Friends of Mineralogy

Colorado Chapter Newsletter

November, 1991

President:	Peter Rabbit		
Vice President:	Pete Modreski	Director:	Gene Foord
Treasurer:	Jim Hurlbut	Director:	Ed Raines
Secretary:	Carol Smith	Director:	Glen Johnson

November Program: 7:30 p.m., November 14, 1991
West Auditorium, Denver Museum of Natural History

Paul Hlava will give a program titled "Zoning in Minerals: Properties, Potentials, and Problems". An abstract of Paul's talk is given elsewhere in this newsletter.

Paul resides in Albuquerque, New Mexico, and is driving to Denver to give this presentation ... it isn't very often that some unsuspecting speaker can be coerced to make the trek over Raton Pass to talk to our group, so I encourage everyone to attend; besides it should be an excellent program (actually, Paul graciously consented to give a talk, with little or no arm-twisting).

Board Meeting - 6:00 p.m., November 14
Denver Museum of Natural History Cafeteria
NOTE CHANGE IN BOARD MEETING TIME AND DATE

Notes From the (soon to be ex-)**President:**

ITS ELECTION TIME !!!

Ballots are enclosed - they must be received not later than November 14th. Bring your ballot to the November Meeting, or mail it to our new address, given below (no, I won't give it to you here - this way you'll have to read the whole damn newsletter to find it!!!).

Evidently the collective effort of those in the "mineral community" (have you ever quite figured out what a mineral community is??) may not be so impotent after all ... Marie Huizing has been asked to stay on as editor of *Rocks and Minerals* magazine, presumably a result of a large number of letters written by irate subscribers. Hopefully a magazine format will be agreed upon and Marie will decide to stay on permanently - if so, we still need to support this magazine. If you haven't already subscribed to it - - WHY NOT ??? (use it or lose it!)

DUES 'R DUE!!!

Fork over $13.00 to Glen Johnson (our "membership chairman") or send to our new address:

P.O. Box 150401
Lakewood, Colorado 80215-0401

Thanks are extended those who contributed to this newsletter: Gene Foord (article on topaz); Marty Zinn (summary of member interests); Pete Modreski (book reviews, etc.), and Bryan Lees ("What's New in Minerals"). While on the subject, acknowledgement is also given Gene Foord's informative and entertaining program presented at the last meeting.

Post Mortem of the last (September) Meeting and Proposed Future FMCC Activities:

Reiteration of earlier discussion regarding activities FMCC might consider in order to increase FMCC exposure to the public and concomitantly increase our membership. Activities discussed were: (1) an FMCC exhibit at the next Denver Show, and (2) hosting an FMCC symposium at the Denver show (Colorado gemstones and field collecting techniques were offered as possibilities). A "symposium extravaganza" similar to the Pegmatite (1986) and Precious Metals (1988) symposia is also a possibility, but new volunteers are needed in order to make this option feasible.

Regarding interests of the FMCC membership, as evidenced by the recent member poll, and consequent suggestions for future FMCC activities:

(1) A field trip may be in order, possibly to a site to which it is ordinarily difficult to gain access.

(2) We may need to do something to increase interest in our auction. Suggestions given were (a) authorize purchase of auction items by designated members (although it may be better to continue to utilize museum items?) (b) combining the auction with a "yard sale"\potluck type of format, (c) a raffle (d) a mine tour; and/or (e) limiting the number of specimens brought to the auction by any one individual.

Other topics for future agenda are (1) pursuing FMCC tax-exempt status (filing fee = $150.00); (2) an exhibit at the new airport; and (3) consideration of formal redesignation of FMCC board directors to more functional titles, such as editor or membership. Glen Johnson has accepted the role of "informal" membership chairman - he will collect your dues (and forward them to the treasurer) and maintain an up-to-date mailing list.

A final idea based on reflection of one of the comments in our recent opinion poll - one of the members stated (in the comment section of the membership survey) that other area rock clubs looked to FMCC for expertise and shared knowledge. It seems appropriate that this organization develop a "speakers bureau", i.e., a list of members who have expertise and interest in giving programs regarding specific topics; this list (which could be expanded to include consenting non-FMCC members) could be distributed to area clubs to facilitate arranging programs. It is very difficult to come up with good programs every other month (much less every month) and I am amazed at how poorly this type of information is disseminated among area clubs. This organization, with its diverse membership and emphasis on education in the Earth sciences, is uniquely suited to organize such a program.

These and other topics are open to discussion - it is the responsibility of the board to be attentive to membership interests - but they cannot do so without your input...

Post Mortem of the Last Two Years:

A final parting comment: while assorted opinions and editorials expressed in various newsletters over the past two years may not be agreeable to everyone - their intent was to stimulate independent thought about what our goals are and what our individual roles are in meeting those goals. As stated earlier, if I've accomplished nothing more than to create a forum for reevaluation of the such topics, then I will consider my time in writing this newsletter well spent.

Lastly, I would like to thank all of those who served on the board of directors for their

indulgence and contributions of time and effort, and all those volunteers who made the meetings, auctions, and other functions run much more smoothly than they might have. Lastly, let's not forget Jack Murphy, who has coordinated our activities with the Denver Museum through all of the past years, and Dianne Kile, who had to put up with me these past two (or was it twenty-something?) years.

Report of Progress on the Update to the 100-Year Record:

Ed Raines has been delegated (by myself) to be the chairman of the photographic committee, pending ratification by the membership. Ed has enthusiastically commenced work on photography and compilation of a species list, and will be effective in this position.

Pete Modreski has written a prognosis for completion of the update, based on the recent activities by the update authors; this is summarized elsewhere in this newsletter.

Current Rumors and Events:

Marie Huizing has written a letter of thanks, on behalf of *Rocks and Minerals*, to all the Denver area clubs, expressing sincere thanks for our continuing support of the magazine and for the donation of $1200.00 to the color fund (this money resulted from the proceeds of the Saturday night auction) - much of which went to support color photographs in a recently published, overbearing Colorado Quartz article.

The Denver Gem and Mineral Guild is sponsoring their annual show at Lakeside Mall, at I-70 and Harland, January 16 - 19, 1992.

The 38th annual Tucson Gem and Mineral Show will be held at the Tucson Convention Center February 12 - 16, 1992. Don't forget the Executive Inn Show that is held concurrently.

Members of all area clubs are invited to attend the annual silent/vocal auction sponsored by the Littleton Gem and Mineral Club, Friday, November 15. It will be held at the South Suburban Realtor's Building, on the northeast corner of Mineral and Broadway; doors open at 6:30 pm and the auction begins at 7. Anyone can bring material to sell at the auction; the Littleton club keeps 20% of the selling price. There are usually great refreshments too!

Rudy Tschernich is working towards completion of a book to be titled "Zeolites of the World" - this monograph is rumored to be THE definitive treatise on zeolite occurrences; publication is projected to be 1992. Since I have a warm feeling for ugly white rocks (i.e., Table Mountain zeolites) I would think this to be a valuable reference.

