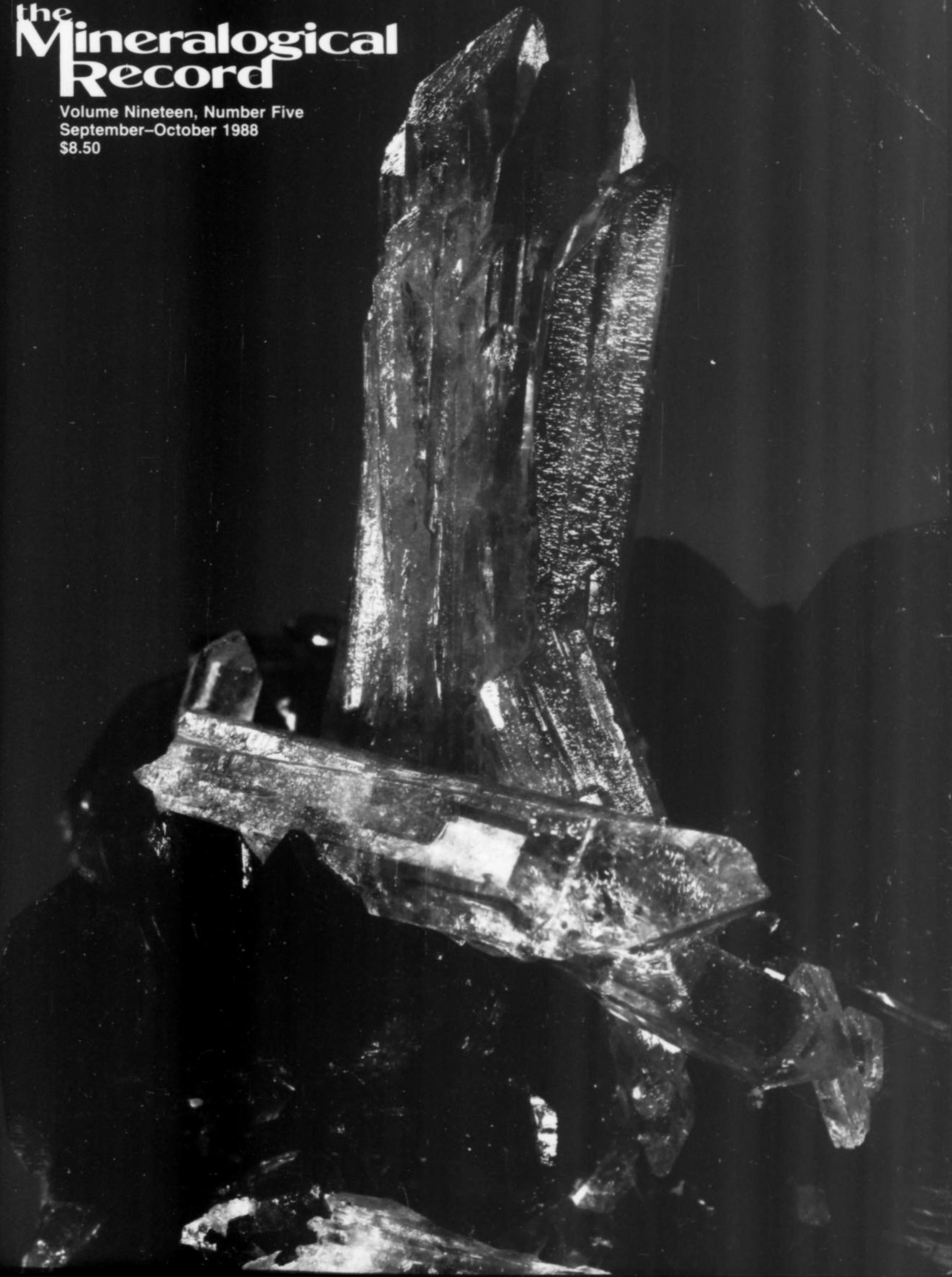
the Mineralogical Record

Volume Nineteen, Number Five
September–October 1988
$8.50



The Mineralogical Record Inc.
is a non-profit organization
The Mineralogical Record
magazine is published by the
Mineralogical Record Inc.,
7413 N. Mowry Place
Tucson, Arizona 85741

Editor & Publisher
Wendell E. Wilson

Associate Editors
Pete J. Dunn
Washington, DC
Peter G. Embrey
London, England
Richard C. Erd
U.S. Geological Survey
Menlo Park, CA
Donald R. Peacor
University of Michigan
Ann Arbor, MI
George W. Robinson
Natl. Museums of Canada
Ottawa, Ontario
Abraham Rosenzweig
Tampa, FL
Richard W. Thomssen
Carson City, NV

Associate Photographers
Nelly Bariand
Sorbonne
Paris, France
Werner Lieber
Heidelberg, W. Germany
Olaf Medenbach
Ruhr Universitat Bochum
Bochum, W. Germany
Eric Offermann
Arlesheim, Switzerland
Harold and Erica Van Pelt
Los Angeles, CA
Julius Weber
Mamaroneck, NY

Circulation Manager
Mary Lynn Michela
(Subscriptions, back issues, reprints)
P.O. Box 35565
Tucson, Arizona 85740
602-297-6709

Editing, advertising
Wendell E. Wilson
4631 Paseo Tubutama
Tucson, AZ 85715
602-299-5274

Promotions Manager
Gale Thomssen
1601 Fairview Dr., Suite C
Carson City, NV 89701
702-883-2598

Bookstore
Marilee Chirila, Manager
Sue Ann Jones, Shipping
1601 Fairview Dr., Suite C
Carson City, NV 89701
702-883-2598

Subscriptions
- **Individuals (U.S.): $30 for one year;** $58 for two years. (First-class mailing available; write to circulation manager for rates.)
- **Individuals (outside the U.S.):** $33 for one year, $64 for two years. (Airmail mailing available; write to circulation manager for rates.)
- **Libraries, Companies and Institutions (worldwide): $50** for one year. (First-class or Airmail mailing available; write to circulation manager for rates.)

Special second class postage
(USPS-887-700)
Paid at Tucson, Arizona, and additional offices. POSTMASTER: send address changes to:
7413 N. Mowry Place
Tucson, AZ 85741

*Continued on p. 351

the Mineralogical Record ®

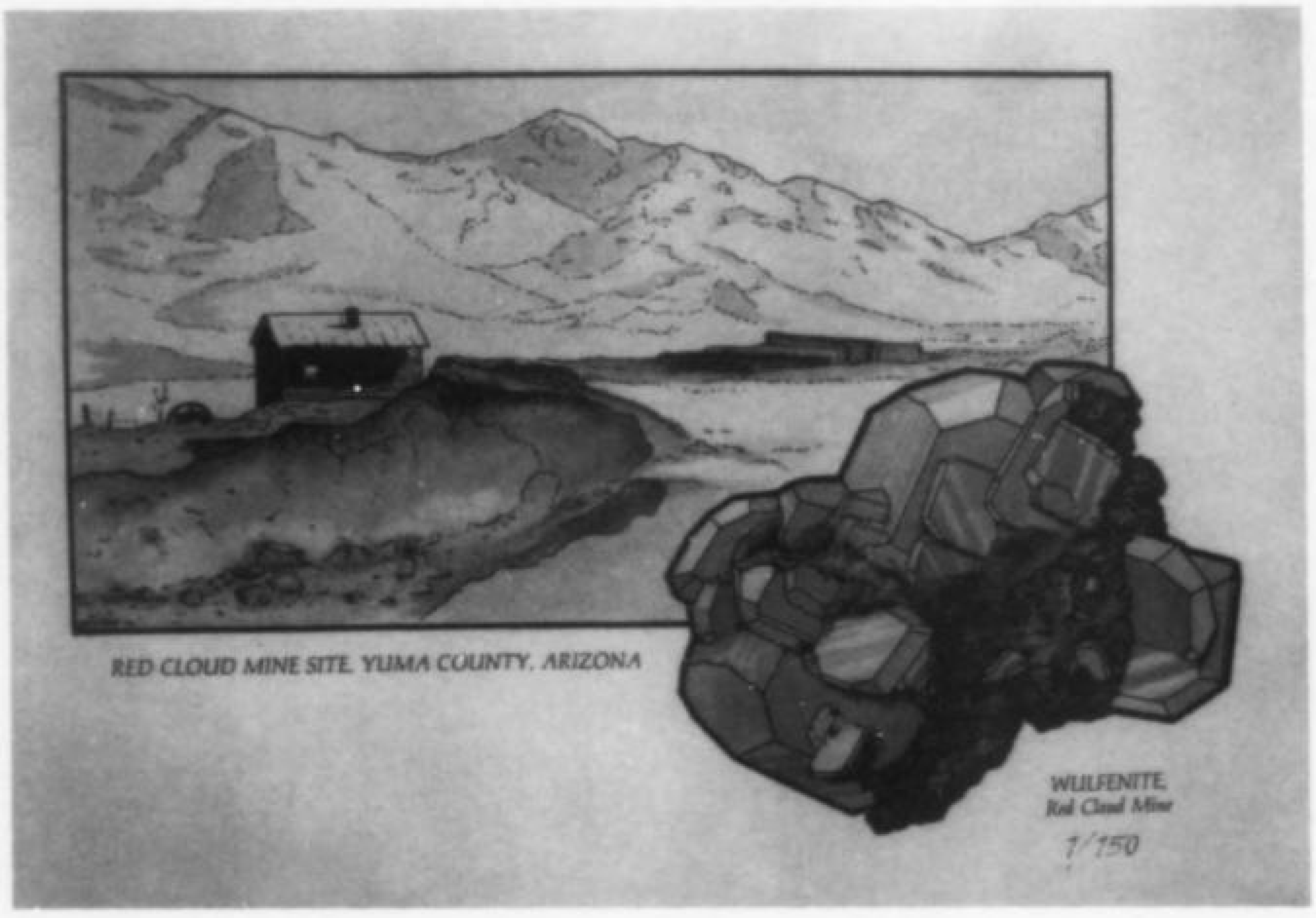
September–October 1988
Volume Nineteen, Number Five

Articles

Departments

COVER: CREEDITE crystal, 3.7 cm, on smoky quartz from the Aktschatau tungsten mine, central Kazakhstan, U.S.S.R. The specimen was collected in 1982. The Aktschatau mine is among the most important specimen-producing localities in the Soviet Union; other species found there include wolframite, pyrite, fluorite, bismuthinite, topaz and aquamarine. Collection of William Larson; photo by Harold and Erica Van Pelt, Los Angeles.

notes from the EDITOR



MINERAL ART

Mineral collectors and connoisseurs, being attuned to the beauties of nature, sometimes wish they could fill that blank spot on the den or office wall with a nice piece of original artwork having something to do with minerals. They soon discover that high-quality mineral art is very difficult to find. This is generally because the market is too small for such specialized subject matter; fine artists today often try to work in a more widely appreciated genre (e.g., wildlife art, Western art, etc.), mostly because of practical commercial considerations. I would have thought that Western art would regularly include scenes of mining and mining life, but apparently it is easier for artists to research the cowboy and the Indian rather than the miner. Thus, mining art is rather rare too.

There are, nevertheless, a very few artists who do occasionally produce such work. Susan Robinson's interesting article in *Rocks and Minerals* (vol. 62, no. 5) listed some of these. But a newcomer to the field is Carl Bentley, a professional commercial artist. Carl has recently turned his efforts to producing an excellent series of signed and numbered, hand-colored lithographs depicting a tantalizing mineral specimen in the foreground, backed by a scene in the area of the mine. The first in the series is a Red Cloud mine wulfenite backed by a view of the mine site; the second is a Tsumeb dioptase backed by a 1910 view of the Tsumeb headframe and ore stockpiles. Others are being planned. These are top-quality watercolors in the most critical sense, not something that might be expected of an amateur weekend painter.

Each hand-colored print is priced at $75 unmounted (plus $2.50 postage) or $100 matted and framed (plus $5 postage). Write to Carl R. Bentley, 30 Filley Street, Bloomfield, CT 06002 (203-243-1906).

MORE MINERAL ART

Mineral art, like gold, is where you find it. Until just recently the only depiction of recognizable mineral specimens on coins has been the series of "Australian Nugget" gold bullion coins, showing a whole series of famous Australian gold nuggets on the various denominations of coins (see this column, vol. 18, no. 2). For 1988 a new series showing more different nuggets has been issued.

Tokens and medals are equally fair game for the mineral art collector, and it happens that a 1-ounce silver trade token depicting a 20-ounce Breckenridge gold specimen has been issued in conjunction with the fifth annual Denver Coin Show Extravaganza, held last May in Denver. The theme of the show was "Colorado Gold and Silver Mining," and there was a large exhibit of memorabilia. The prooflike medal was designed by Doyle Francis of Golden State Mint, Mira Loma, California. To help stimulate commerce at the show, these tokens were sold for $20 but could be redeemed through other purchases at a face value of $25. Jerry Morgan of Denver Coin Shows (P.O. Box 211086, Denver, CO 80221; 303-759-1895) was unsure of future availability but said *Mineralogical Record* readers who might want one are welcome to contact him to see if he still has any. The medal is/was also available in bronze for $3. If that fails, it is likely that some coin dealers (especially those based in Denver) might be able to locate one.

MICROMOUNTERS DIRECTORY

The following note is from Roy I. Grim:

The International Directory of Micromounters has been published biennially, in "even" years, by the Baltimore Mineral Society at the time of its Micromount Symposium in September. Mr. Randolph S. Rothschild has diligently served as the editor for the past 25 years and, for personal reasons, has requested that a new editor be appointed. While we regret his decision, we appreciate all that he has done and we thank him for his efforts.

The appointment took place recently and, because of the timing of the changeover, the 14th edition of the Directory must be delayed until September of 1989. It will be published in "odd" years thereafter. During the coming year, there will be an effort to update the contents. For this purpose, additions, deletions, corrections and other changes needed since the publication of the 13th edition will be gratefully received by the new editor, Roy I. Grim, 9155-A Hitching Post Lane, Laurel, MD 20707.

Information received by June 1, 1989 will be reflected in the 14th edition. The price for the 14th edition will be determined early next year; requests for copies cannot be honored at this time. Monies received for the edition expected this fall must regrettably be returned. We sincerely regret any inconvenience this situation may cause. Further information will be forthcoming.

MINERAL DATABASE

Aleph Enterprises (P.O. Box 213, Livermore, CA 94550) is offering a new mineral database program for personal computers having at least 384K bytes of RAM, a hard disk with four megabytes of storage space available, and MS-DOS 2.02 or IBM PC-DOS 2.0 or greater.

The database is called MINERAL and comes with a search program called TRACKER. Searches can be based on species name, name fragment or synonym; elements or radicals; mineral group name; related species; crystal system and space group; lattice parameters; JCPDS number and mineral classification. Other information which can be called up includes chemical formula, two general references and an additional reference to the origin of the name. A user manual is provided which includes a listing of the name and principal reference for all the species in the database. Full JCPDS file data can be added as an option. Also available is the ability to include your own information about each species such as catalog numbers, localities, etc.

MINERAL represents the combined efforts of Aleph Enterprises and Ernie Nickel at CSIRO (Australia).

The price for MINERAL and TRACKER is $248. There is no built-in copy protection, but purchasers must sign an agreement not to make unauthorized copies.

EASTERN VOLUNTEERS

People who would like to donate a few hours of their time tending the *Mineralogical Record* table at Eastern U.S. shows should contact our new Eastern U.S. volunteer organizer, Charles Weber (1172 W. Lake Ave., Guilford, CT 06437, Tel. (203) 481-2658). We can always use some extra hands.

