gene Foord, Bill Hutchinson, Pete Modreski, Regina Modreski, Barbara Muntyan, Sam Rosenblum, plus non-FM volunteers Susan Eriksson, Paul Pohwat, Dave Allerton, Sarah McFeeters, Bill Silberman, and Brad Van Gosen. Neal Hinrichs coordinated preparation of the beryl exhibit; contributors of specimens to the case included Jack Adams, Howard Bachman, Ray Berry, Bill Chirnside, Pete Modreski, Marge Regel, Jack Thompson, plus additional specimens loaned by the Denver Museum of Natural History and by Wally Griffitts. Marge's specimen of fluorite on aquamarine, which appeared in our exhibit, also won the individual trophy for "Best Colorado Beryl" in the show.

If you didn't help out at the show in some way, please consider doing so next year. Our own group's special projects aside, it takes a lot of work to put on the show, and your help (with ticket sales, set-up, grab bag or poster sales, publicity, security, etc.) will be very much appreciated.

Our **Field Trip to the Sweet Home mine** took place on two days as planned, Sep. 25 and Oct. 2, courtesy of Bryan Lees. About 6 people took part in the first trip, and about 12 in the second. Thanks, Bryan!

News Notes:

FM's membership affiliate status with the Denver Museum of Natural History may be continued by our payment of a "Curators Club" membership fee, of $150 per year, which we must pay by January for 1994. This enables us to hold meetings at the museum, and marks our commitment to help the museum and its earth-science activities. By the way, fund-raising activities for non-museum purposes are not permitted to be held at the museum; our annual auction is being permitted to be held at the museum, only because the funds raised at it are promised to be earmarked for a museum-related project (the publication of *Minerals of Colorado*).

A second installment of Dan Kile's series of articles on **optical mineralogy and the petrographic microscope** is included with this issue.

During the Denver Show, four copies of our past symposium volumes were sold by FM. Only a few copies are left from our 1986 (Colorado Pegmatites) and 1988 (Precious Metal Deposits) symposia; about 18 of the former, and 7 of the latter. These are available for $15 each from the chapter, as long as they last. Several of the remaining copies of the Pegmatite volume are somewhat "irregular"--wrinkled or bent; perhaps we may offer these at a "fire sale" discount at next year's show.

Optical Identification of Minerals - The Petrographic Microscope

Part II

Daniel E. Kile
Mineralogical Technical Chairman, RMFMS

A Brief History of the Development of the Petrographic Microscope

Although there is little information published on the early development of the petrographic microscope, some of the essentials can be obtained from early popular references and textbooks. It is important to remember that microscopy in the Victorian era was as much a form of recreation as it was science, and polarized light microscopy was often used for its sheer entertainment value in that vivid and contrasting colors could be produced from otherwise rather ordinary slide mounts.

An early method of producing polarized light was by reflection, and elementary "polariscopes" were manufactured as early as 1816. These were simple microscopes without a stage, but basic observations could still be made. One of the earliest known polarizing microscopes, of simple design, was manufactured and delivered to the Royal Society of Edinbugh in 1829. Development was greatly accelerated, however, by the invention of the Nicol prism in 1829[1]. Two of these prisms, one above the other in an optical light path and oriented at 90° to one another (commonly referred to as "crossed nicols"), will extinguish all light passing through and allow observation of features essential to mineral identification. Later modifications of this prism design were made by others; a polarizer called the Ahrens prism is often seen in relatively recent microscopes. It is constructed of three sections of calcite (unlike two in the Nicol prism), and allows a wider diameter but shorter overall length, economizing the expensive optical-grade material.

By the 1840s, most of the better microscopes included a polarizer (the lower prism, mounted in the condenser) and analyzer (an upper prism, usually part of the eyepiece in early microscopes, and incorporated into the lower tube in later, specialized designs). Compensators, such as selenite, which retard the speed of light and give more intense colors, were developed by 1830, and the Bertrand lens, mounted in the upper microscope tube and used for studying an interference figure (this will be discussed in more detail later) that is formed at the back of the objective lens, was introduced in 1878. By the late 1800s, the basic design of the petrographic microscope was complete, and is still used to this day with monocular instruments.