The nominees for the 1992 Denver Council of Gem and Mineral Societies are: President - Sandy Walden; Vice President - Keith Sheel; Treasurer - Gloria Charette; Secretary - Kathy Lewis.

The 12th Annual New Mexico Symposium will be November 9 - 10, 1991, at Macey Center, New Mexico Institute of Mining and Technology, Socorro, New Mexico. Lectures are from 8:30 - 5:30, Saturday, November 12, and 9:00 - 12:00 Sunday. There is a silent auction Sunday afternoon, and a dinner Saturday evening featuring Gilbert Gauthier speaking on "Mineral Classics of Shaba, Zaire". Registration is $20.00 to attend the symposium, and $16.00 for the dinner.

(Final) Call for Papers: Thirteenth Mineralogical Symposium sponsored by Friends of Mineralogy, the Tucson Gem & Mineral Society, and the Mineralogical Society of America; held in conjunction with the 38th Tucson Gem and Mineral Show, Saturday, February 15, 1992. Pyromorphite is the show's theme mineral. Papers on the descriptive mineralogy, paragenesis, classic and new occurrences of pyromorphite or secondary lead minerals are invited. Papers on other subjects - new species or occurrences, etc. - are also welcome. Call or write Dr. Carl A. Francis, Chairman (Harvard Mineralogical Museum, 24 Oxford Street, Cambridge, MA 02138) with your topic, a few sentences describing the paper, and your address and telephone number. Following acceptance, authors are required to submit a 200-300 word abstract by September 15, 1991, which will be published in the *Mineralogical Record.*

News of Members:

Membership Survey Results: Marty Zinn has done an outstanding job of compiling the member interests and summarizing them in a "camera-ready" format. This included not only deciphering sometimes cryptic handwriting, but also diplomatically editing assorted comments. I think you will find this summary (included with this newsletter) to be informative and useful - and hopefully it will encourage better communication with members having common interests.

It is of interest to note that at least 29 of 61 respondents are either employed in or have professional training in the earth or physical sciences (and at least 9 of these are employed by the U.S. Geological Survey); nearly 50% are employed in areas other than the sciences. This represents a unique blend of amateur and professional talent and expertise, which I feel that FMCC can use to advantage to further the goals of Friends of Mineralogy.

Two new FMCC members:

Leonard Himes, who will be with us for a short time (many of us will recognize Leonard as an associate of Graeber and Himes Minerals); and Marlin Brusberg, a new member to FMCC. We welcome both these members to our organization.

What's New in Minerals:

Bryan Lees has provided an interesting summary of his mining activities at the Sweet Home mine this past summer; this is included in the "What's New in Minerals?" section of this newsletter.

Miscellaneous Ilk Department:

Pete Modreski has kindly submitted the information on the following three pages for the newsletter:

Mineral Identification Booth

Our thanks to everyone who helped at the FM-sponsored mineral identification booth at the Denver Show. Volunteer identifiers included Howard Bachman, Bill Chirnside, Ed Raines, Sam Rosenblum (special thanks to Sam, who manned the booth almost all day Friday), plus non-FM "friends" Dave Allerton (of the USGS), Susan Eriksson (from VPI), and Paul Pohwat (U.S. Nat. Museum). We had a chance to examine the usual complement of good- to ugly-looking minerals, rocks, and general purpose pebbles.

---Pete Modreski

Report on Minerals of Colorado Update

Producing an "Update" to Minerals of Colorado - a 100-Year Record has been a major project of the Chapter for about the past ten years. Current work on the book mostly involves turning the current version of the manuscript into a "final draft" version, species by species, by the four authors--Bob Cobban, Rik Collins, Eugene Foord, and Jack Murphy. The "final draft" of each species is then reviewed for accuracy by the authors and others; completed, reviewed, and corrected species drafts, ready for publication, will then be "archived" on a computer disk by Jim Hurlbut at the Denver Museum of Natural History. The manuscript contains about 750 separate, valid species entries; headings for mineral groups and name cross-references bring the total number of mineral headings to over 800. At the beginning of 1991, about 106 species had reached "final draft" status. Substantial progress has been made this year, and as of this date of writing (10/9/91), 285 species are in "final draft" form. If this rate of work can be continued, the complete text will be ready in about two years from now. At the same time, Ed Raines is heading a committee to select photographs (and specimens to photograph) for the Update volume. We plan to have a discussion about the progress, prospects, and support for the Update project at the November FM meeting. If you have an interest in the project, please try to attend the meeting to take part in the discussion.

Pete Modreski, update coordinator

(Ed. note: Pete's graph of the progress on the update is included on page 7 of this newsletter.)

Symposium Book Sales

At present, FM still has in stock the 1986 Pegmatite Symposium volume (36 copies left), the 1988 Precious Metals Symposium book (16 copies left), and the 1989 Photography Symposium book (a large stock--several hundred copies--remains). Each of these is available for $15; at the upcoming FM meeting, we may discuss reducing the price of the Photography volume. So far this year, we have sold 6 copies of "Colorado Pegmatites" and 4 copies of the Precious Metals volume. In addition, we donated gratis two copies of the Precious Metals book for review purposes: one to Economic Geology (the bulletin of the Society of Economic Geologists) and one to The Institution of Mining and Metallurgy (London) for IMM Abstracts".

About books

Two new books that may be of interest:

Agates, by H.G. Macpherson (1989; softbound; British Museum/Natural History; 72 p.; $14.95). One perhaps learns not to expect too much of a book about "agate", but this volume is a far cut above the average. It is actually about the agate localities of the British Isles (principally in Scotland). The book is full of superbly taken and printed color photographs of agates, and it contains a thought-provoking discussion about different theories on the origin of agates. Are the bands in agate deposited layer-by-layer from dilute silica-bearing water which continually moves through the agate-lined cavity (the "In and Out" theory), or is the entire cavity originally filled with a thick, colloidal, silica gel, which gradually loses water, hardens, and crystallizes, developing its banding by diffusion of impurities and by differential crystallization (the "In and Sort Out" theory)? Many agates show intriguing features, such as a "tube of escape", "dilation", and "agate dyke", which seem to be evidence for escape of water while the agate bands were soft, supporting the latter theory--take a look at the photographs. One can also find locality descriptions and collecting stories:

"The late Harry Scott of Edinburgh searched for and collected St Cyrus agates for more than twenty years. Some of these he collected below high vertical cliff faces, although he frequently warned young collectors about the obvious dangers inherent in such a practice. Sadly, whilst on a collecting trip in an area where he had discovered large agates of superb quality, the dangers became all too apparent as while hammering at and below a verticle cliff face, he loosened two or three tons of rock which fell on him, killing him instantly."

The book was available at the Denver Show (and by mail order) from the Nevada Mineral and Book Co. (702 453-5718) and presumably elsewhere.