NOTE

The following notice regarding the disposition of investigated mineral specimens is directed primarily at professional mineralogists. However, it is not unusual these days for dealers and amateur mineralogists to commission analytical work from commercial laboratories, or to conduct studies themselves which are later published. Those specimens then have special value to science as well. Depositing them in a major museum, along with full documentation, thus becomes an important contribution to science. Here is yet another way in which mineral collectors can serve the science of mineralogy right alongside their professional counterparts.

PROTOCOLS FOR SCIENTISTS ON THE DEPOSITION OF INVESTIGATED MINERAL SPECIMENS

Pete J. Dunn*
Department of Mineral Sciences
Smithsonian Institution
Washington, D.C. 20560

The mineral specimens which form the basis of scientific investigations should be retained in permanent repositories for future investigators. Just as it is important, as part of the scientific methodology, for a responsible investigator to provide information on the conditions of experiments so that the results may be repeated and corroborated or challenged, it is equally as important that the very specimens used in such investigations be retained in major museums. These specimens are the only mineralogic evidence for the investigations. Although many mineralogists retain studied samples for some time, the duration of this retention period is affected by temporary degrees of interest, and many other factors, mortality among them.

Large, research-oriented museums maintain systematic, well-curated collections in which such material is preserved. It is thus available for both contemporary and future investigators. Mineralogists are encouraged, in all instances, to deposit all studied samples in these repositories.

Unfortunately, this has been done only infrequently, and the vast preponderance of investigated mineral specimens has either been lost, or the necessary linkage between these specimens and the published studies of them has been lost because the studied material was not deposited. Careful institutional curation can preclude the loss of information and specimens, and should be utilized by the responsible investigator as a normal adjunct to the completion of such studies, much in the way publication functions as a final repository for the data. The preservation of investigated specimen material is, therefore, a critical responsibility of professional mineralogic practice. Even unpublished data can best be preserved in museums so that it, too, with the specimens, may be eventually shared with others.

The original investigator is the person best qualified to document which specimens were actually used; this is of *critical* significance in the case of type specimens (Dunn and Mandarino, 1987). The use of specimen numbers, carefully cited in the published research, remains the best method of correlating specimens and data. Deposits should be made in a direct manner, not third-hand, so that the integrity of the material is not compromised. Supporting correspondence is useful in the archival aspects of curation, and is therefore encouraged. The cooperation of all mineralogists is necessary in this long-term effort to serve the science; those who have used such research collections know well their potential and value. Please help to enhance and sustain them by depositing investigated specimens in large, well-established institutional mineral collections.

The preceding statement was approved by both the Commission on Museums, and the Commission on New Minerals and Mineral Names, of the International Mineralogical Association.

REFERENCES

DUNN, P. J., and MANDARINO, J. A. (1988) Formal definitions of type mineral specimens. *Mineralogical Record*, **19**, 227–228.

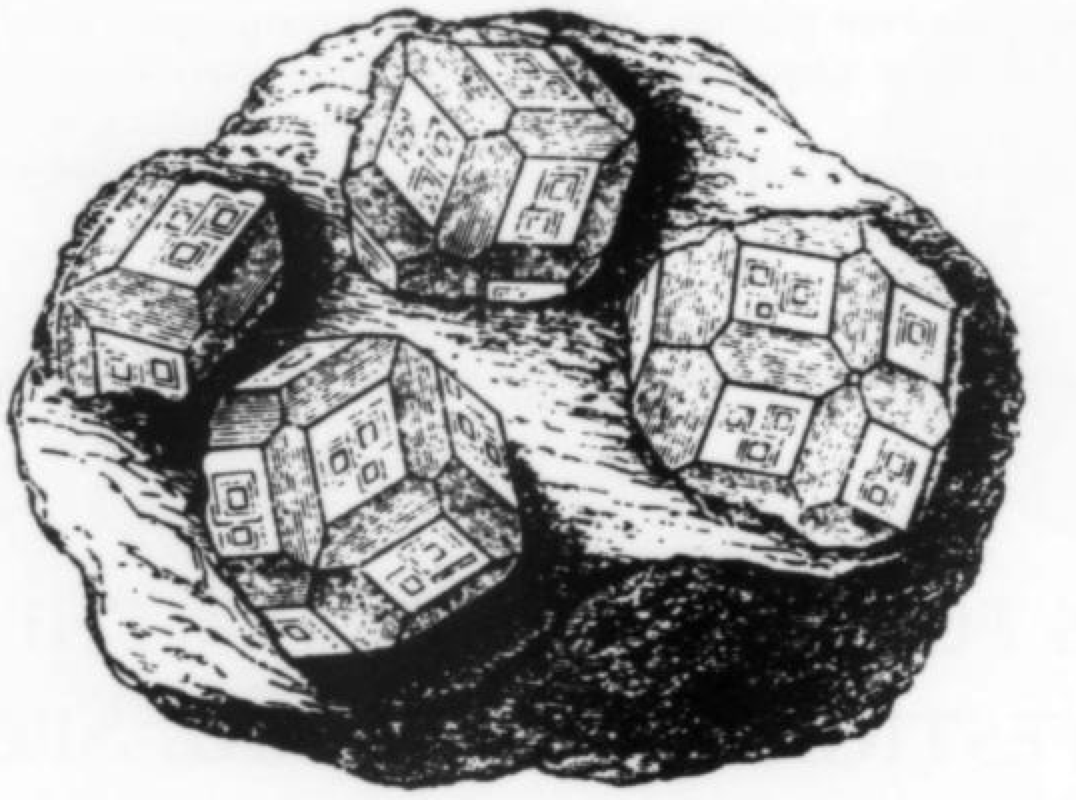
---

*U.S.A. member, Commission on New Minerals and Mineral Names, I.M.A.

EXHIBITION!

"This is New England"

—Part Two!



COME BACK TO RHODE ISLAND October 28, 29 and 30, 1988. Rhode Island Mineral Hunters is proud to host the Eastern Federation Mineralogical and Lapidary Societies Convention on October 28, 1988 in conjunction with our **SEVENTEENTH ANNUAL GEM & MINERAL SHOW October 29 and 30, 1988.** To be held at **Community College of Rhode Island** (CCRI0 **Knight Campus, Warwick, Rhode Island.** (exit 12B off I-95)

In addition to the superb exhibits of the various EFMLS members, Harvard Mineralogical Museum, Yale University, The Smithsonian and The American Museum of Natural History are expected to participate.

From Rhode Island-amethyst scepters; from Connecticut-dinosaur tracks from Massachusetts-the alpine minerals of Acushnet, from Vermont-garnets, from New Hampshire-topaz, from Maine-rose quartz—these outstanding locally collected specimens will be exhibited.

We will have the best of speakers, demonstrations in lapidary, a workshop in micromounting, a children's area. We invite you to **COME BACK TO RHODE ISLAND IN '88.**

Sponsored by:

Rhode Island Mineral Hunters
At: Community College of Rh. Is.
Knight Campus (Mall Exit I-95)
Warwick, Rhode Island

Show Chairman:

Marilyn F. Dodge
72 Woodbury St.
Providence, R.I. 02906
Tel: 401-751-5217

FAMOUS MINERALOGISTS:

JÖNS JACOB BERZELIUS

(1779–1848)

Paul B. Moore*
Department of Geophysical Sciences
The University of Chicago
Chicago, Illinois 60637

I would like to take a path in my reflective tendencies away from minerals *per se* and more toward great men who studied them. At first, I welcomed yet another foray into the intersection of seemingly disjoint sets since I always admired Sir J. B. S. Haldane's dictum, "Things are interesting insofar as they relate themselves to other things."

Yet the task proved difficult and the reason is simple. I could select a few or many examples of famous mineralogists from our rich past. I could concentrate on certain branches of our science and forego the others, or I could pick personalities who were as colorful as the tourmaline family, as complex as the sulfosalts, as simple as halite or as perverse as calaverite. Of likely candidates, I could choose among one score famous mineralogists and offer little *bon mots* (or bon bons) on each. Rather, I decided to concentrate on three. Two at least, remain to this day among the immortals. The third is perhaps more representative of a mineralogist in *sensu stricto*. In all three cases, I present examples distantly separated from the narrow-minded specialist. The three choices are Jöns Jacob Berzelius, Victor Moritz Goldschmidt and Samuel Lewis Penfield (the former treated here; the latter two in subsequent installments).

Another difficulty in any reflective presentation on past great men is the depth of presentation. Although I am reasonably at home in mineralogy and am passable at psychohistory, I decided to dismiss most of the arcane terminologies in these two professions. Both are dynamic disciplines, the former more scientifically grounded in the laws of chemistry and physics, the latter even more dynamic but perhaps less objective, deterministic and integrated. To seek insights on the creative process through psychohistory is a hopeless task.

Therefore, to glean insights on these men, I resorted to sources in the literature. Even this proved a problem. Reflections on persons of the past are not easy. The sources may become altered somewhat with time. The only real hope is either direct contact with the person or direct access to his diaries. In no case can I claim this. Therefore, in fairness I should state my principal sources. J. Erik Jorpes produced a delightful *Jac. Berzelius: His Life and Work* in 1966. The major source for Goldschmidt I found in Obituary Notices of Fellows of the Royal Society (1948) by Cecil E. Tilley; and Penfield is covered by H. L. Wells in National Academy of Science, Biographical Memoir **6** (1909).

Jöns Jacob Berzelius
1779–1848
Johan Way portrait of 1826, courtesy of the Royal Swedish Academy of Science

Jöns Jacob Berzelius was perhaps the greatest inorganic chemist of all time. Straddled between the eighteenth and nineteenth centuries in a period of great scientific insight and accomplishment, he stands in brilliant relief to those creative scientists of a century later who evolved the atomic basis of crystal structure and quantum mechanics.

---

*This is the first of three parts originally delivered as a lecture. Ed.

One hundred years earlier Berzelius, more than anyone else, laid the foundations of the discovery of new elements and the fundamentals of mineral chemistry. This master of elemental extraction was also a master at chemical analyses and, like his countrymen Anton Svab and Axel Cronstedt, became a master of the art of blowpipe analysis.

Born on August 20, 1779, in Väversunda Sörgård, Östergötland province in Sweden, his lineages on both sides were clergymen for three generations. He died August 7, 1848, and was buried in Solna Cemetery, near Stockholm. In 1835, aged 56, Berzelius married. It was a happy but childless marriage. Migraine attacks plagued him since youth. Gout besieged him much later. At 39 he had a nervous breakdown and traveled abroad upon physician's advice for restoration of his health. I interject here that the term "nervous breakdown" has little meaning today, but I conjecture from what I have learned of Berzelius's habits and astounding, tireless productivity that he suffered the relatively rare affective disorder called manic-depression, formerly colloquially called the "thin line between genius and insanity." In 1841, he wrote in a letter to his admired German compatriot in zealous research, Friedrich Wöhler, "please work hard as long as you have the strength. You cannot imagine what a creature man becomes when he begins to get old." By his sixties, Berzelius was a member of 12 royal orders and a member of 94 learned societies.

Of the 68 elements known up to 1880, 22 were of Swedish origin and of Swedish discovery. Brandt discovered cobalt in 1730; Cronstedt nickel in 1751; Gahn manganese in 1774; Scheele then announced oxygen, fluorine, chlorine, tungsten and molybdenum; Ekeberg isolated tantalum; Berzelius cerium, selenium and thorium; Arfvedson in 1818 separated lithium, the simplest and most distributed of metals; Sefström described vanadium; the rare earths lanthanum, didymium (later neodymium + praeseodymium), erbium and terbium by Mosander in the 1840's; scandium by Nilsson; the rare earths holmium and thulium by Cleve in 1879. Ekeberg named tantalum because its oxide could not be dissolved in mineral acids. The allusion is to the Greek mythological Tantalus who was immersed in water up to his chin, but could not quench his thirst. Berzelius laboriously worked out the atomic weights, valences and salts of the elements. He created the Latinized initials for the elements. Until his time, even compounds (minerals, etc.) were written and described under the same nomenclatural umbrella. I wonder if this had not something to do with the occurrence of certain elements in native form such as sulfur, iron, copper, gold, silver, platinum, mercury and carbon (as graphite and diamond). Chronologically, Berzelius was a scholar at Linköping, Doctor at Karolinska Institutet in Stockholm, finally Secretary of Kungliga Svenska Vetenskapsakademien (= Royal Swedish Academy of Sciences).

I shall concentrate on this great man's mineralogical side, bypassing his many contributions to analysis of the bodily fluids, analyses of the many waters of health spas for their curative agent and his later multifarious administrative duties. I only remark that his analyses of curative waters usually brought nothing of significance, and he suspected therefore that many of these spas were fraudulent. However, a recent study of the health spa waters by a psychopharmacologist shows that they are enriched in lithium ion, in amounts up to 100 parts per million, significant but too low for the detection limits at Berzelius' time. Isn't it ironic that his student Arfvedson discovered lithium yet Berzelius did not see the link between lithium as a stabilizer in madness, or manic-depressive illness?

Both parents of Berzelius died when he was young, but his mother's side, the Sjösteen family, provided him with a remarkable upbringing. Step-father Pastor Ekmarck determined the boy's future development, as young Jacob hunted birds and collected insects. The boy kept a diary and frequently implanted Lutheran prayers such as "May God give me His grace to grow stronger, govern my passions and to refrain from anything evil." Jacob's school grades in theology were poor, contrasted with his excellent marks in the natural sciences.

In 1796, he began medical studies at Upsala. Unfortunately he was apparently an adventurous young man since "although gifted, his behavior (truancy) was not up to standard."

The leading scientists of that day were Lavoisier (on combustion), Scheele and Torbern Bergman, an expert on phlogiston—later to be identified with oxygen. At this time Berzelius built a voltaic pile, based on a principle discovered by Volta in 1800. It consisted of 60 pieces of zinc disks alternating with copper coins. He analyzed the water of Medevi spa. The water was evaporated and the residue was studied. His dissertation was on the Galvano theory of chronic diseases. In 1807, Sir Humphrey Davy isolated pure Na and K from potash and soda using a galvanic pile. Later, Berzelius isolated Ba, Ca, Sr, Mg and Li in the same fashion. The relationship between ammonium and ammonia was unclear. Even the dimer N_2 was a big problem, or gaseous atmospheric nitrogen. Berzelius believed it was a suboxide until the 1820's.