The development of Polaroid by Edwin Turner in 1932 led to another period of rapid advances in design[2]. The relative thinness of this material permitted the adaptation of binocular design to petrographic microscopes. Most of this development seems to have taken place after the mid 1940s, presumably when optical-grade Polaroid became readily available. Calcite prisms nevertheless continued to be used by some manufacturers up to the early 1970s because of their low absorbance of certain wavelengths of light and freedom from color.

Basic Design of the Petrographic Microscope

The construction of a monocular instrument is shown on the next page. For purposes of clarity, I will differentiate a "petrographic microscope" that has a polarizer and analyzer, Bertrand lens, cross-hair eyepiece, rotating graduated stage, centerable objectives, and slot for insertion of compensators, from a "chemical microscope" that has a polarizer and analyzer but lacks a cross-hair eyepiece, wave plate slot, and Bertrand lens. Many biological microscopes were equipped with a polarizer only, and are unsuitable for petrographic work.

Accessories, discussed below in more detail, are the gypsum (1λ) compensator plate (an essential accessory), mica (1/4λ) plate, and quartz wedge. Some microscopes include a pinhole eyepiece to be used instead of the Bertrand lens. "Luxury items" include a rotatable analyzer, focusable, centerable Bertrand lens with diaphragm, mechanical stage, and centerable condenser with field (lower) diaphragm.

Microscope Components

eyepiece: with cross hair for measuring crystal angles and extinction angles; usually 8 - 10 X.

Bertrand lens: slides into upper body tube; focuses on the rear lens of the objective. Allows observation of interference figures that are indicative of crystal system and orientation under the microscope. May have diaphragm for giving sharper resolution of interference figure, and may be focusable (up and down motion) and centerable.

analyzer: slides in an out of lower body tube, and when crossed with lower polarizer, extinguishes all light. The appearance of a mineral under "crossed nicols" yields information on crystal system (isotropic *vs.* anisotropic), extinction angle, twinning, zoning, and other properties.

accessory slot: for insertion of wave (compensator) plates or quartz wedge; the change of color indicates

[1] Prior to the use of calcite, tourmaline was commonly used to polarize light, but serious drawbacks were interference by the color, and relative unavailability of flawless material. Two plates of tourmaline, when crossed, will extinguish all light passing through, much as would two polaroid sunglass lenses or Nicol prisms.

[2] The basic constituent of this material, iodocinchonidine sulfate (a salt of quinine), was found in crystalline form to be an effective polarizing material much earlier, in 1854, by W.D Herapith. It was then known as "artificial tourmaline", or more recently as "Herapithite".

optic sign (this will be either positive or negative as indicated by the color change, and is related to the different velocities of light rays as they separate upon passing through a crystal relative to its c-axis - this will be explained in more detail later).

coarse and fine focus: mechanism often very stiff in older microscopes due to hardened grease.

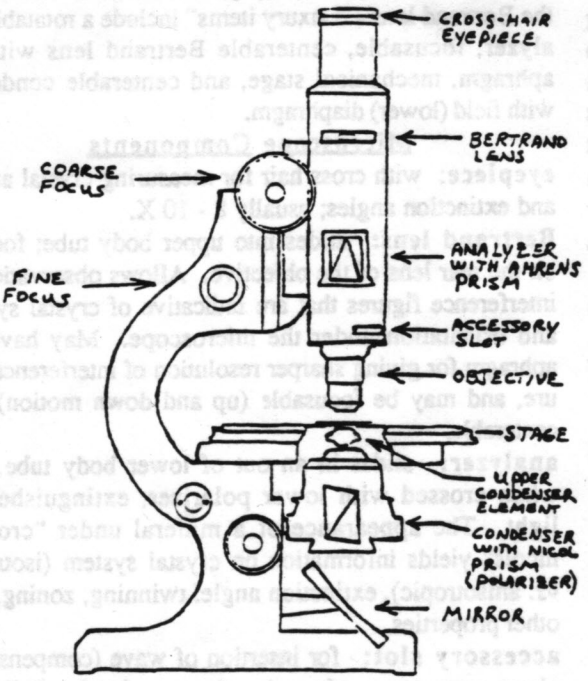
objective: powers ranging from 3 - 45 X; centerable with respect to optic light path. Generally marked for polarizing use, as "strain-free" or "pol", although most ordinary biological objectives will work as well.