---Pete Modreski

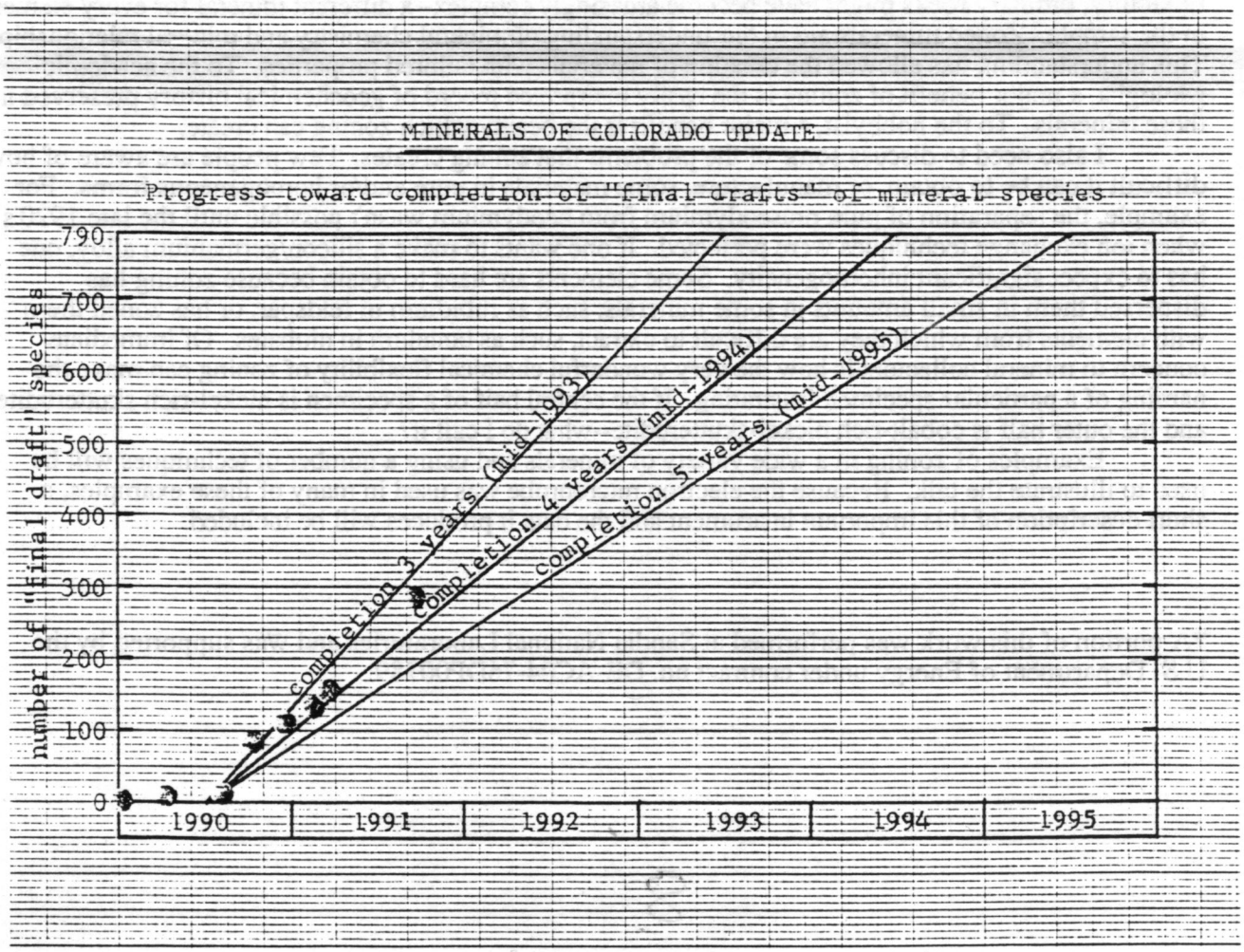
Giant Crystals - Precious Minerals, by Henri-Jean Schubnel (1987; hardbound; Hachette/Museum National d'Histoire Naturelle de Paris; 64 p.; $14.95). This remarkably enjoyable book (in English) is basically an account of the history of the mineral collections of the National Natural History Museum in Paris. However, by way of describing the French collections, it includes a well written and interesting account of the history of mineralogy in general, and particularly fascinating is its description of the Deleff collection, "The Legendary Giant Crystals of Brazil". Ilia Deleff, born in Bulgaria, was a prospector, collector, and adventurer who roamed the Amazon and other regions of Brazil from the 1950's through the 1970's. He assembled an absolutely unique collection of giant crystals of quartz, microcline, and other minerals, ranging in mass from hundreds to thousands of kilograms (!), several of which are illustrated in color in this book. One can read, for example, of one of Deleff's failures:

"...in 1959, when Deleff was beginning his collection, he did not succeed in acquiring a perfect, slightly brownish monocrystal weighing

7 tons: the mine owner preferred to break it up in hopes of finding a "transparent heart" usable in the piezoelectrical industry. Unfortunately, his expectations came to nothing. None of the fragments of this giant marvel proved to be industrially useful and both the miner and the collector saw their dream smashed to pieces."

The Deleff collection now resides in the Museum National d'Histoire Naturelle. Some items from it are now on display (only through Oct. 27) as part of the spectacular "Gems" exhibit at the Boston Museum of Science--see the article by Dorothy Stripp in the September Lapidary Journal. The only way I know of to obtain this book at present is in person or by phone order (617 723-2500 ext. 319) from the Boston Museum of Science, and it is uncertain whether it will be available after the exhibit closes.

---Pete Modreski



Zoning in Minerals: Properties, Potentials, and Problems

Paul F. Hlava
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Most minerals are chemically complex and can exhibit large variations in chemistry. We often see tables of analyses of one mineral or another where the chemistry of the mineral reflects the differences in geochemistry from one locale to another. Therefore most of us are aware of such changes. However, many of us are only vaguely aware that if the chemical and physical conditions change while any one crystal of such a mineral is growing, this individual crystal will show chemical variations within it. This phenomenon is called **zoning** and, while we have all seen this, few of us have thought about what causes it or what it is telling us. In this talk, I plan to remedy that by examining some of the properties of zoning as well as discussing some of the good (potentials) and bad (problems) features of this phenomenon.

In discussing properties I plan to mention phenomena such as diadochy which allow zoning to occur as well as discuss the various properties that zoning exhibits. These properties include the fact that some elements can change concentration while others don't. Zoning occurs in various styles or types (normal, reverse, sector, and oscillatory), several of which can be exhibited by any one crystal at the same time. Zoning can be manifested in many different ways (color, berefringence, microprobe analyses, etc). It is important in discussing zoning to remember that essentially all minerals are zoned, some obviously, some not so obviously.

I will also discuss some of the potentials (benefits) of mineral zoning. For example, zoning helps to simplify the mineral kingdom by making minerals chemically "flexible". Without this flexibility, ordinary rocks might have become amazingly complex--a different mineral for every element in the sample. Zoned minerals aid in our understanding of mineral chemistry and mineral relationships. This understanding has allowed the creation of materials with tailored properties. To the academic geologist, a major benefit of zoning is the easily interpreted record of geochemical history preserved in these minerals. To the hobbyist, a major benefit is the beauty which zoning can create.