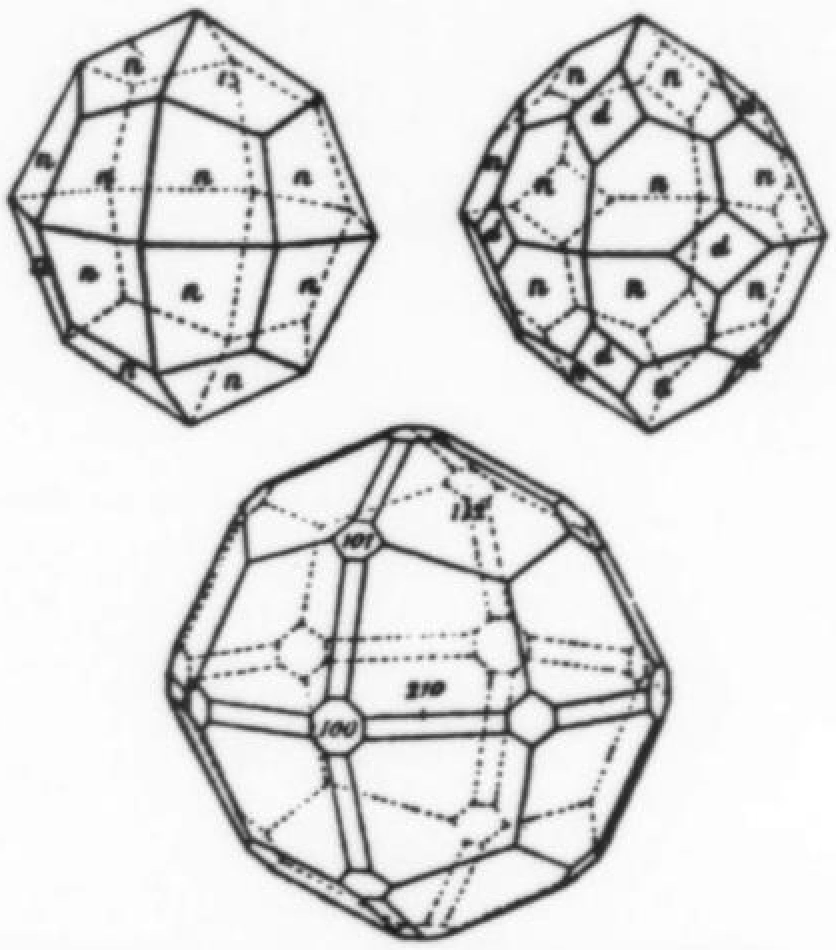
In 1803, Berzelius visited the chemist Wilhelm Hisinger at his estate in Skinnskatteberg, Västmanland. Here, he was presented with so-called Bastnäs tungsten from nearby Riddarhyttan (note that "tungsten" in Swedish means "heavy stone" in English, and was a common mining term for any heavy, glassy ore). In 1794, Johan Gadolin extracted yttrium in gadolinite from Ytterby, near Stockholm. This town eventually gave pieces of its name to four elements: yttrium, ytterbium, terbium, and erbium. From the Bastnäs tungsten, Berzelius isolated the new element cerium, which he named after the asteroid Ceres which was discovered the same year. The "Bastnäs tungsten" itself was renamed cerite. In the process, in his enthusiasm, Berzelius thought he had isolated yet another new element and was about to name it *gahnium* but it turned out to be zinc oxide. In 1810, the Karolinska Institut was founded and Berzelius got a new chair, now in chemistry and pharmacy. At this point, he was in the midst of an extensive study on animal fluids.

One central problem was the concept of atomic weight and equivalent weight. Since the quantity, let alone the size, of atoms could not be measured, the only recourse was to apply them to a standard. Unfortunately, the standard was not known! In 1792, Benjamin Richter published a book on mass relations of the chemical elements. In this, he determined thirty basic oxides and eighteen acids. The quantities were determined by weight at the point where they exactly neutralized each other. In addition, Joseph Louis Proust came out with his law of simple proportions. In this thesis, elements mix to form compounds whose components are related in simple ratios as 1:1, 1:2, 2:3. Dalton amplified this discovery, noting simple multiples as well as simple ratios. In this fashion, Berzelius could characterize N_2O, NO, N_2O_3 and N_2O_5. The program then became clear: for a metallic element, one route was to oxidize it to the most oxygen-rich compound. The other was to isolate the metal. The most oxidized states were appended with—"at," the next down with—"it." All of this occurred before a good concept of valences, valence electrons, lone-pair electrons, bonding theory had been developed! Compare, for example, sulf*ate* with sulf*ite*.

The problem of a reference was settled by considering combining weights with respect to oxygen. A typical experiment usually involved a metal oxide which was weighed. It was then reduced with hydrogen. Then the metal was weighed. By 1826, values had been established for C, O, S, N, Cl, P, As, Pb, Hg, Cu and Fe which closely matched the present atomic weights (note that the concept of neutrons was unknown then: the key to unraveling the elements involved equivalent weights). Na, K and Ag must be divided by two. This is because, in modern language, the valency of these metals is one-half the magnitude of the oxide anion. By 1818, Berzelius reported the atomic weights of 45 of the 49 known elements, published in a huge 600-page paper in *Afhandlingar i Fysik, Kemi och Mineralogi*.

The biggest problem still remaining was distinction between atomic weights and equivalent weights, that is to say the concept of *valency*.

Two big triumphs were the separation of metallic Si and Zr. These were obtained from the gaseous fluorides which were allowed to react with metallic potassium, thus producing the metals of these Group IV-A elements. This development hinged on the abundant production of metallic potassium from the galvanic pile.



Berzeliite crystals from Långban, Sweden. The mineral was named after Berzelius by Gustav Flink in 1886. (from Goldschmidt's *Atlas*, 1913)

Berzelius also isolated selenium from ores at Skrikerum, the major ore being Cu_2Se, later named berzelianite. Berzeliite was already preempted by an arsenate analog of garnet from Sjögruvan near Grythyttan, and later at the fabled locality nearby, Långbanshyttan. Recognizing the close relationship of selenium to tellurium, he extended his research to tellurium chemistry, later to report, "in course, my breath took on a foul odor, making social contacts difficult." Doubtless, this was due to formation of foul-smelling dimethyl-tellurium in his body.

Inorganic chemistry and mineralogy were Berzelius's major interests. New elements, he realized, were usually discovered in the wake of understanding and recognizing unusual minerals. A famous trip to Utö, an island in the outskirts of the Stockholm archipelago, was related by Friedrich Wöhler, the once and future discoverer of the bridge between the inorganic and organic world in the dimorphism between ammonium cyanate and urea: "One of my most pleasant recollections is an exceedingly successful excursion to Utö in the company of Berzelius, Hisinger, Arfvedson and Carl Retzius. The islet . . . is the first site of discovery of petalite and spodumene, in which Arfvedson later in Berzelius' laboratory discovered lithium. . . . After an abundant dinner at the foreman's place, we had quite a rough crossing sailing back to Dalarö, where we spent a restless night because of bedbugs and the loud snoring of Berzelius . . ."

Many famous assistants populated Berzelius's laboratory. Included were Hans Gabriel Trolle-Wachtmeister, Chancellor of Justice; Carl Gustaf Mosander; Nils Gabriel Sefström; and the German chemists Christian Gottlob Gmelin; Eilhard Mitscherlich and the brothers Heinrich and Gustav Rose. Sefström had discovered a new element which gave pretty salts. Berzelius named it after Vanadis, cognomen of the Norse goddess Freya, alluding to her beauty. Thorium was also named by Berzelius for a Norse god, Thor. It was originally extracted from what we call thorite from the Langesundfjord in Norway.

Mosander discovered in the Bastnäs cerite yet another element which he named lanthanum, meaning *hidden*. He also extracted yet another new element from the residue which he named didymium, meaning *twin* because it occurs with lanthanum. This name was ironically prophetic because in 1885, Welsbach demonstrated that it was not one element but two, neodymium and praeseodymium. After Berzelius's death, a rationalization of the elements still remained. A number were neither yet isolated nor characterized. Later, the genius Mendelejev predicted two elements eka-boron and eka-aluminum (or scandium and gallium respectively). Mendelejev is generally recognized as the first person to rationalize the Periodic System of Chemical Elements.

Not all of Berzelius' *famuli* were intended to become world-renowned chemists. Some appeared to have earned a peculiar nuisance value. One Mr. R. finally forced Berzelius to declare to Hisinger after a fabricated analysis on Mr. R's part: "The mineral is the most ordinary gray copper ore on earth . . . I now believe that he will never do anything that one will be able to trust and that his natural vocation would be to become a dealer in minerals." This I offer with all due apologies and respect to the dealers in the audience. I must remark that in Berzelius's time, dealing in minerals and other objects of natural history was indeed quite profitable.

By accident, an English physician Dr. MacMichael studied in Berzelius's laboratory and attempted also to assemble a good representative collection of Swedish minerals for the British Museum. Many of the duplicate specimens which he assembled through the purchase of private cabinets from various estates were later donated to Berzelius. As a general scholar in mineralogy as well as chemistry, Berzelius was acquainted with the classificatory systems of Haüy, Werner, Karsten, and Hausmann. Dissatisfied with their classificatory principles, Berzelius created his own based on acid radicals and salts of these radicals. In other words, his system was purely chemical in its origin. He published a 103-page book on the subject. Interestingly, Cronstedt, the discoverer of nickel, suggested a similar system 60 years earlier. Berzelius's book received early criticism. A noted German mineralogist criticized the foundations of the classification because it said nothing about geological aspects. An English review equated the chemical system as one which forced minerals into Procrustean beds. In any event, the system of Berzelius is the one which has best stood the test of time.

Berzelius always seemed at the center of nearly every significant scientific discovery in chemistry. One reason involves his laboratory in Stockholm as the proving ground of nearly every young chemist from the Germanic countries. His many assistants reported him to be a generally good-humored and amiable man, except when he endured one of his periodic migraine attacks and appeared bleary-eyed and grouchy, not fit for human discourse. In the 1820's, the raging dispute of isomerism involved Berzelius greatly. His former pupil, Wöhler, outlined the concept after his famous discovery of the ammonium cyanate-urea dimorphism. A rearrangement of the internal structure of atoms was postulated to explain this phenomenon, an encounter with Nature so profound that its confirmation had to await X-ray diffraction in the twentieth century, although many intervening chemical reactions and conversions were convincing enough. Yet his former pupil, Eilhard Mitscherlich, was the true genius since he rationalized concepts which became clear only after X-ray diffraction, and terms like end-members and solid solution series. Thanking Berzelius for all he learned in his laboratory, he continued to spread the word of his master.

In his later years, married life and a continuous stream of books occupied most of Berzelius' time. He remains, beyond doubt, the greatest chemist who ever lived.

REFERENCE

JORPES, J. E. (1966) *Jac. Berzelius; His Life and Work*. translated by B. Steele. Almquist and Wiksell, Stockholm, 156 pp.

Colorado Dealers

Collector's Edge
Bryan & Kathryn Lees
402 Gladiola Street
Golden, CO 80401
303-278-9724
We Buy Collections

Collector's Stope
Jim & Patti McGlasson
7387 S. Flower Street
Littleton, CO 80123
303-972-0376
Fine Minerals, Species, Micromounts

Crystal-Linn International
Martin Zinn
P.O. Box 2433
Evergreen, CO 80439
303-670-1960
Display Quality Minerals

Eldorado Enterprises
Don Belsher
P.O. Box 219
Eldorado Springs, CO 80025
303-494-7785
Specimen Trimmers, We Buy Collections
Fine Minerals, Call for Appt.

Genesis Epoch
Mitch Abel & Mel Bersh
2417 Sandridge Court
Grand Junction, CO 81503
303-242-3134 (call for appt.)
P.O. Box 440356, Aurora, CO 80044
303-695-7600 (call for appt.)

Golden Minerals
Don E. Knowles
13030 West 6th Place
Golden, CO 80401
303-233-4188
Largest Stock in Colorado

Colorado Mineral & Fossil Show
September 13-16, **1989**
Holiday Inn-North Denver
THE SATELLITE SHOW!
10 a.m. to 10 p.m. Daily

L & T Creations
Tag & Lee McKinney
6780 S. Logan
Littleton, CO 80122
303-794-7803
Colorado-Utah Minerals

Mineral Treasures
Dee Belsher
9250 W. 100th Circle
Broomfield, CO 80020
303-466-4128
Fine Minerals, Collections

Moly B • Caviano
5910 South University
Littleton, CO 80121
303-798-6696
Mon-Sat 10-5:30, Sun call first
Quality Minerals from the
Ray Thompson Collection

Mountain Minerals International
George & Cindy Witters, Dudley Blauwet
P.O. Box 302
Louisville, CO 80027
303-499-2920
Please Call for Appointment

Red & Green Minerals, Inc.
Ernest Porterfield & Denzil Wiggins
7595 W. Florida Avenue
Lakewood, CO 80227
303-985-5559
Custom Jewelry, fine mineral
specimens, lapidary & jewelers'
tools & supplies

Tavernier
3355 S. Wadsworth, G123
Lakewood, CO 80227
303-985-9646
Fine Minerals & Gems

Topaz Gem & Mineral
David Burchett
942 Pearl Street
Boulder, CO 80302
303-447-0600
Minerals from Around the World,
Including Nepal

Williams Minerals
Keith & Brenda Williams
P.O. Box 1599
Idaho Springs, CO 80452
303-567-4647
Colorado Minerals & Mineral Mounts

Worldwide Resources
Dennis O. Belsher
P.O. Box 636
Golden, CO 80402
303-322-4748
South American Minerals

Columbine Mineral Shop
Benjy & Liz Kuehling
633 Main Street
Ouray, CO 81427
303-325-4345
Open 7 days, May 1-Oct. 31
9 a.m. to 9 p.m.
Off-season by Appointment
Fine Minerals for Collectors

Mike Madson Minerals
3201 Snowberry Court
Grand Junction, CO 81506
303-243-2234
Wholesale Minerals

The Rock Hut
Gus Seppi, Jim & Irene Witmer
706 Harrison Avenue
Leadville, CO 80461
303-486-2313
Specimens, Unique Gifts, Jewelry

famous mineral localities:

The Almadén Mines

Ciudad Real, Spain

Jack W. Crawford
Torre Marfil 12-1
Aguadulce
04001 Almeria, Spain

Almadén has been producing mercury ores continuously for over 2,000 years. Modern geologic studies have now identified many of the mineralizing controls in these deposits which have led to ore reserves in several new mines, ensuring production for many years to come. Large cinnabar crystals, though rare, occur as lustrous gemmy specimens of high quality.

INTRODUCTION

The Almadén mining district is located in the south central part of Spain, 225 km southwest of the capital, Madrid. The area is one of gently rolling hills in a semi-arid poor agricultural zone. The original orebody still supports active stopes after at least 2,000 years production, but mill feed is also supplemented from several other separate mines which are either in active production or being developed for the future. The deposits are operated by Minas de Almadén y Arrayanes, S.A., a government-owned company.

Crystals from the original mine have not been common for many years, as the workings have deepened and the formations tightened with a reduction in open spaces. But the opening of new mines in the area, especially El Entredicho and Las Cuevas, have exposed many new occurrences of the highly prized cinnabar crystals. It is unfortunately against company policy to collect specimens and many beauties are lost to the crusher.

HISTORY

The deposits of Almadén have been worked by a number of ruling cultures over the centuries. Old workings are encountered in modern mining which have yielded coins, medals, tools, lamps and other artifacts that indicate over 2,000 years of continuous exploitation. The oldest written references to the Spanish deposits are by the Roman author Pliny in chapters VI, VII, and VIII in book XXXIII of his *Natural History.* Pliny discusses the uses of vermillion, cinnabar and native mercury in his time (23–79 A.D.). In those days vermillion was a sacred color and was used to paint the gods, the faces of statues and the bodies of triumphant warriors.

Pliny stated that "about 10,000 pounds of bulk cinnabar are extracted from the Spanish mines and carried, under seal, to Rome every year." The price was fixed by law at 70 sextercios per pound.

Speaking of native mercury, Pliny says that it is a strong poison that must be used with care. The primary uses are to clean gold, to recover gold on hides and to plate gold on copper. Periodically gold objects were wiped with mercury and polished to remove accumulated tarnish. Gold recovery was effected by coating a hide with mercury and passing crushed gold ores over the hide, then squeezing excess mercury through the hide (the same process I have used, of squeezing amalgam through a chamois cloth), then the upgraded alamgam was roasted. Another use was to cover parts of copper objects with mercury and then spread a thin gold coat on top which the mercury would bind to the copper.

After the Roman authors there is little written about the mines until the twelfth century. Spain had been invaded by Germanic tribes and then in the year 714 by Arabic invaders who ruled until 1151. In the twelfth century the Arabic author Abu-Abd-Alla-Mohamed-Al-Edrisi mentions over 1,000 men working at the mines of Al-Mahaden (Arabic

***Figure 1.* A view of the city of Almadén, with mine workings in the foreground.**

= "the mine"), from which the present name Almadén was derived. The workers had by this time followed the ore down over 250 brazas (420 meters). The men were employed in various jobs such as miners, wood cutters for the ovens, retort makers and for servicing the ovens where cinnabar was roasted to liberate the mercury. (The miners at that depth with poor ventilation must have had a very short life span. Present day underground miners are only allowed to work 8 days per month at Almadén due to mercury build-up in the blood.)