stage: rotatable and graduated in 360 degree circle; may have a mechanical stage for more sensitive positioning of small grains. Better stages operate on ball bearings to give smoother rotation.

condenser: contains upper swing-away lens element that directs convergent light on the specimen, allowing observation of interference figures. Upper aperture diaphragm always present; lower, field diaghragm sometimes present, which allows better resolution of light in some situations. Condenser is focusable vertically by rack and pinion.

polarizer: contained within the condenser; rotatable and graduated.

mirror: present on older microscopes and works well with low-wattage illuminators having blue daylight filter. Newer microscopes may have built in illuminators, some with variable transformer.



Variations of this design were developed in the late 1880s; such were the "Dick" design by Swift Co. (English) that featured synchronous rotation of analyzer and polarizer, and a microscope by Nachet (French) that coupled rotation of the objective with the stage. These designs were intended to avoid the need to center the objective in the light path (an essential requirement with a rotating stage, otherwise the object will rotate out of the field of view), but their short-lived history attests to the utility of the conventional pattern. Other petrographic microscopes were manufactured by Zeiss, Leitz, and Fuess (German); Reichert (Austrian); Spencer/American Optical and Bausch and Lomb (American); and Nikon (Japanese).

Several items should be checked when purchasing a used microscope. The balsam at the interface of the calcite prisms in older microscopes may have become decemented, giving a mottled or blotched appearance. Polaroid can also lose its ability to function properly, especially if subjected to intense light. The coarse and fine focus should work smoothly (grease in older microscopes can become hard, rendering the mechanism nearly inoperable). The stage should rotate freely. Objectives and eyepieces should be checked for excessive scratches, presence of cross hairs (some use platinum or spiderweb which are easily destroyed), and condition of lens coatings in newer optics; for objectives, decementing of lower lens elements may result in cloudy image formation. Most of these deficiencies can be repaired, but can significantly add to the aquisition expense.

The cost of a microscope need not be prohibitive: a basic system can be as little as $350-800 (although the cost can easily run much higher). Grain mounts can be easily made with minimal equipment, and thin section preparations can be commercially made for around $10.00 each. Refractive index oils can be an expensive item, but used sets can sometimes be obtained; even so, much can still be learned without the use of such oils.

A fundamental knowledge of the microscope and its use can be gained by most anyone willing to invest the time, and the benefit is not only an ability to make presumptive mineral identifications from mere grains, but also an increased understanding of mineralogy resulting from an integration of physics, chemistry, and crystallography, by optical mineralogy concepts.

References

Hogg, Jabez (1898). The Microscope, its History, Construction, and Application, G. Routledge & Sons, New York, 704 p.

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Carpenter, W.B., and Dallinger, W.M. (1891). The Microscope and its Revelations, J.A. Churchill, London, 1099 p.

Rogers, A.F., and Kerr, P.F. (1942). Optical Mineralogy, McGraw Hill, New York, 390 p.

Malies, Harold (1981). A Short History of the English Microscope, Microscope Publications, Ltd., Chicago, 98p.

Lima-de-Faria, J., editor (1990). Historical Atlas of Crystallography, Kluwer Academic Publ., Boston, 158p.