I also need to discuss some of the problems that zoning creates. Few people are aware of how difficult it can be to obtain, or manufacture, some materials in pure and/or homogeneous forms. For example, the separation of pure praseodymium from neodymium wasn't possible until the late 1920's when ion exchange techniques were perfected. If one wants to make a silicon/germanium alloy, one has to expect significant inhomogeneity. Some elements are hard to obtain because zoning has dispersed them in small amounts in some minerals, such as rubidium in feldspar, or has zoned them with elements from which they are difficult to extract, such as tantalum in niobates. Of immediate concern to mineral collectors is how the very wonderful chemical flexibility of zoning can make the naming of a particular specimen frustrating. If the central half of a specimen is nickel-rich skutterudite and the outer half is cobalt-rich nickel-skutterudite--what do I call it?

Examples of zoning in a wide variety of minerals and using a number of techniques will be used to illustrate the talk. Because the electron microprobe was used in many of these examples, a short description of this important instrument and the data it produces will be included.

*A portion of this work was performed at Sandia National Laboratories and was supported by the U.S. Department of Energy under contract no. DE-AC04-76DP00789.

What's New In Colorado Minerals ?

by Bryan K. Lees

Sweet Home Mine

This May the historic Home Sweet Home Mine, located in Alma, Colorado was reopened and underwent a complete rehabilitation program. In order to meet today's stringent State and Federal laws, a complete mine renovation had to be performed before crystal mining could take place. This included the installation of a new portal, ventilation system, compressed air and water lines, emergency communications system, air and water testing program, mine crew saftey program, air compressor, new electical service, miner refuge chamber and a dozen other sundry things including the remodeling of mine-site buildings to meet fire codes.

After compliance with regulations, several other things had to be accomplished in order to get to the rhodochrosites. First, a complete, full-time mine crew was hired (5 people). Then we went to work widening the tunnels and removing the railroad system. This was done so that we could bring in a rubber-tired low profile front-end loader to remove rock waste. Following all of this preliminary work, we could finally get down to the task at hand: FIND RHODOS!

"Finding Rhodos" proved to be the most interesting challenge. Every area of the mine was carefully studied and evaluated for rhodo potential. The evaluation phase included several small drifts, or tunnels, into areas that showed promise. During this phase, we studied six areas throughout the mine and settled on three targets for further consideration. One of these targets was already worked extensively in the past and produced now-famous specimens such as the Bancroft specimen and the pieces in the Dever Museum of Natural History.

Much geological, geophysical, geochemical, and survey work is currently underway. These will help us develop a paragenetic model, mine map, and geologic map to isolate other potential mining areas.

Mine rehabilitation work took most of the first season. However, during the past several weeks, as our targets were delineated, some pockets were discoverd. Included in the discoveries were large tetrahedrites (to 1.5 inches), apatites (to 3/8 inch), nice blue-purple cubic fluorites (to 3/4 inch), beautiful dodecahedral fluorites (to 1 inch), bournites (to 1 inch), topaz crystals (micros), huebnerites (to 1—1/2 inches, flat-lying) and, of course, some fine rhodochrosite crystals.

Our discoveries thus far have encouraged us to continue. The project will last through next year when we hope to find quantities of rhodochrosite capable of returning the investment required to hunt them.

Topaz, $Al_2SiO_4(F,OH)_2$, A favorite of the mineral Kingdom

by

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Topaz, a mineral structurally related to danburite and andalusite, has been known since Antiquity. The name is from the Greek word 'topazios', an island in the Red Sea, meaning 'to seek', the island often being covered by mist.

Crystallography. Fluortopaz, $Al_2SiO_4(F)_2$, is orthorhombic, point group is 2/m2/m2/m, sp. grp. Pbnm(62), prismatic to equant, {110} or {210} predominating. In pegmatitic topaz, {401} is often prominent. Contact twins are rare, on (010). Unit cell data for fluorine-rich topaz (Thomas Range, Utah): a- 4.648Å, b- 8.792Å, c- 8.394Å, V 343.0Å^3 (data from Rosenberg, 1967), Z = 4. OH-rich topaz, with a maximum of about 30 mol. % OH substitution for F, is triclinic, sp. grp. P1, with similar habit to that for F-rich topaz. Unit cell data for OH-bearing topaz, with 25 mol. % OH substitution for F (Ouro Preto, Brazil): a-4.660Å, b- 8.833Å, c- 8.395Å, V 345.55Å^3 (Data from Rosenberg, 1967), Z = 4.

Structure. The key structural units are crankshaft-like chains of edge-sharing $[AlO_4(F,OH)_2]$ octahedra parallel to c, cross-linked by corner-sharing $[SiO_4]$ tetrahedra. Oxygens lie in approximately closest-packed layers in which layers of oxygen alone alternate with layers of $[(F,OH)_2O]$ in the mixed hcp-ccp sequence ABAC. One-third of the octahedral sites are filled with Al and one-twelfth of the tetrahedral sites with Si. Oxygen atoms are coordinated by 1 Si and 2 Al atoms, (F,OH) by two Al atoms. The perfect basal (001) cleavage is present because only Al-O and Al-F bonds are broken. Orthorhombic (Pbnm) topaz contains eight symmetry equivalent positions for F and OH. OH is disordered over these sites. Triclinic topaz (Pl), with up to 30 mol. % OH for F, found in hydrothermal veins, has ordered H on only one of the eight sites. Parise (1980) concluded that the reason why topaz always has less than 50% OH for F is that the closest distance between two hydrogen atoms (1.5Å) at occupancies > 50% is too short for two adjacent sites to be simultaneously occupied. Pure fluorine dominant topaz is fully orthorhombic. As substitution of OH for F occurs, ordering of OH and polarization of H reduces symmetry to monoclinic (along certain directions) and then triclinic (Parise et al., 1980). Ordering is detected in the OH-vibrational spectra in the mid-IR and by Raman spectra. Different responses to heating indicate that more than one type of ordering scheme is likely (Ribbe, 1980). Some optically anomalous topaz, such as that from Ouro Preto, Brazil, may be heated to 950°C for 4 hours and the fully orthorhombic structure is attained. However, other specimens of topaz, such as one from Queensland, Australia, was heated at 950°C for 18 hours, with no change. The F-OH ratio correlates with, and possibly is controlled by the temperature of crystallization.