Spain was reconquered by Alfonso VII in 1151 but there remained pockets of conflict until 1248 when the area finally came firmly under Christian rule. At this time the mines at Almadén became the first Royal Mining Company where half of any production became property of the crown. Production was carried out at different times by royal lessees or actual state entities. The people of Moorish descent who still lived in the area were subject to semiforced labor where they were alloted bread, wine and meat in return for six months work per year in the mines. A contract was signed at the end of the fifteenth century with Alonso Gutierrez that he would be allotted up to 30 Moors to help with his work, during which time they would not have to pay government taxes. An interesting law was written in the lease to Fucar (a German) in 1573: "Fucar cannot sell nor give to anyone any rock or metal but must convert all to native mercury or vermillion for his king." This must be one of the first written laws against sample collecting! (Tascon, 1958.)

During these centuries from the Arabic times through the 1500's the ore was finely broken (walnut size) in the mines and hauled to the surface where it was placed in ceramic jars (*Aludeles*) and capped with damp mud. The jars were heated in wood or charcoal furnaces for 12 hours, cooled, and the native mercury poured into water to clean it. These methods were not very efficient and many stokers were poisoned from the escaping fumes. The work was thus generally assigned to slaves and later to prisoners.

A great impulse was given to the demand for Spain's mercury with the great finds of silver and gold in Latin America during the 1500's. Peru, Mexico, Colombia, Ecuador and Bolivia all suddenly were clamoring for mercury from Almadén. During 1573–1582 eight new brick reverbatory furnaces were built in Almadén which each held an average of 250 jars of ore. The furnaces continued to be a problem over the centuries and many innovations were made; those being installed at the Entredicho plant today claim over 98% recovery.

***Figure 2.* Location map.**

Production records are only available from 1499 to the present, indicating about 8 million flasks (a flask contains 34.473 kg or 76 pounds). Of this production over 7 million flasks are from the original orebody. This production certainly places Almadén as the world's premier mercury producer.

GEOLOGY

The known economic mercury deposits at Almadén have two main geologic controls: favorable sedimentary horizons for replacement and, secondly, Silurian and Devonian volcanics which have intruded the sedimentary sequence. The ores may be present in the sedimentary rocks or in the volcanics but they are always closely associated with the intruding volcanics. (See, for example, Arnold, 1973; Hernandez, 1984.)

A visit to the old mine was made by De Kalb in 1921, who studied the ore-wallrock relationships. De Kalb visited three lodes, the San Nicholas, the San Francisco and the San Diego, which were exploiting cinnabar to a depth of 350 meters. De Kalb only reports seeing ore-bearing Silurian quartzite bounded by belts of black slate. No igneous or volcanic rocks were to be observed. The rock suite collected by

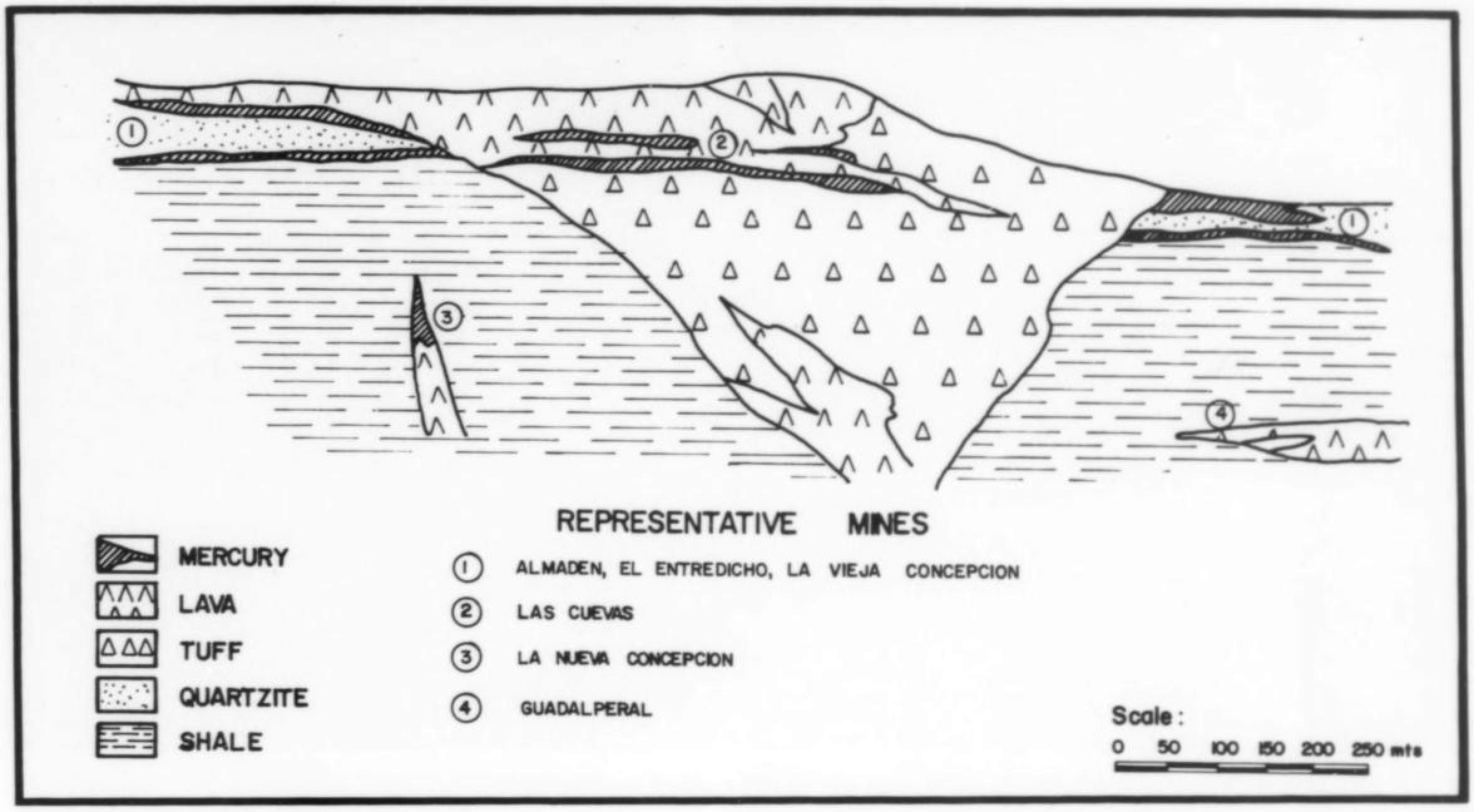


Figure 3. **General geologic cross section through several mines at Almadén.**

De Kalb was studied by the famous geologist F. L. Ransome (1921) who also concurred that only sedimentary rocks were observed.

Minerlization always occurs in or adjacent to lower Silurian quartzites. Small amounts of remobilized mercury and cinnabar are found in the adjacent slates where faults or brecciation have developed porosity (many crystals are developed in these fault breccias). This quartzite filling type of mineralization is typical of the Almadén, El Entredicho and La Concepcion mines. The relationship of the sedimentary rocks to the volcanics is beautifully exposed in the new open pits.

The second major type of mineralization found within the intruding volcanic rocks is fracture or breccia filling. The vulcanism is basaltic with a porphyritic texture. Less frequently there occurs a diabasic volcanic rock with abundant plagioclase phenocysts. The vulcanism was basically syngenetic with the Silurian quartzites and gave rise to dikes, sills, lavas and pyroclastics which formed cones. It is common within the volcanics to find fragments of older ultrabasic rocks which contain olivine, orthopyroxene and chromian spinel.

The native mercury and cinnabar always increase in grade as the volcanics are approached. Overall mine grade is typically 6–8% Hg but near the contacts with the volcanics grades of 30% Hg are common. When drilling for mine development in the Las Cuevas mine, it is common to be standing ankle-deep in native mercury!

The mercury minerals are found invading the original porosity of the Criadero quartzite, in fracture filling near the intruding basic volcanics, especially near explosive cones, and concentrated in the upper parts of dikes and sills. It is accepted by all students of the district now that the mercury moved up the same openings from the lower crust or upper mantle as these Silurian volcanic rocks and that spacially and genetically they are closely associated.

Within the district are also a number of lead-zinc-silver orebodies which were concurrently being worked until the recent collapse of metal prices closed the last one (Navalmedio mine). These deposits are generally galena, sphalerite and pyrite associated with quartz and carbonates.

Figure 4. **Geologic cross section through the Las Cuevas mine, Almadén.**

Figure 5. **A view of the El Entredicho open pit.**

MINERALOGY

The mineralogy of the deposits is very simple, with massive to interstitial cinnabar representing about 90% of the ore and native mercury the rest. Part of the native mercury may be secondary from reduction of the cinnabar with organic material in the slates or black quartzites. The other mercury mineral present, but rarely seen, is calomel. One of the best calomel specimens preserved may be seen on page 258 of Burchard and Bode's *Mineral Museums of Europe*. Pyrite is the only other sulfide commonly seen although galena, sphalerite and chalcopyrite are noted. The pyrite is syngenetic with the volcanics and reduced sedimentary rocks.

Gangue minerals are quartz, dolomite, barite and less commonly calcite. These light colored gangue minerals commonly fill the breccia openings formed by faults and intruding volcanics and are almost always pre-mercury deposition. This is fortuitous for the mineral collector, for it provides a light colored background for the cinnabar crystals.

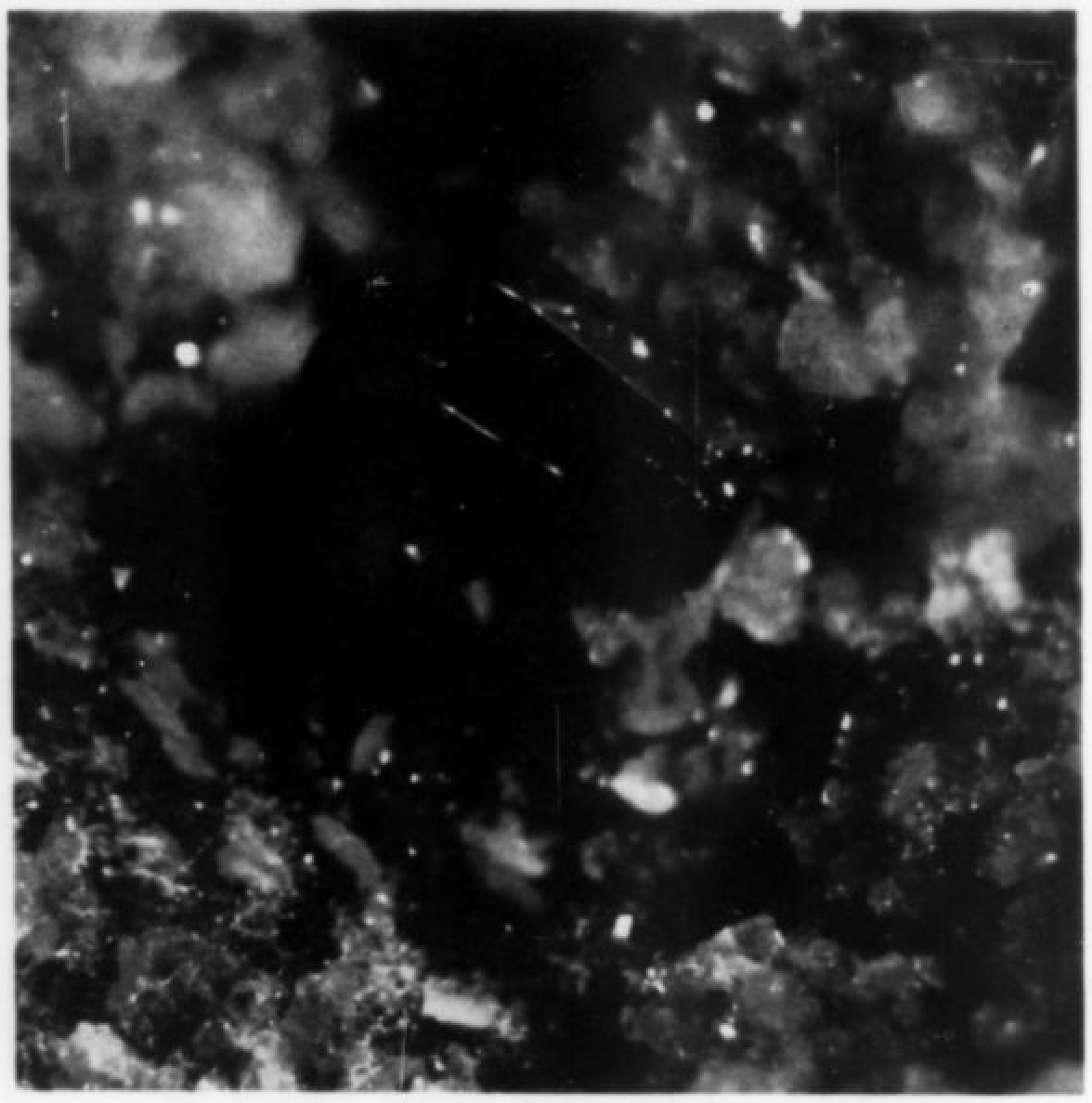


Figure 6. **Cinnabar crystal, 8 mm, on calcite from Almadén.**

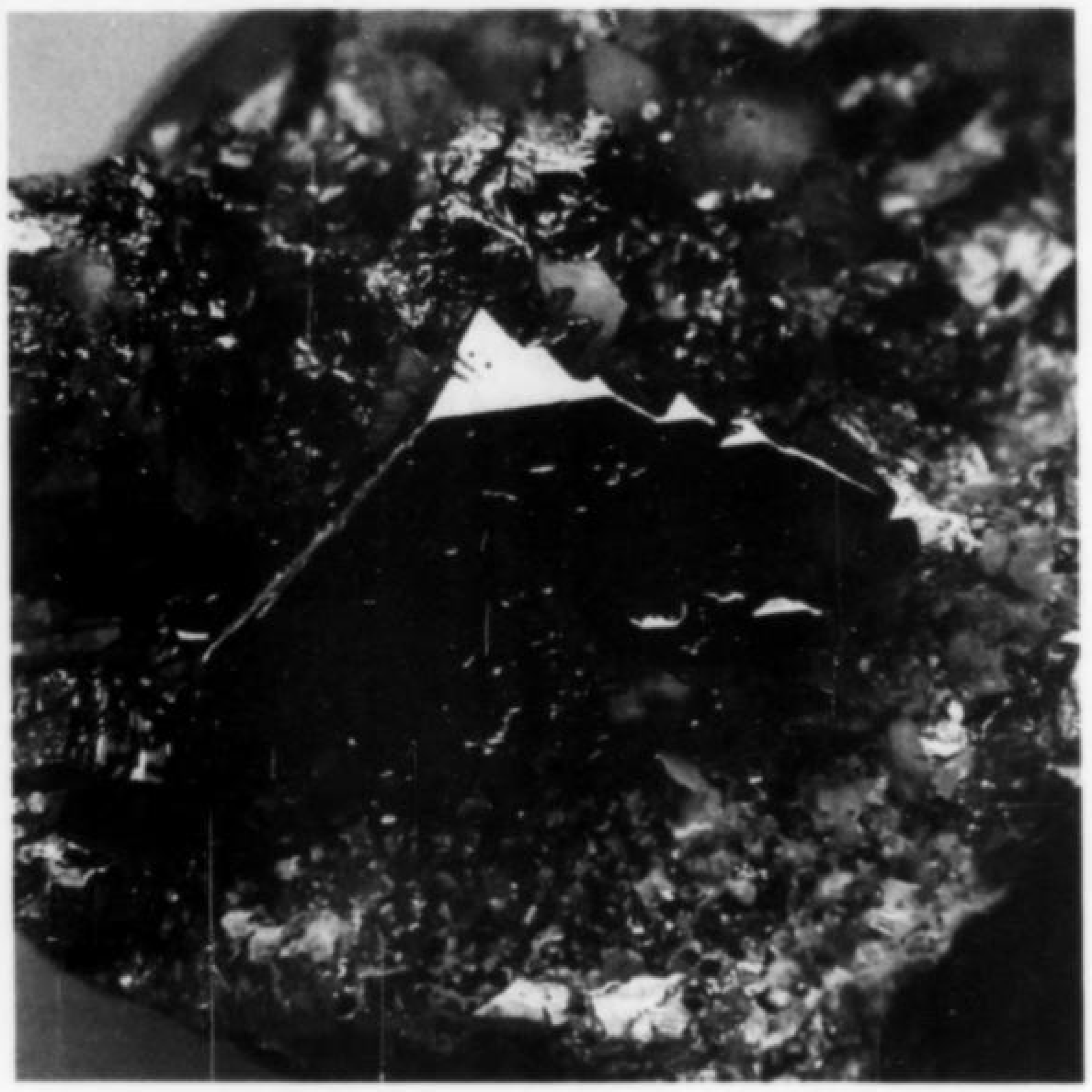


Figure 7. **Cinnabar crystal, 2.4 cm, from Almadén. This specimen sold for $1,400 in 1986.**