Delehar, Peter (1991). Museum Report: the Royal Scottish Museum, Edinburgh, *in* Bulletin of the Scientific Instrument Society, no. 30, p. 14-16.

Copies of the Photography Symposium volume (1989) are also available, for just $8.00; we and the Denver Museum have a good stock of these.

Letter to Members of Congress about proposed changes to the mining law: A form letter has been drafted by members of the Mile Hi Rock and Mineral Society, asking members of Congress to consider the past contributions and interests of "small miners, amateur geologists, and rockhounds" in any proposed changes to the mining laws. The Denver Council is helping to distribute copies of this letter, addressed to each member of the Colorado congressional delegation, to each of its member clubs; they encourage each person to sign (with your name and address) and mail copies of the letter to as many of the Colorado representatives and senators as you care to. Copies of the letter will be available at our next (and succeeding) meetings.

Coming Up:

The **November FM meeting** will be Thursday, Nov. 11, 7:30 p.m., in the Ricketson Auditorium. The speaker will be Bryan Lees, telling us about "**The Sweet Home Mine in 1993**". Members of all other Denver area clubs have been invited to come to this program.

The **New Mexico Mineral Symposium**, Nov. 13-14 in Socorro, N.M., will feature Bernard Kozykowski of Franklin, New Jersey, speaking on "Franklin, its mines and minerals", plus talks on silver minerals; new mineral finds of the San Juans; the Organ Mountains (NM); Prospect Hills (NM); Steeple Rock district (NM); Patagonia Mountains (AZ); Linchburg mine (NM); Pioneer district (AZ); Broken Hill, Australia; "What's new in Colorado minerals" (Jack Murphy), and "What's in a name: a discourse on the pronunciation and origins of some mineral names" (Paul Hlava). Sunday afternoon there will be a silent auction, and this year the informal tailgating and mineral selling activity will take place at the Super 8 Motel in Socorro. Registration is $22; for information contact the New Mexico Bureau of Mines, (505) 835-5302.

All interested persons are invited to two **auctions** hosted by local mineral clubs: the Colorado Mineral Society on Friday, Nov. 5 (6:00-9:30 p.m.) at the Jefferson County Fairgrounds, and the Littleton Club at the South Suburban Realtors Building (Broadway and Mineral Ave.) on Friday, Nov. 19 (7:00 p.m.).

FM Nominating Committee: Ray Berry, Jim Hurlbut, and Jack Murphy are the FMCC nominating committee for 1994 officers and directors. Suggestions or offers to serve in these positions should be directed to them. A ballot will be mailed to all members in advance of the November meeting. Remember--if you enjoy and support the activities of this organization, consider offering to help keep them going.

FMCC Membership Survey: In 1990, a membership survey about the areas of greatest interest to FMCC members was conducted, and the results were published in the Nov. 1991 FMCC newsletter (copies of this are available to any member who requests one). For those new members who have joined since then, we are attaching a copy of the membership survey form; if you wish, please fill it out and return to us, so we can print an updated supplement to the survey.

1993 Calendar

Oct. 14 - -	October FM meeting, Ricketson Auditorium, DMNH
Nov. 5 - -	Colorado Mineral Society auction, Jefferson County Fairgrounds
Nov. 5-6 -	WIPS/DMNH Colorado Paleontology Symposium, Denver Mus. Nat. Hist.
Nov. 11 - -	November FM meeting, Ricketson Auditorium, DMNH
Nov. 13-14	Fourteenth Annual New Mexico Mineral Symposium, Socorro, NM
Nov. 19 - -	Littleton Club auction, South Suburban Realtors Building

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Everyone is invited to attend our special November lecture,
7:30 p.m., Thursday, Nov. 11, Ricketson Auditorium,
Denver Museum of Natural History:
"The Sweet Home Mine in 1993", by Bryan Lees

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FM annual dues are $13.00.
All persons interested in the mineralogy of
Colorado and in the study and preservation
of minerals are welcome to join.

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