Physical Properties. Topaz may be colorless, straw to wine yellow, pink, blue, green, red and rarely other colors. The colors of topaz are due primarily to radiation-induced color

centers and/or trace levels of transition metals (Petrov, 1977). The natural radiation-induced colors (yellow - orange - brown and blue, which are commonly activated by artificial gamma-ray, neutron, and electron bombardment (Nassau and Prescott, 1975) are unstable and may be destroyed or altered by relatively gentle heating (<500°C) or even by exposure to sunlight. Some colored crystals of topaz fade to colorless (e.g. Thomas Range, Utah); others change color (e.g. sherry to blue, an example being a cut 235 ct topaz in the USNM collection that was originally sherry colored and then turned very pale blue after exposure to light). More rarely, an original color is intensified upon exposure to light (e.g. some blue crystals from the Little Three mine, Ramona, Calif.). The streak is colorless to white, and the luster is vitreous. The mineral has a perfect c (001) cleavage, and no parting. Fracture is subconchoidal to uneven, and the mineral is brittle. Hardness = 8. $D_{meas.}$ 3.4 - 3.6, $D_{calc.}$ 3.56 (fluorine-dominant topaz: end-member). $D_{Calc.}$(OH-rich topaz: 25 mol. % OH for F) 3.37. Infrared reflectance spectra of F-rich and OH-rich topaz are distinct (Foord et al., 1990). Three narrow, well-defined, OH absorption bands are characteristic of F-rich topaz (3400 to 3800 cm^{-1}). Topaz from pegmatites and greisens shows absorption features from 3400 to 4200 cm^{-1}. Hydroxyl-rich topaz displays a more complex series of OH absorption bands between 3400 and 4200 cm^{-1}. Hydroxyl-rich topaz also contains CO_2 as indicated by a sharp peak at 2300 cm^{-1}. The CO_2 is, for the most part, contained in fluid inclusions. Additional details regarding the behavior of OH in topaz at various temperatures are given by Aines and Rossman (1985). Raman spectra for topaz were first recorded in 1947 and single-crystal data are given by Beny and Piriou, 1987.

Topaz is rarely fluorescent yellow, blue-white, orange, or greenish yellow under both SW and LW UV light. Specimens of topaz from the following localities are known to fluoresce: Ouro Preto (yellow-orange, orange, LW and bright blue-white, SW); Katlang, Northwest Frontier Province, Pakistan (blue white and pale yellow, SW; LW no response); Schneckenstein, Saxony (weak light green to yellow green); Little Three mine, Ramona, CA (yellow to yellow orange, SW and LW); Sawtooth batholith, Idaho (yellow to yellow orange, SW); Mason Co., TX (yellow, SW); Lake Co., CO (yellow to yellow orange, SW); Sangkei area, Burma (yellow, SW), and others. In the case of the Ouro Preto topazes, different portions of crystals fluoresce under SW and LW respectively. It is believed that in some cases, the blue-white fluorescence may be due trapped hydrocarbons. No chromophore has been specifically identified for the yellow-yellow orange fluorescence in specimens of topaz from pegmatites, greisens and hydrothermal veins or for the blue-white fluorescence in pale yellow or pink topaz from Katlang, Pakistan. The fluorescence in Ouro Preto topaz may be related to primary growth zones or is present as random patches. The fluorescence of topaz from other localities appears to be coincident and related to primary growth zoning. Topaz is pyroelectric and piezoelectric because of OH for F ordering. Color is sometimes changed by heating or exposure to light due to presence of radiation-induced color centers and differences in their stability to heat (e.g. Petrov, 1977).

The variation of density, unit-cell parameters and refractive indices for topaz is a direct consequence of the OH for F substitution (Rosenberg, 1967; Ribbe and Rosenberg, 1971; Foord et al., 1990). Measurement of density, refractive indices (for most topazes) or unit-cell data may be used to determine the OH or F content and to most likely predict

topaz type (i.e. volcanic, rhyolite-hosted; pegmatitic and greisen-hosted, and hydrothermal vein-hosted). Substitution of Cr and/or Fe cause refractive indices to vary as well.

Chemical Tests. Partially attacked by H_2SO_4.

Chemistry. Topaz usually does not contain many trace or minor elements. As much as about 700 ppm Ge has been reported. More than 100 ppm each of B, Li, and Na have been reported from rhyolite-hosted topaz. Pink to burgundy-colored topaz from Ouro Preto, Brazil and Katlang, Pakistan contains as much as 400-500 ppm Cr. As much as 2700 ppm Cr has been reported from pink-red topaz from Sanarka, USSR. Vanadium is often elevated along with chromium content. Octahedral ferric iron may also play a role in the coloration of topaz. Thus, Cr, Ge and Fe^{3+} substitute for octahedral Al in topaz. In the case of Ge, there is a coupled substitution involved: O^{-2} for F^- (or OH^-). Topaz from topaz rhyolites is essentially end-member fluorine-dominant topaz. That from pegmatites and greisens contains from 0.2 to 0.9 wt. % H_2O^+ and topaz from hydrothermal veins contains from about 1.5 to 2.7 wt. %. Topaz from sillimanite-rutile gneisses is chemically like that from pegmatites. F ranges from about 20 wt. % in topaz from rhyolites down to 15 wt. % in topaz from hydrothermal veins.

Optics. colorless, Nx = 1.610 - 1.630, Ny = 1.612 - 1.632, Nz = 1.619 - 1.639. Biax. +, $2V_z$(meas.) 48 - 68°. Z-X = 0.009. For orth. topaz, OAP = (010), BXA = [001]. X = a, Y = b, Z = c. A linear relationship between 2V and F content was found by Ribbe and Rosenberg (1971) and Konno and Akizuki (1982). Details for triclinic (= optically anomalous) topaz are given in Akizuki et al. (1979) and Ribbe (1980).

Geology and Paragenesis. Topaz is a product of crystallization from F-rich vapors in lithophysal cavities in rhyolites. It also crystallizes as a liquidus phase from rhyolites and certain silicic magmas forming rocks known as ongonites. It is found in Al-rich granites, greisens, tin veins, and pegmatites. Topaz also occurs in hydrothermal veins and rarely in high-temperature sillimanite-bearing metamorphic rocks. Cr-bearing topaz is usually found in hydrothermal veins that transect rocks containing elevated levels of Cr or are closely associated with such rocks. Light pink, and possibly chromium-bearing topaz has also been found, hosted by rhyolite, in the Thomas Range, Utah. Several localities are known northeast of Topaz Valley.

One of the largest known crystals of topaz is a 596 pound crystal presently on display at the Museum of Natural History in New York. The crystal is from a pegmatite in Minas Gerais, Brazil. Still larger crystals are known to exist.

Occurrences. Stoneham, ME in fine crystals; in miarolitic cavities in pegmatites at Moat Mtn. and the Lovejoy gravel pits near Conway, NH; blue topaz is found in pegmatites in the Llano uplift, Mason Co., TX; in pegmatites in the Pikes Peak region, CO; in lithophysae in rhyolite from the Thomas Range, Juab Co., UT and Ruby Mtn., Nathrop, CO. In pegmatites at the Little Three mine, Ramona and at the Blue Lady mine, Aguanga Mtn., CA. Rhyolitic occurrences are found in Mexico in the states of Zacatecas, Durango and San Luis Potosi (particularly near Tepetate). In Germany at Schneckenstein, Saxony. In the USSR in pegmatites at Miask, Ilmen Mts.; the Volyn region, Ukraine; in superb nearly equant crystals of sky-blue color from Alabaschka, near Mursinsk, Urals; from the Adun-Tschilon Mts., Nertschinsk, Transbaikal region, Siberia. Cr-bearing, pink to purplish red crystals are found in placer and gem gravels derived from quartz veins as well as in the

quartz veins and within vugs in limestone, near Sanarka, Orenburg district, Urals, USSR. From Pakistan (Northwest Frontier Province) in deep pink, Cr-bearing, gem crystals with quartz and calcite in a hydrothermal vein at Katlang, and in fine wine-colored crystals in pegmatites in the Gilgit area. In Japan at Tanokamiyama, Omi Pref. In Nigeria at Jos in veins with cassiterite and columbite. In Zimbabwe in fine blue crystals at St. Anne's mine, Karoi district. In Namibia at Klein Spitzkopje, Usakos. In Brazil in fine yellow, orange and pink to violet gem crystals ("Imperial Topaz") in hydrothermal veins in the Ouro Preto district, Minas Gerais, associated with euclase, hematite, rutile; also in Minas Gerais abundant in the Marambaia district in fine colorless crystals; at Virgem da Lapa, in pegmatites in fine blue crystals, one of which weighed 28 kg. associated with lepidolite and herderite; and at the Fazenda do Funil, Sta. Maria de Itabira, in magnificent large crystals associated with gem beryl and cassiterite. One of these crystals weighed over 270 kg. and several exceeded 100 kg.