The cinnabar crystals are of great interest to the collector even though most of the crystals are more suitable for the micromounter (1–3 mm). More rarely open spaces large enough to accommodate crystals over 2 cm in size are found. The crystals are usually a very lustrous, deep gemmy red color and prismatic or tabular rhombohedral in habit. Where these crystals occur on white dolomite or barite they are truly breathtaking. Many early mineralogists such as Mohs, Lévy,

Figure 8. **Cinnabar twin, 1 cm, from Almadén. Sorbonne collection; photo by Nelly Bariand.**

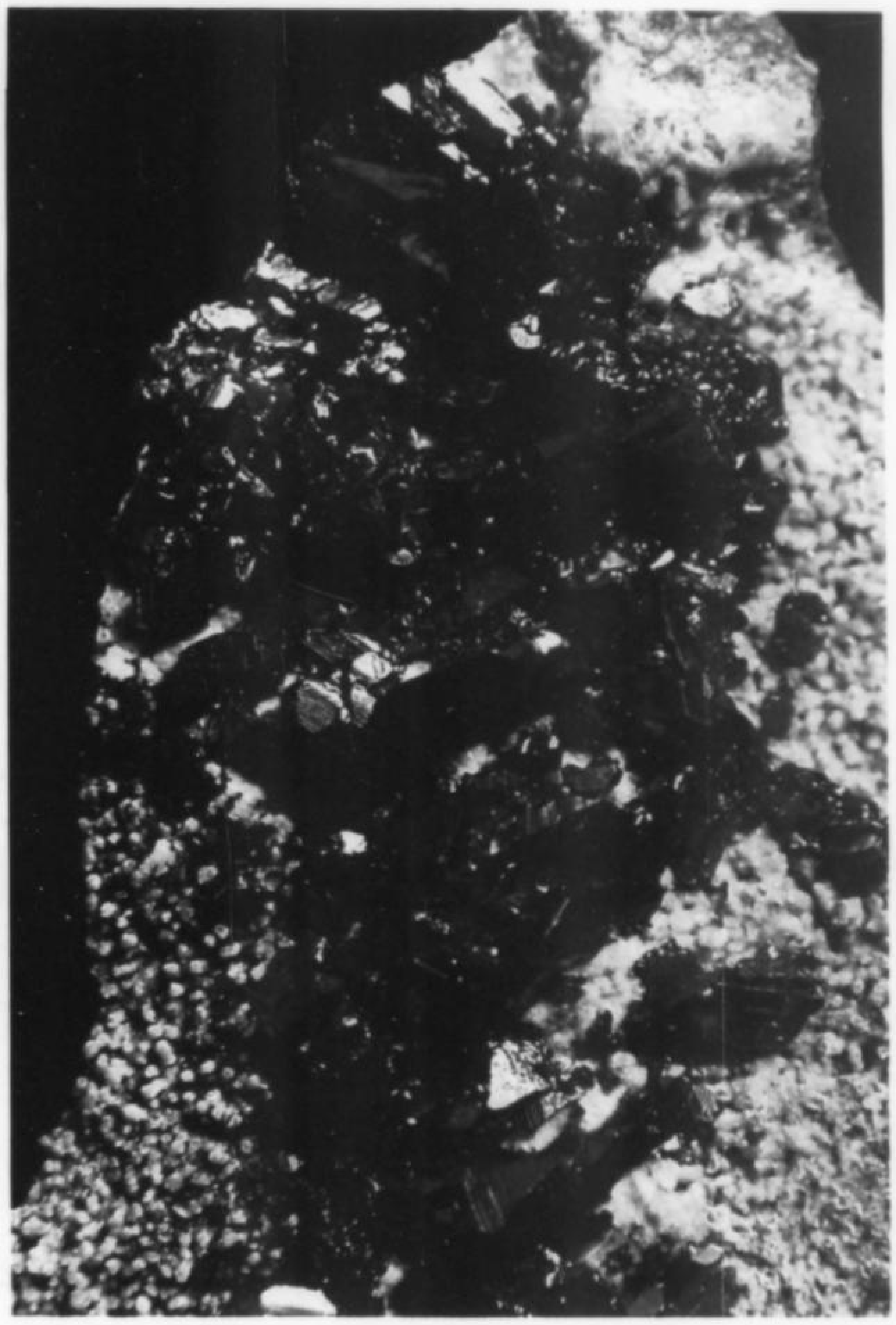


Figure 9. **Prismatic cinnabar crystals to 1.7 cm on calcite-coated matrix, from Almadén. Collection of the author.**

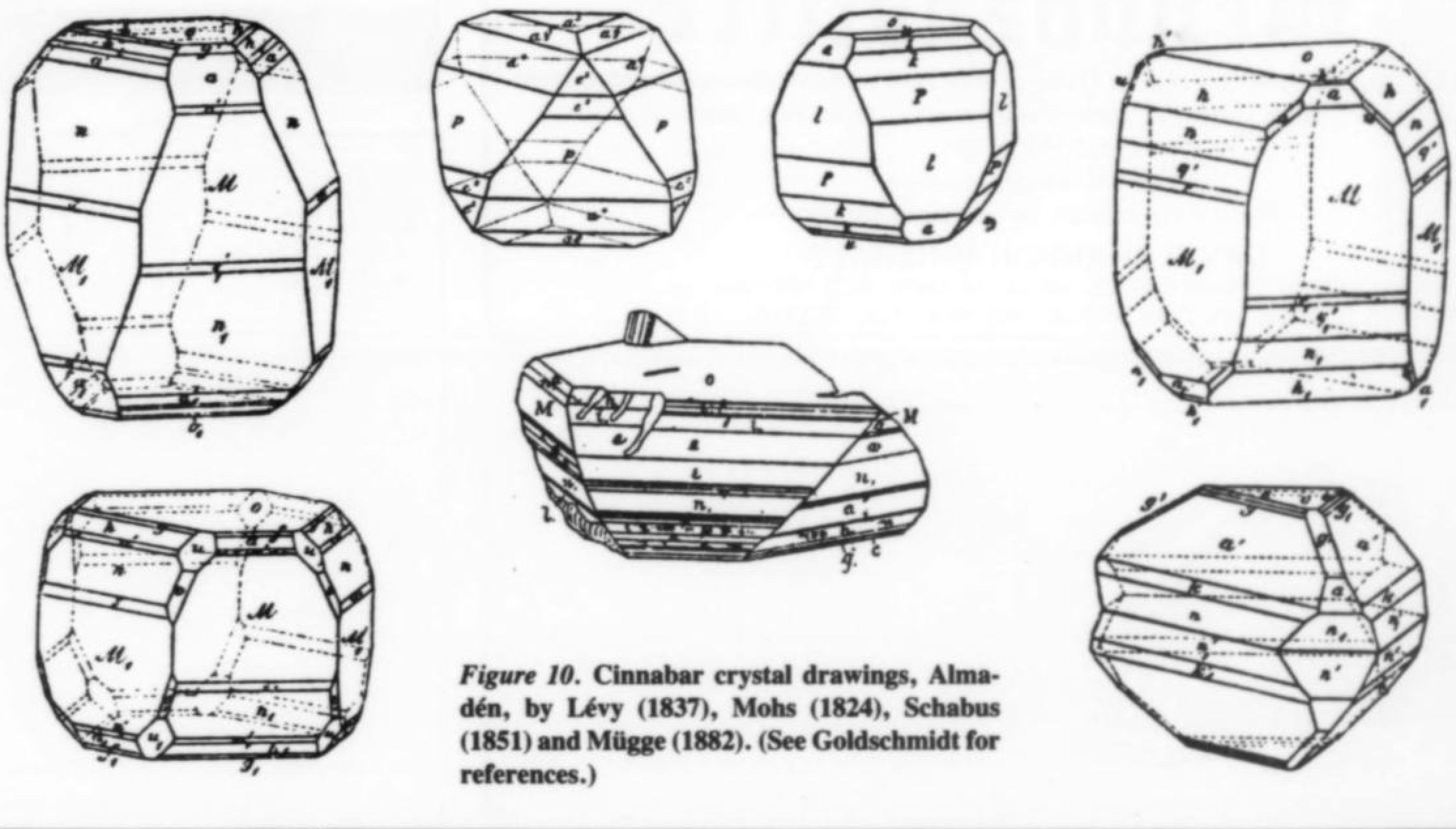


Figure 10. **Cinnabar crystal drawings, Almadén, by Lévy (1837), Mohs (1824), Schabus (1851) and Mügge (1882). (See Goldschmidt for references.)**

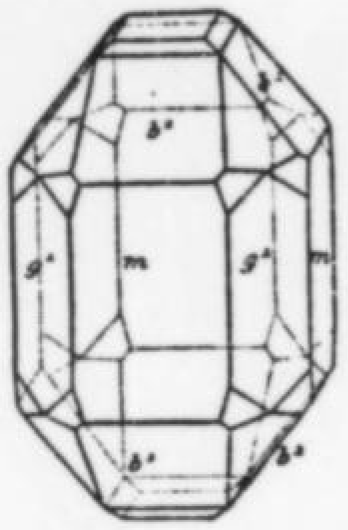


Figure 11. **Calomel crystal drawing, Almadén, by Lévy (1837).**

Dufrénoy, Schabus, Dana, Mügge and Hintze studied and illustrated Almadén cinnabar crystals (see Goldschmidt, 1923).

ACKNOWLEDGMENTS

I wish to thank Jesús Talabán of *Cosmos and Bailey's Minerals* in Madrid for permission to photograph several of his specimens. Thanks also to Enrique Ortega G. and Angel Hernández S. of Minas de Almadén y Arrayanes for very informative discussions on the deposits and permission to visit one of the mines.

REFERENCES

ARNOLD, M. (1973) Ores in sediments. *Procedures of the International Congress on Sedimentology,* Heidelberg, 7–19.

DE KALB, C. (1921) The Almaden quicksilver mine. *Economic Geology,* **16**, 301–312.

GOLDSCHMIDT, V. (1923) *Atlas der Krystallformen.* vol. 9, Carl Winters Universitätsbuchhandlung, Heidelberg.

HERNANDEZ, A. (1984) *Estructura y Génesis de los Yacimientos de Mercurio de la Zona de Almaden, Salamanca.* 64 p.

INSTITUTO GEOLÓGICO Y MINERO DE ESPAÑA (1983) *Depósitos Minerales de España.* 63–68.

LÉVY, A. (1837) *Description d'une collection de minéraux, formee par Henri Heuland . . .* London.

PLINY, C. (79) *Natural History.* The first English edition was prepared by Philemon Holland in 1634.

RANSOME, F. L. (1921) The ore of the Almaden mine. *Economic Geology,* **16**, 313–321.

TASCON, A. M. (1958) *Historia de las Minas de Almaden.* Madrid, 506 p.

California Dealers

Bourget Bros.
1636 11th Street
Santa Monica, California 90404
Tel: (213) 450-6556

California Rock and Mineral Co.
P.O. Box 86
Brea, California 92622
Tel: (714) 990-5073

Frazier's Minerals and Lapidary
Si and Ann Frazier
Suite 306, 6331 Fairmont Ave.
El Cerrito, California 94530
Tel: (415) 848-9541

Galas Minerals
Chris and Agatha Galas
1419 N. Commons Road
Turlock, California 95380
Tel: (209) 632-6222

Geological Center of California Inc.
P.O. Box 1911
Fallbrook, California 92028
Tel: (619)723-8674

Cal and Kerith Graeber
P.O. Box 47
Fallbrook, California 92028
Tel: (619) 723-9292

Grieger's, Inc.
900 S. Arroyo Parkway
Pasadena, California 91105
(800) 423-4181 (national)
(800) 362-7708 (in Calif.)

Ikon Mining & Exploration
Jim Walker & Mary Fong/Walker
2030 Shipway Avenue
Long Beach, California 90815
Tel: (213) 430-0080

Jewel Tunnel Imports
Rock H. Currier
Mail: P.O. Box 267
Arcadia, California 91006
Showroom: 222 Kruse
Monrovia, California
Tel: (818) 357-6338
Wholesale Only

Kassionas
John and Dolores Kassionas
P.O. Box 578
Alviso, California 95002
Tel: (408) 263-7784

Kristalle
332 Forest Avenue, #8
Laguna Beach, California 92651
Tel: (714) 494-7695

A. L. McGuinness
Al McGuinness
4305 Camden Avenue
San Mateo, California 94403
Tel: (415) 345-2068

Nature's Treasures
P.O. Box 10136
Torrance, California 90505
Tel: (213) 373-3601

Pala International & The Collector
912 So. Live Oak Park Road
Fallbrook, California 92028
Tel: (619) 728-9121
US Wats 1-(800)-854-1598

Pathfinder Minerals
Mary Jean & Larry Cull
41942 Via San Gabriel
Fremont, California 94538
Tel: (415) 657-5174

Mark & Jeanette Rogers
P.O. Box 1093
Yucaipa, California 92399
Tel: (714) 797-8034

Schneider's
13021 Poway Road
Poway, California 92064
Tel: (619) 748-3719

Silverhorn
Mike Ridding
1155 Coast Village Road
Montecito, California 93108
Tel: (805) 969-0442

Video Minerals
Art Graeber
P.O. Box 252
Yucaipa, California 92399
Tel: (714) 797-2591

Weber's Minerals
605 San Dieguito Drive
Encinitas, California 92024
Tel: (619) 436-4350

Whatever you're looking for in the way of fine display specimens, rare species material, moderately priced specimens for beginning and intermediate collectors, bulk material for reserach and study, wholesale or retail, you'll find it in California.

AGARDITE-(Y), GYSINITE-(Nd) AND OTHER RARE MINERALS FROM SARDINIA

Filippo Olmi and **Cesare Sabelli**
CNR, Centro di Studio per la Mineralogia
e la Geochimica dei Sedimenti
Via La Pira 4
50121 Firenze, Italy

Giancarlo Brizzi
Amici Mineralogisti Fiorentini
Via L. il Magnifico 16
50129 Firenze, Italy

The rare-earth minerals agardite-(Y) and gysinite-(Nd), as well as koechlinite, philipsburgite, theisite and wroewolfeite, occur at the Santa Lucia and Sa Duchessa mines; fine micromounts can still be collected.

INTRODUCTION

The Santa Lucia and Sa Duchessa mines are located respectively in the Fluminese and Oridda districts, which are part of the Iglesiente region in southwestern Sardinia. Much mineralization is present in this mining area, hosted mostly by Cambrian and Ordovician sediments.

The present investigation, as part of a continuing study of the alteration minerals (mainly copper minerals), is just a preliminary account of this region. Additional studies, extended also to other districts of the island, need to be made in order to establish the conditions of formation of the alteration minerals, and of their paragenetic associations. Systematic and exhaustive samplings of the mines are therefore necessary.

All the minerals described (agardite-(Y), gysinite-(Nd), koechlinite, philipsburgite, theisite and wroewolfeite) represent the first occurrences for those species in Italy.

HISTORY

Santa Lucia

In the last 30 years of the nineteenth century, lead-zinc ores were exploited by intensive underground mining operations. In the current century mining also continued by open-pit methods on new veins of "calamine" (mainly hemimorphite) and galena at the S'Oreri, Pala su Sciusciu and Monte Argentu localities. At the end of World War II mining was reduced, after which first barite and then fluorite bodies were mined. But in the last few years the mine has been idle.

Sa Duchessa

The Sa Duchessa deposit was discovered in 1866. The surface portion, very rich in zinc silicate, was at first easily mined. After 20 years the ore mined (from 20% to 38% zinc) reached 50 tons per day. From 1890 the mining of galena, mainly by underground workings, also became profitable. Subsequently, until 1930, workings were strongly reduced due to unfavorable economic conditions and to the depletion of mineralized bodies. In the years that followed, new research allowed the localization of important veins of "calamine," and of copper silicates (chrysocolla) and carbonates (malachite, azurite), embedded in limestone and chaotic shales. For many years Sa Duchessa was the leading copper producer in Sardinia. After World War II activity was progressively reduced, and in 1952 mining ceased.

GEOLOGY

Santa Lucia

The chief host rocks of the Santa Lucia orebody are carbonaceous shales, quartzites and sandstones (Cambrian to Ordovician), covered in part by Upper Ordovician transgressive conglomerates (Carmignani *et al.*, 1986). Isolated blocks of carbonates of the Cambrian Gonnesa formation, mainly dolomites and limestones, crop out at S'Oreri and Pala su Sciusciu (Bakos and Valera, 1972). The ore deposits (F, Ba, Pb) of the Santa Lucia complex are associated with the emplacement of a post-tectonic intrusion of leucogranites of Variscan age, with consequent circulation of high temperature fluids and mobilization of metals (Aponte *et al.*, 1988).

Sa Duchessa

In Oridda the intrusion of a leucogranitic body caused a characteristic metamorphic aureole, with the formation of marbles and the

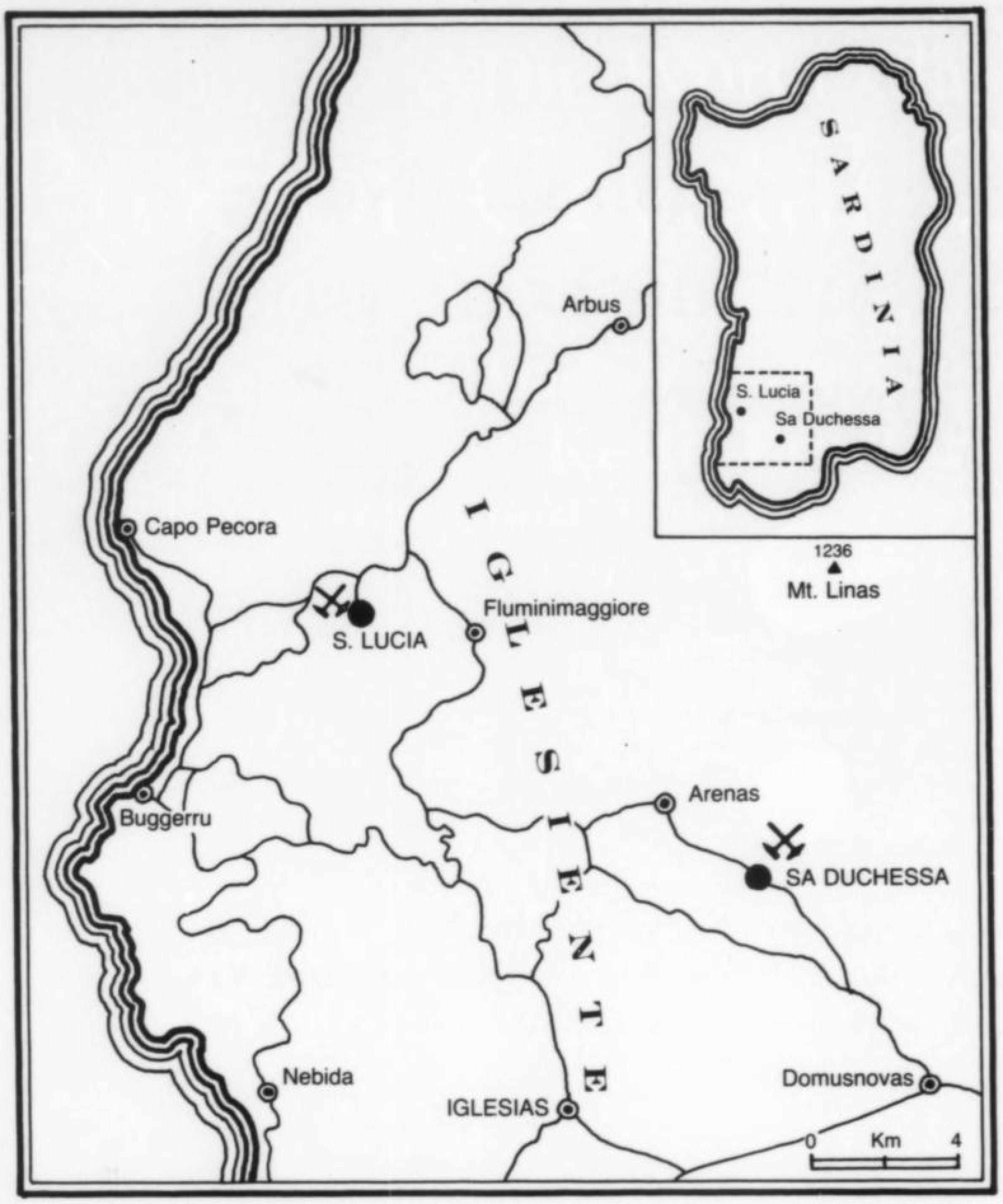


***Figure 1.* Location map of Santa Lucia and Sa Duchessa mines in the Fluminese district, southwestern Sardinia.**

development of skarns. The most common rock types in the area are the Ceroide Limestone of the Cambrian Gonnesa Formation, and Ordovician sediments (conglomerates and shales). At Sa Duchessa, located south of the granitic body, the skarn formation was followed by a strong hydrothermal alteration which generated mixed-sulfide orebodies. Lower temperature hydrothermal minerals, like quartz, chlorite and calcite, were also observed. The main ore concentration, consisting of zinc silicate and copper carbonates, have resulted from enrichment by supergene processes in karstic cavities (Aponte *et al.*, 1988).

MINERALOGY

This paper documents recently identified rare species from the Santa Lucia and Sa Duchessa mines. Unfortunately, the old tunnels of the mines have collapsed or are flooded and it is impossible to reach the underground workings. All the specimens described have been collected from the old mine dumps in front of the adits, or from the debris of the test holes in the mines.

Repeated trips to the mines, with the aid of some mineral collectors, resulted in the accumulation of a study collection of interesting specimens of alteration minerals. For mineral identification and analyses, X-ray powder diffraction, single-crystal Weissenberg analysis and electron probe microanalysis (with EDAX microanalyzer) were employed.

The species most frequently encountered in the Santa Lucia complex are brochantite, cerussite, malachite and pyromorphite. Less common are anglesite, aurichalcite, azurite, chrysocolla, ferritungstite, jarosite, linarite and rosasite. Uncommon are bindheimite, cuprite, mimetite, partzite, serpierite and cuprian adamite. All these minerals and those described later on in this section come from Pala su Sciusciu and from Su Sizzimurreddu localities, on the east and on the north of the Santa Lucia complex respectively (see map).

The most common alteration minerals at Sa Duchessa mine include azurite, brochantite, chrysocolla, malachite and smithsonite (Uras, 1951). In recent years mineral collectors have reported the presence of other minerals. Porcellini (1983) reports the occurrence of aurichalcite, cerussite, connellite, cyanotrichite, pseudomalachite, pyromorphite and wulfenite; Perchiazzi and Preite (1986) noted the presence of libethenite. The minerals described below, as well as other uncommon species (cuprian adamite, atacamite, mimetite), have been collected from the old dumps of the main working sites, Maremma Superiore and Maremma Inferiore.

Agardite-(Y) *(Sa Duchessa and Santa Lucia)*

The agardite series is a member of the mixite group with the general formula: $Cu_6M(RO_4)_3(OH)_6 \cdot 3H_2O$ where M = Y (and REE), Bi, Al and Ca; and R = As and P. In mixite Bi and As are dominant elements in M and R sites respectively. According to the recently revised nomenclature for rare-earth minerals approved by the IMA Commission on New Minerals and Mineral Names, the approved agardites are agardite-(Y) (Dietrich *et al.*, 1969) and agardite-(La) (Fehr and Hochleitner, 1984), with Y and La respectively as dominant rare earths in the M site, and As prevailing in the R site in both cases. So far, two other minerals are known to belong to this group: goudeyite (Wise, 1978), with Al in M and As in R as prevailing elements; and petersite-

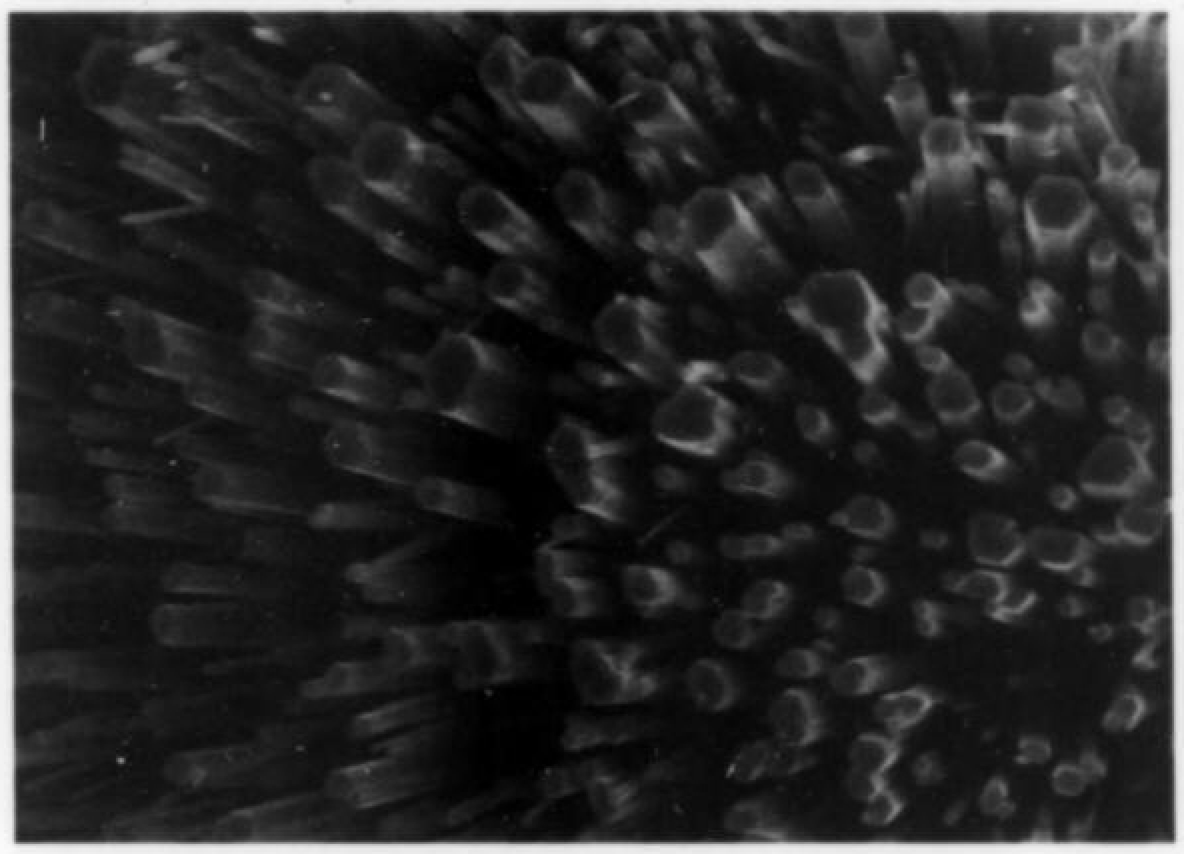


Figure 2. **SEM photograph of a tuft of agardite-(Y), from Sa Duchessa. (526X)**

(Y) (Peacor and Dunn, 1982), the phosphate analog of agardite-(Y).

At Sa Duchessa five samples with agardite-(Y) were found. On the basis of EDAX analytical tests, the dominant element in the *M* site is always Y, while there is a variability regarding the *R* site. Two specimens have As dominant and thus can be regarded as agardite-(Y); the other specimens present almost equal amounts of As and P (with a prevalence of P) and seem to occupy an intermediate position between agardite-(Y) and petersite-(Y). Of course, quantitative analyses are needed to determine an accurate chemical composition for all samples, in order to ascertain if they are members of a solid solution between arsenate and phosphate.

Figure 3. **SEM photograph of agardite-petersite crystals in the shape of hexagonal tubes, from Sa Duchessa. (230X)**

A confirmation of the simultaneous presence of (PO_4) and (AsO_4) anions comes from the comparison of the unit cell parameters of the three PO_4-rich Sa Duchessa agardite-(Y) with those of agardite-(Y) and petersite-(Y) given in the literature. The refined *a* parameter of Sa Duchessa specimens (hexagonal $P6_3/m$) varies from 13.38 to 13.40Å, against the longer value of 13.55Å for agardite-(Y) and the shorter one of 13.288Å for the phosphate analog petersite-(Y). In fact, in the (001) plane the anionic groups connect the cationic polyhedra in such a way that a partial substitution of P for As (P-O bond length = 1.56Å instead of As-O = 1.75Å) causes a shortening of the *a* parameter. On the contrary, the *c* parameter is practically identical in agardite-(Y) and petersite-(Y), 5.87 and 5.877Å respectively, and in Sa Duchessa specimens, 5.87Å, because the anionic groups do not affect the structural connections parallel to [001].