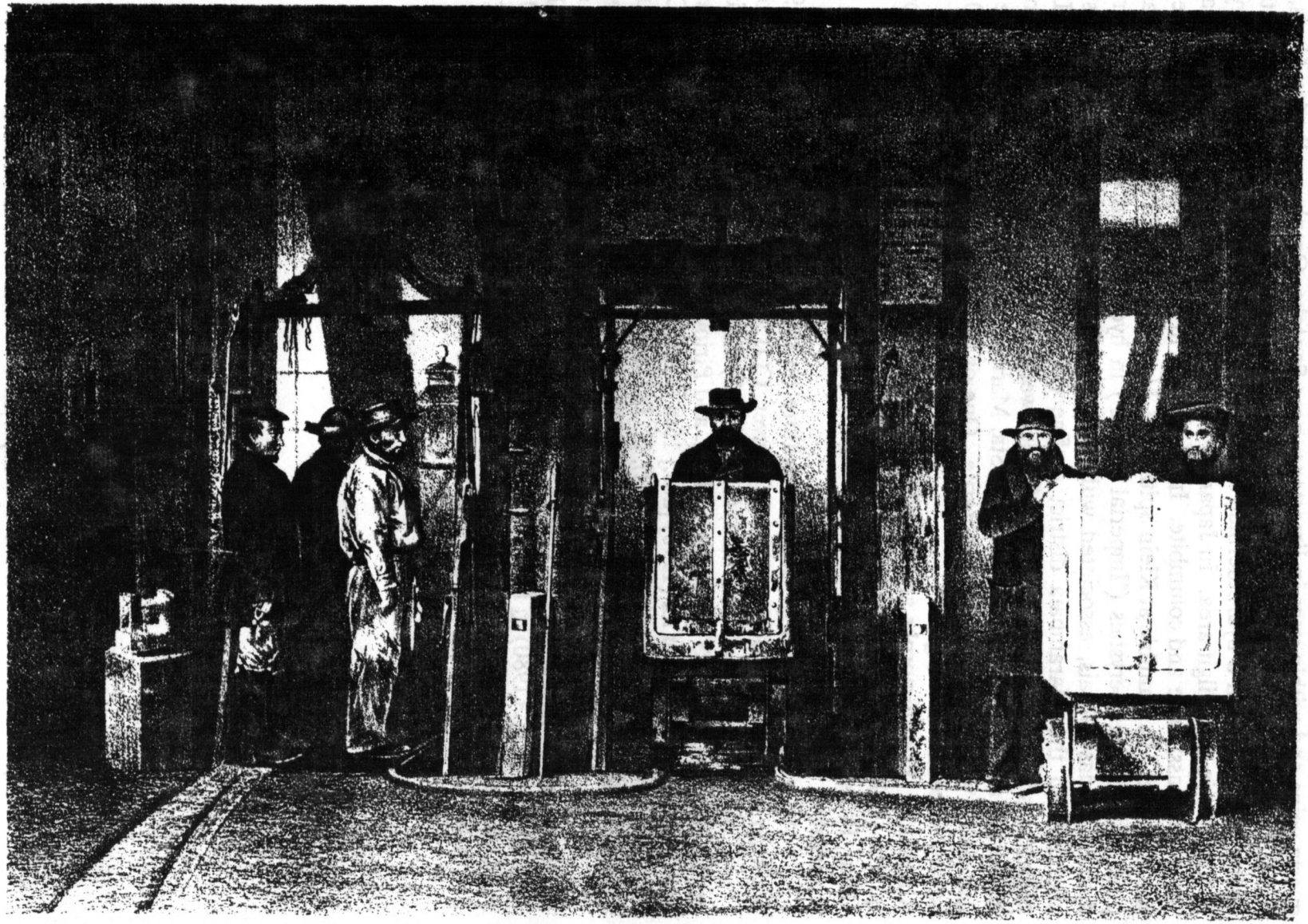
Alteration. Pseudomorphs are sometimes formed by hydrothermal clays or muscovite and quartz. Other alteration products include fluorite, margarite, and kaolinite.

Uses. Principal use is as a gemstone.

References.

An extensive bibliography of literature on topaz is given by Rickwood (1978). A book on topaz by Donald B. Hoover (Denver, CO) is currently nearing completion.

Aines, R. D., and Rossman, G. R. (1985) Amer. Min., 70, 1169-1179. Akizuki, M. et al. (1979) MM, 43, 237-241. Beny, J. M. and Piriou, B., 1987, Phys. Chem. Minerals, 15, 148-154. Foord, E. E., et al. (1990) [abs.] 15th General IMA meeting, Beijing, PRC, p. 306-307. Konno, H. and Akizuki, M., (1982), N. Jb. Miner. Min. Mh., 465-470. Nassau, K. and Prescott, B. E. (1975) Amer. Min., 60, 705-709. Parise, J. B. (1980) Order-disorder phenomena in minerals: Structural studies. Ph.D. dissertation, James Cook Univ. of N. Queensland. Parise, J. B. et al. (1980) MM, 43, 943-944. Petrov, I. (1977) NJBA, 130, 288-302. Ribbe, P. H. (1980) in Ribbe, P. H. (ed.) Reviews in Mineralogy, v. 5, 215-230. Ribbe, P. H. & Rosenberg, P. H. (1971) AM, 56, 1812-1821. Rickwood, P. C. (1978) Univ. of New South Wales Press Ltd. 165 pp. Rosenberg, P. H. (1967) AM, 52, 1890-1895.



SHAFT LANDING AT THE SAVAGE MINE, COMSTOCK LODE
From King 40th Parallel, Vol. III

FMCC MEMBERSHIP SURVEY

SUMMARY OF MEMBER INTERESTS AND ACTIVITIES

Acker, Robert — Science Teacher who has collected minerals for 30 years. Areas of special interest are quartz inclusions, fossils, pyrite.

Adams, John (Jack) — Retired Geologist with experience in USGS and mining companies. Author or co-author of papers on mineralogy and resources of rare-earth elements, radioactive materials, and pegmatite commodities. Volunteer work at DMNH, adjunct Curator of Mineralogy at NMMNH in Albuquerque. Special interest in gem crystals, phosphates, minerals of rare metals.