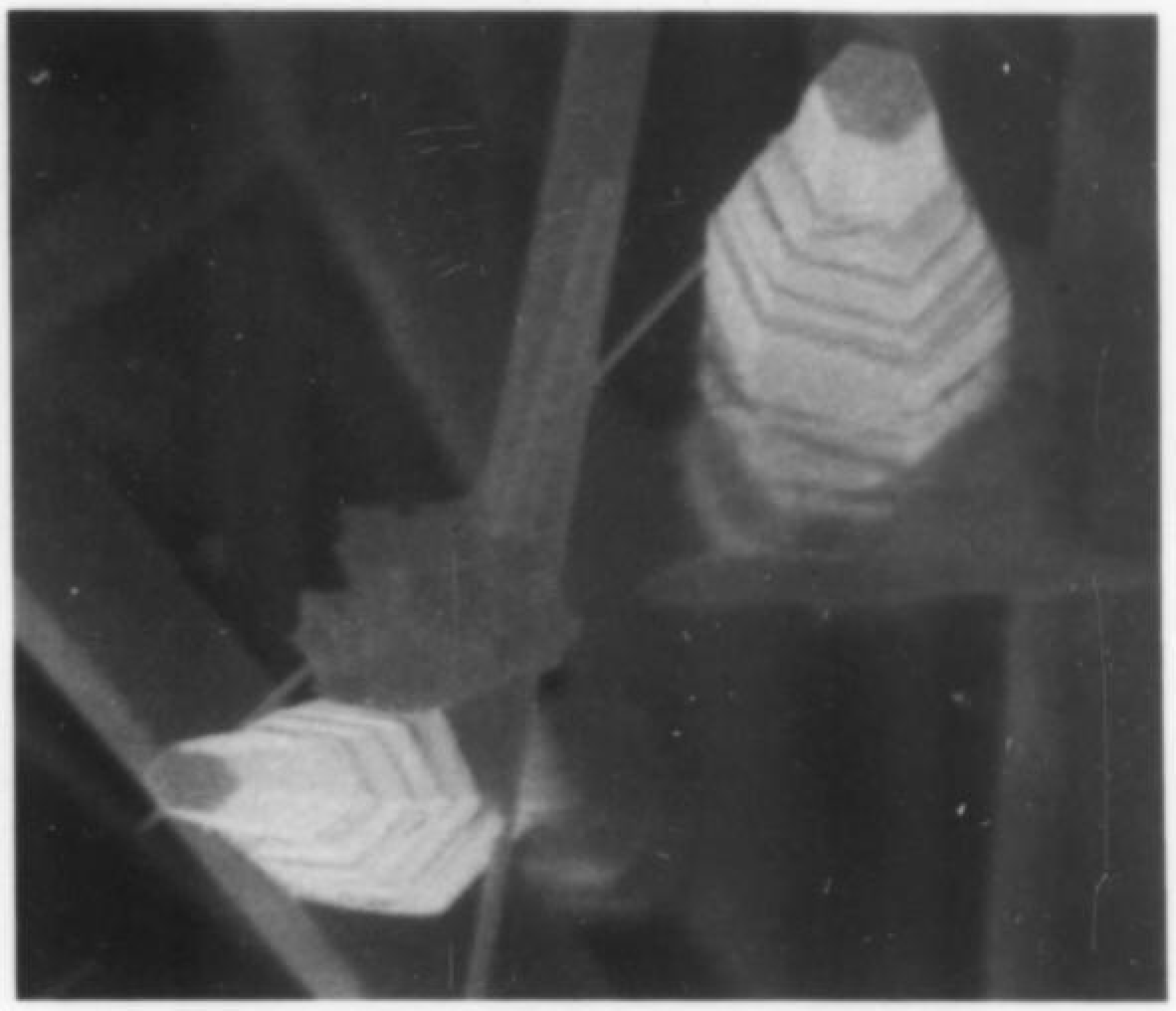


Figure 4. **SEM photograph of two curiously tapered crystals of agardite from Santa Lucia. (2930X)**

From the morphological point of view all the Sa Duchessa agardites are similar. Crystals are very thin hexagonal prisms elongated on [001]. Sometimes they are hollow shells with a hexagonal outline. The acicular prisms are usually grouped in radial tufts, often in the form of a sheaf, yellow-green to green in color, implanted on chrysocolla.

The samples of agardite collected at Santa Lucia, both from Pala su Sciusciu and from Su Sizzimurreddu, are much more numerous than at Sa Duchessa. The tufts of crystals, yellow-green in color, stand out against the white of the granular quartz matrix. Like that from Sa Duchessa, the crystal habit of Santa Lucia agardite is acicular, with the hexagonal prism sometimes well defined. Preliminary analytical tests indicate the absence of P in the *R* site and, in some cases, the prevalence of Ce among rare earths in the *M* site. On this basis agardite from Santa Lucia could be regarded as the Ce analog of agardite-(Y). More detailed investigations are in progress in order to characterize this new variety of the agardite family.

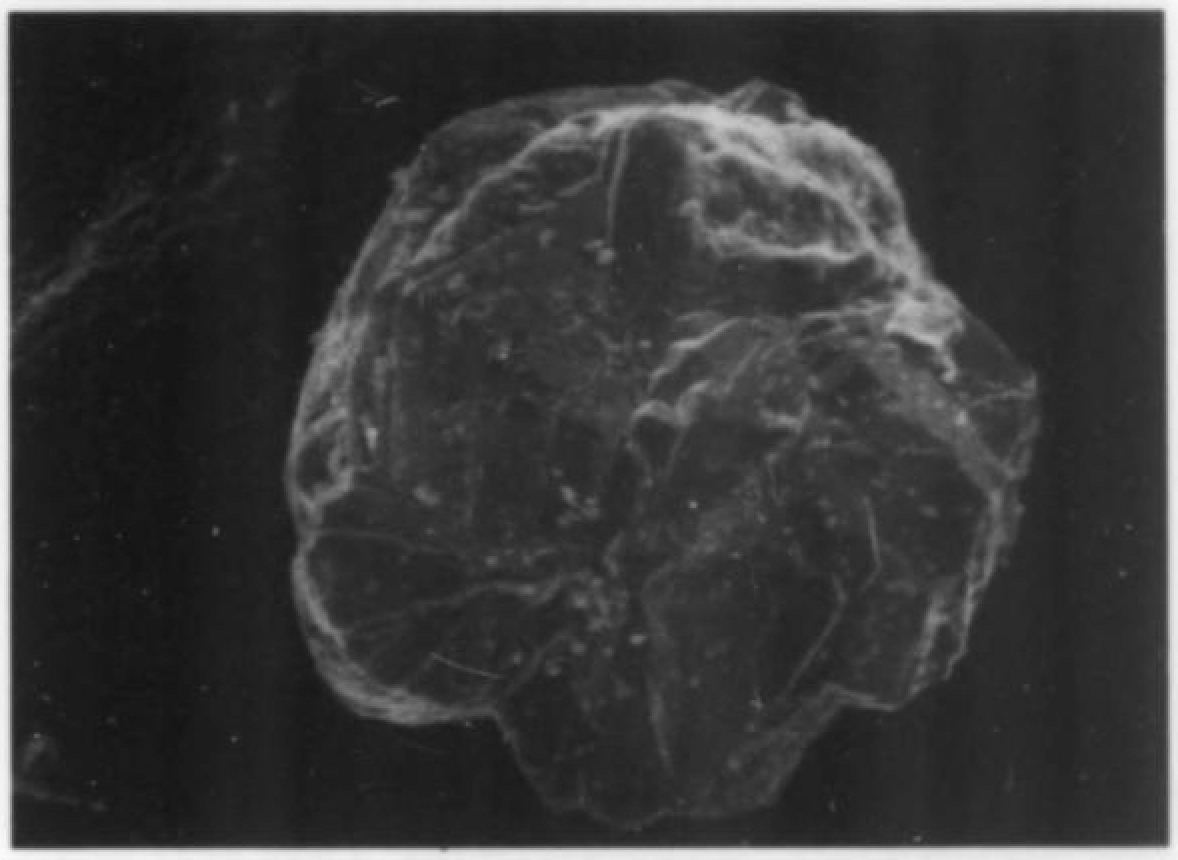


Figure 5. **SEM photograph of a rounded aggregate of gysinite-(Nd) crystals, from Sa Duchessa. (128X)**

Gysinite-(Nd) *(Sa Duchessa)*

Gysinite and its isostructural analog ancylite have the general formula: $M_x\mathrm{REE}_{1-x}(\mathrm{CO}_3)(\mathrm{OH})_{1-x}\cdot x\mathrm{H}_2\mathrm{O}$ where *M* represents divalent ca-

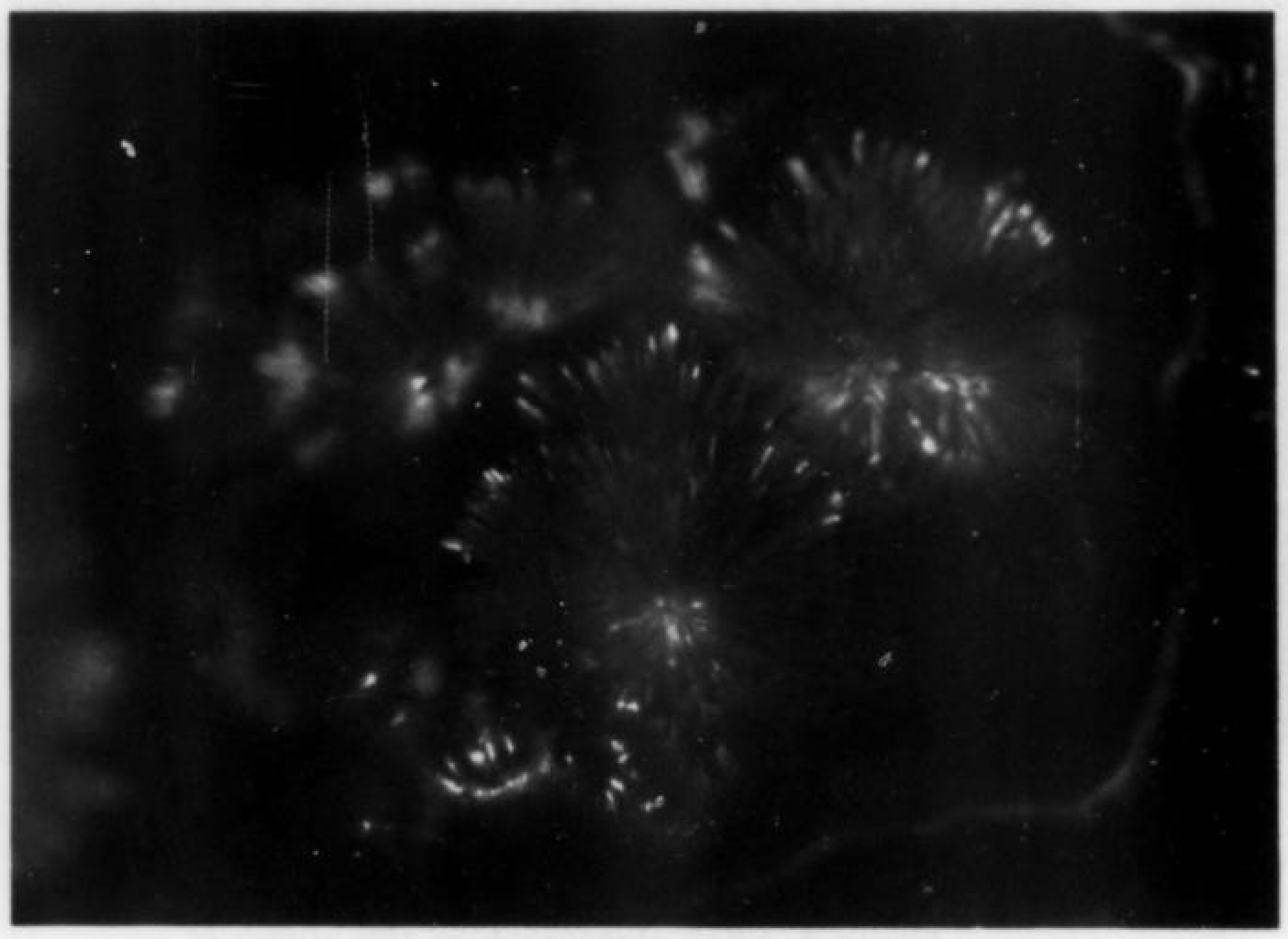


Figure 6. **Tufts (0.8 mm) of agardite-(Y) crystals implanted on chrysocolla, from Sa Duchessa. Photo by G. Brizzi.**

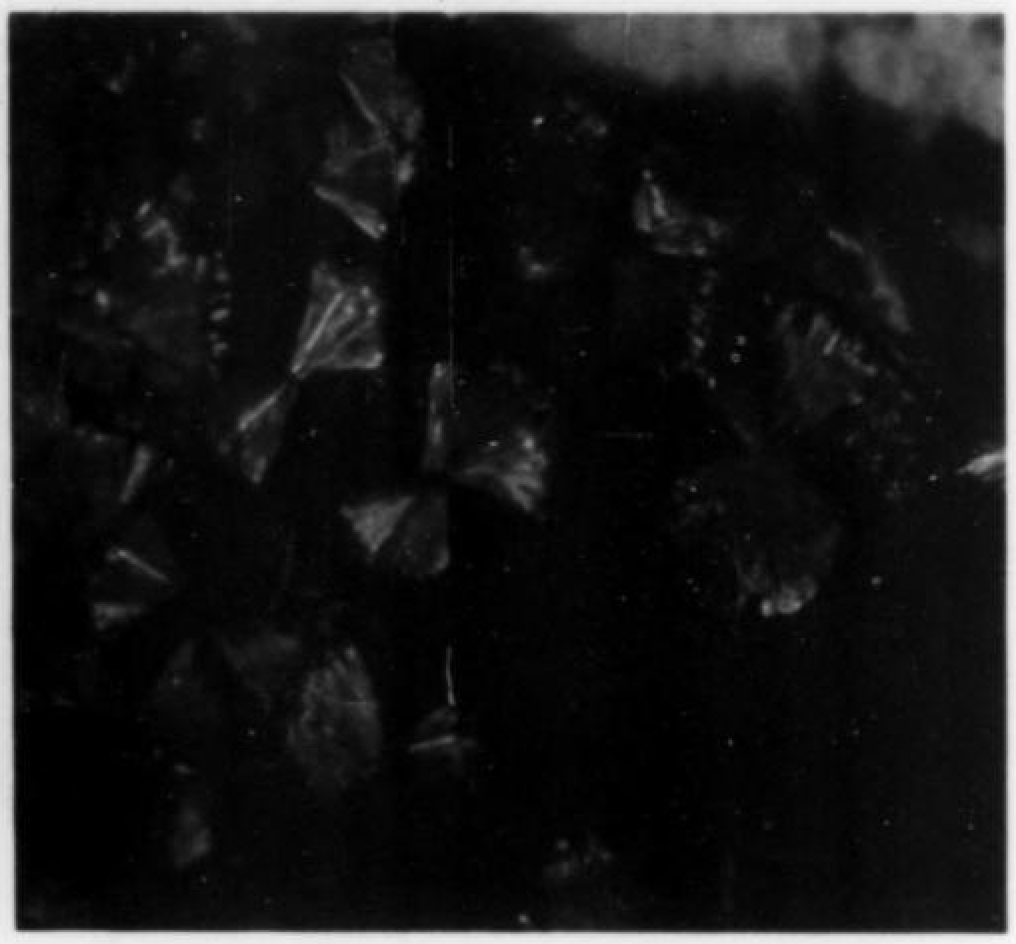


Figure 7. **"Sheafs" (0.5 mm) of agardite-petersite crystals on goethitic matrix, from Sa Duchessa. Photo by G. Brizzi.**

Figure 8. (above) **Tufts (0.5 mm) of acicular crystals of agardite-(Y) on quartz from Santa Lucia. Photo by G. Brizzi.**

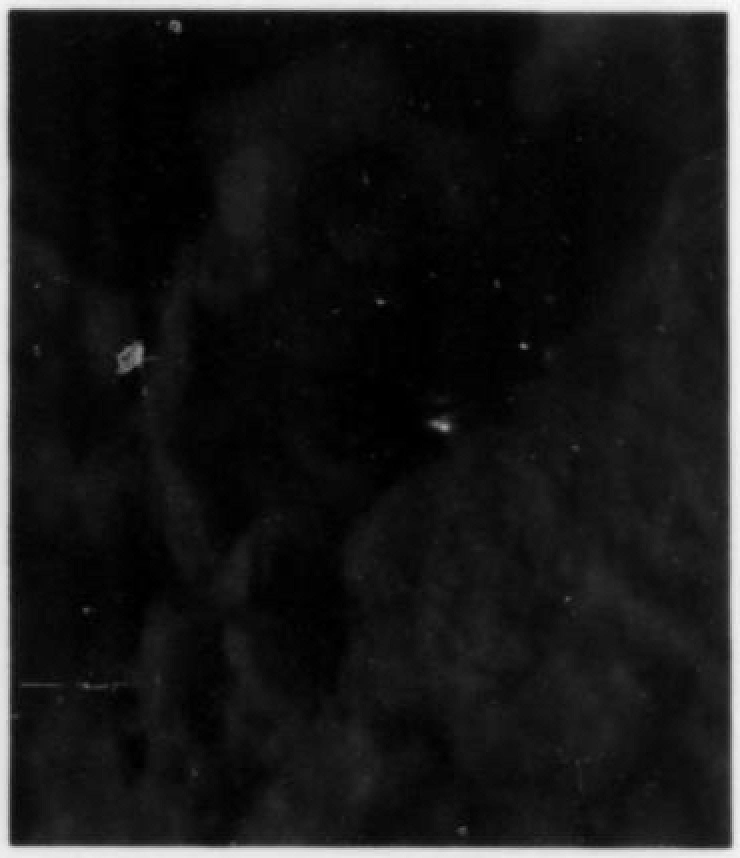


Figure 9. **A grain (0.2 mm) of gysinite-(Nd) implanted on quartzose matrix, from Sa Duchessa. Photo by G. Brizzi.**

Figure 10. **Rounded aggregates (1 to 2 mm) of philipsburgite crystals, from Sa Duchessa. Photo by G. Brizzi.**

tions: Ca and Sr in ancylite, Pb in gysinite. According to the recently revised nomenclature, the names of these carbonates should be ancylite-(Ce) and gysinite-(Nd), Ce and Nd respectively being the dominant rare earths in the formula. While ancylite-(Ce) has been known from the beginning of this century, gysinite-(Nd) is a very recently described mineral (Sarp and Bertrand, 1985).