Allen, Glenn H. — Member of C.M.S., Littleton, and field trip chairman/co-chairman from 1974 thru 1982, swap area of Denver Gem & Mineral Show. Interests - worldwide minerals, field collecting, lapidary & CO minerals.

Anderson, Ronald — Trustee for Littleton Gem & Mineral Club. Interests include mineralogy, paleontology & photography of specimens. Collect crystallized minerals & books on mineralogy & fossils. Enjoys field collecting of minerals and fossils.

Bachman, Howard C. — Nuclear safety radiation detection at Rocky Flats. Field trip chairman, 37 years on Mt. Antero. Interests include field collecting, Leadville, Mt. Antero, & western states.

Barrell, Robert F. — Retired Civil & Electrical Engineer. Past president of Flatirons Mineral Club. Interests - field collecting microminerals (phosphate micros) and Point of Rocks, NM, specimens.

Beals, Dennis L. — Mineral Dealer. Field collector for 25 years. Past VP of Scottsbluff, Nebraska Mineral Club, Past field trip leader for CSMS. Interested in Mexican minerals, specimen mining and preparation.

Belsher, Dee — Charter member & past Director FMCC, past Director FM (national). Past President, VP, Secretary of Rocky Mtn. Federation of Min. Societies. Past Secretary 1975 national show in Denver, Denver Gem & Mineral Guild. Past Editor, Publications Chairman & Exhibits Chairman for CMS. Past Secretary Colo. Federation of Mineral & Gem Societies. Past Director, American Federation of Mineralogical Societies. Interests include thumbnails and miniature mineral specimens.

Bennett, Norman L. — Geologist. Served in many positions in DGMG, Colorado Mineral Society, AIME, Denver Mining Club & Denver Show Committee. Judge for competitive mineral displays. Interested in field collecting, underground mining.

FMCC MEMBERSHIP SURVEY - SUMMARY - PAGE 2

Bennett, Roger	Statistician - US Census Bureau Past President & other board positions Denver Gem & Mineral Guild. Interested in worldwide minerals, field collecting and faceting gemstones.
Berry, Raymond R.	Retired Die Shop Manager. Past Pres. & Show Chairman for CSMS, past VP for FMCC. Given many programs to grade school classes, service organizations, etc. Interested in field collecting, faceting gemstones.
Brunstein, Craig	Geologist & Geologic Map Editor. Interests - field collecting of pegmatite minerals, especially Saint Peter's Dome, Crystal Park, Crystal Peak.
Bunk, David	Mineral dealer. Mining Engineering student at CSM. Has underground mining experience in Colorado. Has given programs on Black Cloud Mine. Interests include worldwide minerals emphasizing Leadville & Colorado.
Chirnside, Bill	Supervisory Cartographer, USGS. Field collector since 1957, past field Trip chairman for N. Jeffco Club. Interests include collecting pegmatite and rhyolite minerals.
Charette, Carl	FDIC. President of Littleton Club. 1992 DGMS Show Chairman. Interested in worldwide minerals (rare) and gemstones.
Charette, Gloria	Real Estate Broker. Secretary of Littleton Club, past Treasurer of Denver Council. Interested in field collecting and lapidary.
Christensen, Chris	Retired. Past President CSMS. Past AFMS Rules Chairperson (4 years). Judge at AFMS shows. Interested in micromounting.
Denham, Dale L.	Metallurgist. Involved in production of mineral concentrates. Interested in worldwide micromounts, field collecting, mineral suites by locality.
Elizondo, Joseph B.	Retired Geologist & Mining Engineer. Interested in worldwide minerals.
Fisher, George W.	Retired. Past President and Show Chairman for CSMS, Colo. Director and Bulletin Aids Chair. for RMFMS. Produced programs on collecting. Interests include worldwide minerals, fossils, rock carving, lapidary, silversmithing, with emphasis on field collecting pegmatite minerals. Prospected in CO, CA, TX, AR, OK, IA, ID, WY, UT, MT, NM, NB, over the past 30 years.
Foord, Eugene E.	Professional Mineralogist, Geologist. 140 papers, books, etc. published. FM Board of Directors. Given numerous progams. Interests include Descriptive Mineralogy, Economic Mineralogy & Historical Mineralogy.

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Foord, Eugene E.	Professional Mineralogist, Geologist. 140 papers, books, etc. published. FM Board of Directors. Given numerous progams. Interests include Descriptive Mineralogy, Economic Mineralogy & Historical Mineralogy.

Golosow, Nikolas — Medical Doctor. Collects worldwide mineral specimens. Displays mineral specimens and mining artifacts.

Gray, Edward W. Jr. — Civil (Geotechnical) Engineer. President-elect for Littleton Gem & Mineral Club, author or co-author of 15 professional technical articles and papers. Interested in worldwide minerals.

Hampson, Arnold G. — Retired VP Engineering. Presently Project manager & Chief Engineer. Past Director & Treasurer of FM, National Chapter. Past President and Field Trip Chairman of Colo. Federation of Gem & Mineral Societies. Past President of Ute Mtn. Gem & Mineral Society. Many lectures at symposiums on multiple topics including Colorado Western Slope Minerals, microminerals of SW CO, et. al.. Numerous publications on photomicrography. Interests include microminerals, micromounting, photomicrography, field collecting and Colorado mineralogy.

Hanou, Bert P. — Retired. President DGMG. Program on Colorado Micromounts. Interested in field collecting, micromounts, worldwide minerals.

Hinrichs, E. Neal — Retired Geologist. Beryl pegmatites 1948-51, Uranium deposits 1951-7, geologic mapping Nevada test site 1958-71, Kentucky 1972-76, Wyoming 1976-86. Interests: field collecting, beryllium minerals.

Hurlbut, James F. — Physicist, Sales Engineer. Past President CMS, RMFMS, FMCC. Currently Treasurer AFMS, Judge for Minerals for AFMS, Taught Rocks & Minerals of Colorado at UCDC for 20 years. Interest is micromounts.

Jacobson, Mark — Geophysicist. Numerous published articles and lectures on pegmatites. Trained Geologist with experience in field collecting, pegmatites. Interests include worldwide pegmatite minerals, especially beryl, tourmaline, rare earth minerals and phosphates.

Johnson, Glen A. — Past President, VP, Membership Chmn., Field Trip Chmn. of DGMG. 6 years on Denver Show Committee. Director of FMCC. President of Denver Council in 1991. Interested in worldwide minerals, field collecting, postage stamps and annual show each September.

Kile, Daniel E. — Research Chemist, USGS. Published numerous articles on topics including Table Mountain Zeolites, Colorado Quartz Occurrences, Thunder Bay (Ontario) amethyst and Alice & Patch Mine geology. Lectures on these and additional topics. Denver Show Committee Judging Chairman. President of FMCC, Past President DGMG. Special interests include field collecting in Colorado, Lapidary, antique books & scientific instruments.

Lieberman, Marcus — Cartographer. Several articles published in Rock & Mineral Magazine. Many lectures to mineral clubs. Past-Secretary of Brooklyn Mineral Club. Past President, Program Chairman, Secretary of Littleton Club. VP of CMC. Past member of New York Mineral Club.

Liff, Nathin — Retired. 30 year member of Grand Junction Gem & Mineral Society. International Thumbnail Mineral Society. Has over 7000 thumbnail specimens. Main interest is thumbnail minerals.

Longbrake, William V. — Retired Clergyman. Life-long collector of worldwide minerals.

Madson, Michael E. — Chem-Nuclear Geotech UMTRA Program Manager, Geologist, Univ. of Minnesota, 1971. Mineral occurrence developer since 1972. Mineral dealer since 1962. Lectures on deposits that were developed 1978-88. Particularly interested in gemstone deposits & crystalline deposits.

Mast, Virginia — Museum Curator, CSM Geology Museum. Fourteen years experience with museum starting with special exhibits. Multiple talks on related topics and co-authored papers on museum related topics. Special interest is educating others in field of earth science.

Michalski, Thomas — Geologist -USGS. Mineral collector for 20 years. Written articles and given lectures on Colorado amethyst and topaz. Field collected in MI, OH, ME, NH, and Ontario. Special interests include pegmatites, kimberlites, US gemstone deposits and geology of gemstone deposits.

Modreski, Peter J. — Geologist-USGS. M.S. & Ph.D. Penn. State (geochemistry), B.A. Rutgers Past President Littleton Gem & Mineral Club. Past President - FMCC. Past officer of FM -National. Past President of Denver Council. Past member of Albuquerque Gem & Mineral Club. Member of Geol. Soc. of America, Mineral Soc. America, Mineralogical Assn. of Canada, Colo. Scientific Soc., Fluorescent Min. Soc., Denver Region Exploration Geologists Society, Franklin-Ogdensburg Soc., and others. Special Interests include field collecting, worldwide minerals with emphasis on minerals of NM, CO, NJ, fluorescent minerals, pegmatite minerals, minerals of alkalic igneous rocks, oxide minerals.

Modreski, Regina A. — Mineral collector and associated with geology for 23 years. Denver Show Committee Publicity Chairman for 8 years. 1986 Denver Show Chairman. Past President and Newsletter Editor (6 yrs) for Littleton Gem & Mineral Club. Special interests include shows, jewelry, dinosaurs and esthetic worldwide minerals.

Mogel, Arnold — Operations Supervisor, Bell Telephone of PA. President and past Treasurer of PA Chapter-FM. Interested in field collecting, symposiums.

Montgomery, Louellen — Homemaker. Past President of Rocky Mtn. Federation, President of AFMS Scholarship Foundation, chaired mineral section exhibitors and judges and seminars for Stillwater, OK, club, on multiple occasions. Emphasis on thumbnails, micromounts, stilbite and other zeolites.

Muntyan, Barbara	Museum Director - Ouray County Museum. Past President, Secretary and Treasurer of FMCC. Board Member of FM-National. Published articles and lectured for FM, TGMS, NM Symposium, Littleton Club, etc.. Interested in CO localities like Pikes Peak granite, San Juan Mountains, field collecting and mineral photography.
Olsen, Fred	Geologist. M.S. Geology. Past President WIPS. Member DGMG. Enjoys field collecting, fossils.
Pedersen, Ed	Ground Water Geologist. Past Chairman Minerals Section - Houston Gem & Mineral Society. Chairman Mineral Section - Lincoln Gem & Mineral Club. Interests focus on minerals of AZ, wulfenites, secondary lead-zinc-copper minerals. Numerous lectures and programs given.
Piekenbrock, Carmen	Works for State of Colorado. Field collector. Enjoys pegmatite minerals and fossils.
Piekenbrock, L. T.	Philatelist. Interested in field collecting, CO minerals, pegmatite minerals and micromounts.
Raines, Ed	Geologist. Multiple offices in several clubs. Lectures and programs on every major mining district in CO, numerous papers and articles. Interested in CO mineral deposits, metallic ore deposits, pegmatites, mining and mining history, photography.
Regel, Marge (Bachman)	Postal Employee. Interested in field collecting, hiking, symposiums.
Rosemeyer, Tom	Mine Manager, Camp Bird Mine, Ouray, CO. Numerous articles for Mineralogical Record and Rock & Mineral, and lectures on these topics. Interested in field collecting CO localities, Western US microminerals.
Rosenblum, Sam	Retired Geologist - USGS, Consultant. Many publications on economic geology, mineralogy, mineral exploration & development. Interests are rare-earth minerals, platinum minerals, magnetic properties of minerals, lapidary, silversmithing and field collecting.
Smith, Bill	Past President of Mineral Society of D.C.. Especially interested in rare-earth (U, Th, Nb, Ta) minerals and in rock-forming minerals.
Smith, Carol	Programmer/Analyst. Secretary - FMCC. Enjoys mineralogical history.
Tomkus, Chris	Tour Guide. Held multiple offices in local clubs. Lectured on mineral collecting in CT. Interested in odd forms/inclusions/sceptered quartz crystals, as well as fossils (trilobites and ammonites).

Tribbey, Gene	Retired Dentist. Worked in mineral shop. Displayed in shows. Competitive and non-competitive exhibits in shows. Special attention to TN's, CO minerals. Enjoy field collecting.
Vendl, Mark	Geologist. Interested in Colorado minerals.
Verbeek, Earl	Research Geologist - Structural. Member FM, FOMS, FMS. Displays minerals at Denver show. Numerous publications and articles, including Rock & Mineral Magazine and Journal of the Franklin-Ogdensburg Mineralogical Society. Special interest in Franklin/Sterling Hill mineralogy, luminescence in minerals.
Walden, Chauncey L.	Computer Programmer. Littleton Gem & Mineral Club, Denver Gem & Mineral Guild. Stereo mineral photography lecture & slide program. Likes worldwide minerals, field collecting, faceting, mineral photography
Walden, Sandy	Teacher. Special Exhibits Chairman for Denver Gem & Mineral Show. President & VP of Denver Council, member of DGMG and Littleton clubs. Program on China, England-mines, minerals, & rock swaps. Special emphasis on Fluorite, Quartz, field collecting and cleaning minerals.
Wenrich, Karen	Geologist. Director of FM - National. FM-TGMS-MSA Symposium Chmn., Colo. Sci. Society, Denver Regional Exploration Geology Assn., and other affiliations. Numerous lectures and programs at meetings & symposiums. Interests in worldwide minerals, gemstones, uranium minerals, mineral photography and field collecting.
Weller, William D.	Retired - Electric Power Operations & Engineering, The Adjutant General for Colorado. Past Treasurer & Field Trip Chmn for Littleton Gem & Mineral. Interests in gemstones, lapidary and field collecting.
Williams, Keith	Geologist, Mineral Dealer. Mineral dealer for 18 years, specializing in Colorado minerals. Collects mining candlesticks and CO minerals.
Zinn, Martin	Gem & Mineral Show Manager. Mineral collector for 30 years. Past President Dallas Gem & Mineral Society, Past Dallas Show Chairman, Competitive and non-competitive displays. Primary interest is in top quality worldwide small cabinet mineral specimens.