At Sa Duchessa gysinite is very rare: only a few specimens were found. The mineral occurs as little grains pink in color, sparingly scattered on quartzose surfaces, or as thin films lining the matrix. The grains are rounded aggregates of interpenetrated crystals. Semiquantitative analytical tests indicate Nd to be dominant among the rare earth elements in the mineral, so it is gysinite-(Nd).

Koechlinite *(Sa Duchessa)* Bi_2MoO_6

Another molybdenum mineral, wulfenite, is known to come from Sa Duchessa, but no species containing Bi have so far been reported for the locality. Only one specimen of koechlinite has been collected.

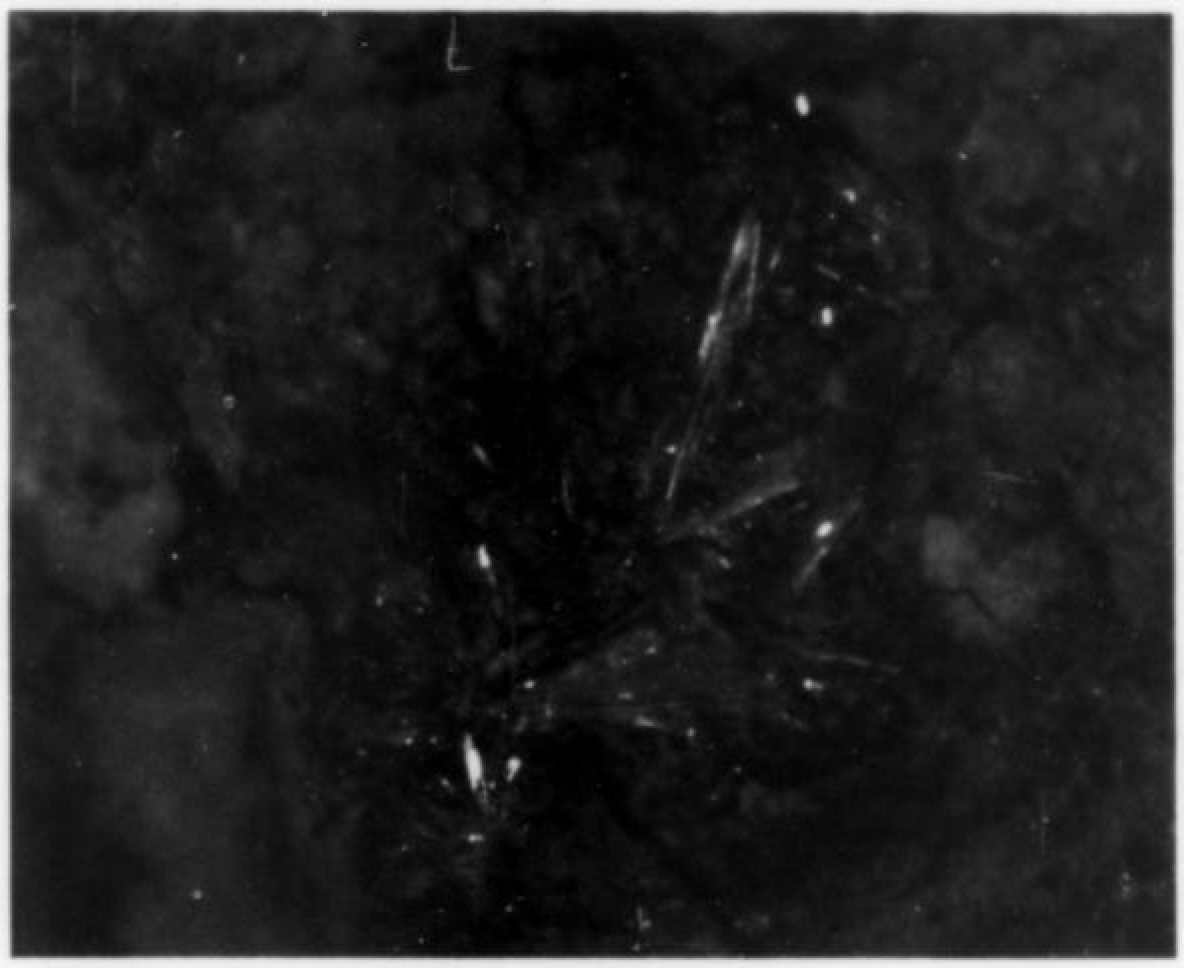


Figure 11. **Some bright crystals (0.4 mm) of koechlinite on goethitic matrix, from Sa Duchessa. Photo by G. Brizzi.**

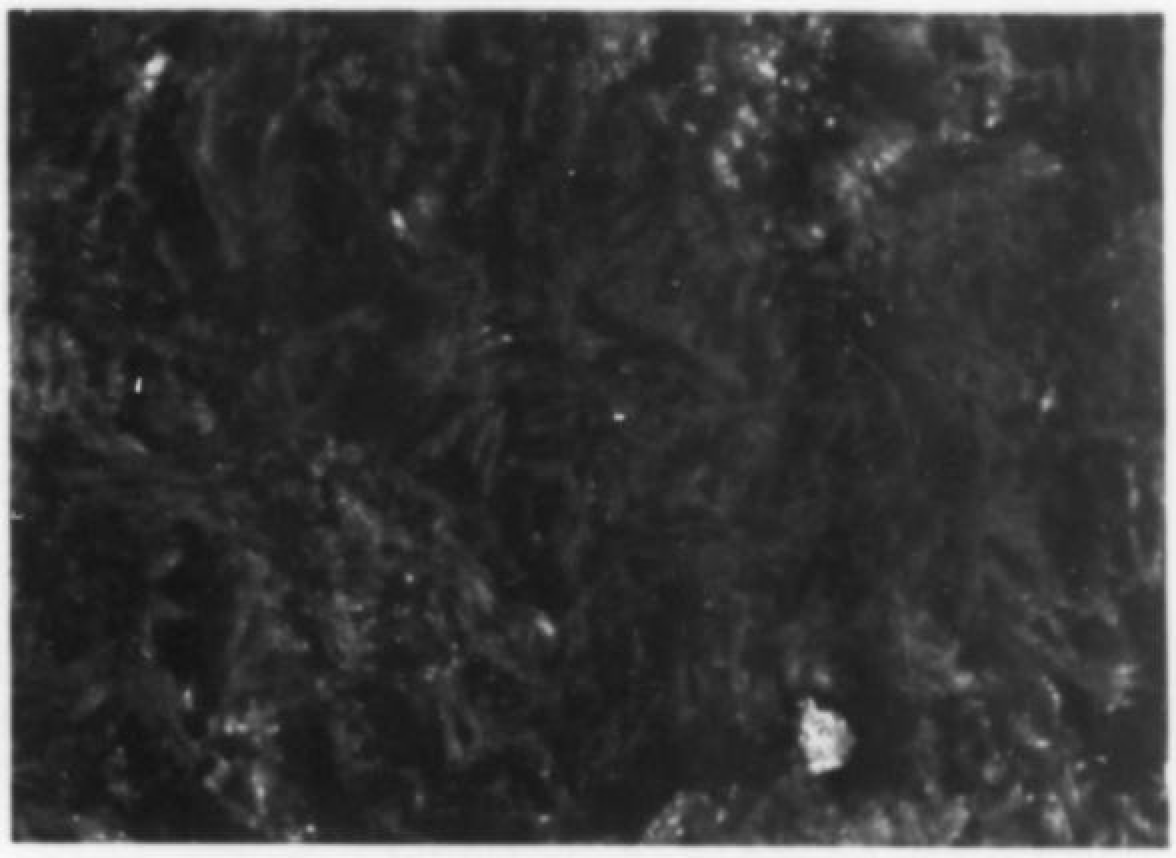


Figure 12. **A "carpet" of lamellar crystals of theisite, from Sa Duchessa. Width of picture = 5 mm. Photo by G. Brizzi.**

Figure 13. **SEM photograph of lath-like crystals of koechlinite, from Sa Duchessa. (800X)**

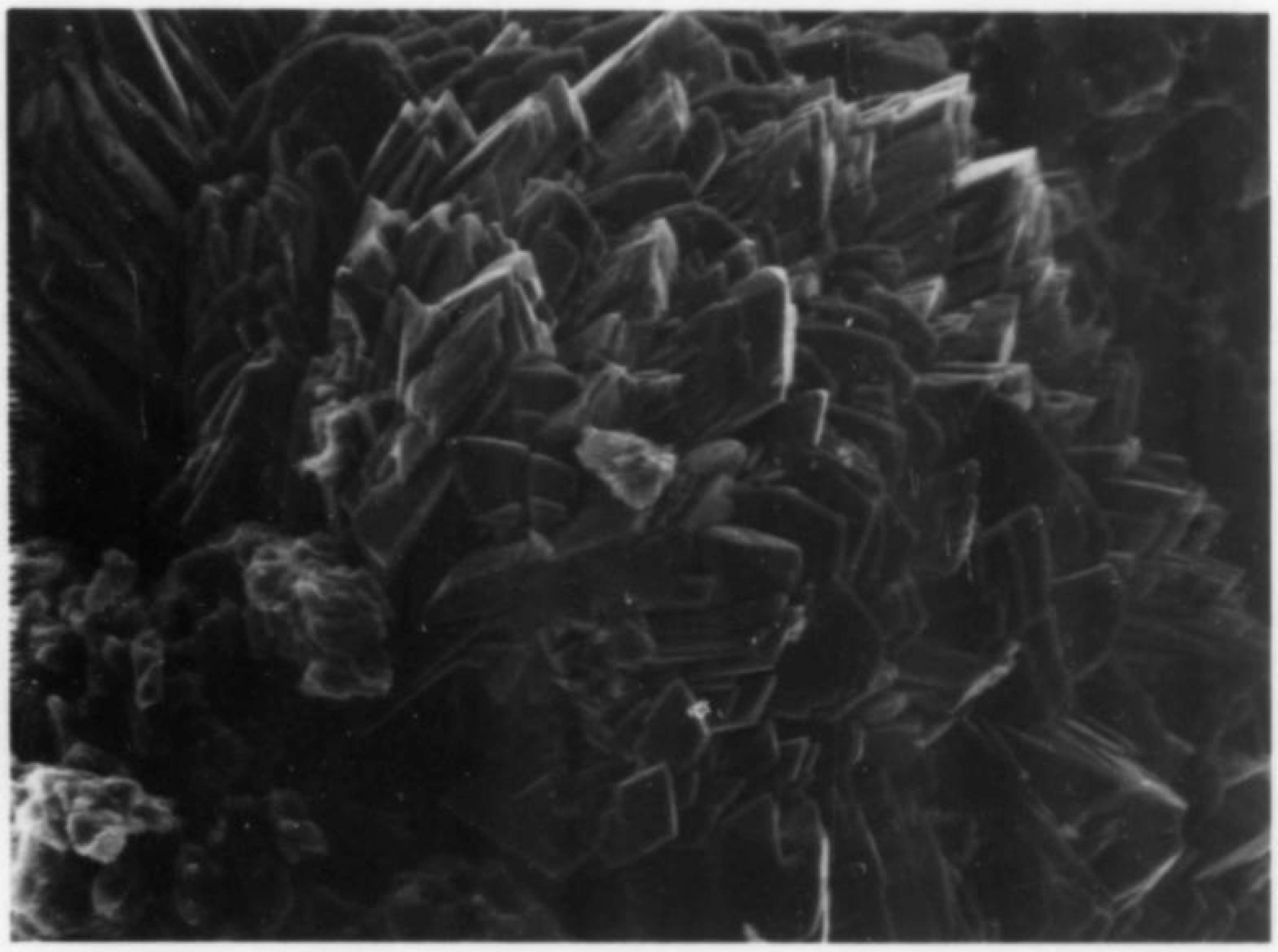


Figure 14. **SEM photograph of an aggregate of philipsburgite crystals, from Sa Duchessa. (390X)**

The mineral occurs as pale yellow crystals, transparent and with a silky luster, in small aggregates or as isolated randomly oriented platelets on limonitic matrix.

Philipsburgite *(Sa Duchessa)* $(Cu,Zn)_6(AsO_4,PO_4)_2(OH)_6\cdot H_2O$

The first occurrence of philipsburgite to be described was reported by Peacor *et al*. (1985) from Montana. It is isostructural with kipushite, $(Cu,Zn)_5Zn(PO_4)_2(OH)_6\cdot H_2O$, which was described as a new mineral from Zaire in the same year (Piret *et al.*, 1985).

The mineral found at Sa Duchessa contains As in partial substitution for P (semiquantitative tests indicate P:As and Cu:Zn ratios of about 2:1 and 4:1 respectively); therefore, it should be regarded as philipsburgite. Few specimens of this mineral, often associated with pseudomalachite, have been found. It occurs as emerald-green spheroidal aggregates and fan-shaped clusters of subparallel prismatic crystals.

Theisite *(Sa Duchessa)* $(Cu,Zn)_5(AsO_4)(SbO_4)(OH)_7$

Theisite was discovered near Durango, Colorado, by Williams (1982). Only one specimen of this mineral was found at Sa Duchessa. It occurs as minute lath-like crystals implanted on chrysocolla. The X-ray powder pattern fits well with that given in the literature, and a semiquantitative analysis indicates the presence of Cu, Zn, As and Sb in similar proportions to those of theisite. Crystals, turquoise-blue in color and with micaceous appearance, are grouped to form fibrolamellar crusts on the matrix.

Wroewolfeite *(Santa Lucia)* $Cu_4(SO_4)(OH)_2\cdot 2H_2O$

This species was described as a new mineral by Dunn and Peacor (1975). In chemical composition and powder pattern wroewolfeite closely resembles langite. The color (deep greenish blue) and the habit (euhedral, tabular or prismatic) is also similar in both minerals. Wroewolfeite is among the rarest minerals at Santa Lucia. It is often associated with langite and serpierite. Positive identification of the species was achieved by means of single crystal investigations.

ACKNOWLEDGMENTS

We would like to thank the following people for helping in sample collection, and for bringing to our attention mineral specimens:

U. Santucci for agardite-(Y); I. Ciselli and A. Santucci for gysinite-(Nd) and philipsburgite; and E. Cocco for theisite and koechlinite. R. Meli did location mapping of the area.

REFERENCES

APONTE, F., BALASSONE, G., BONI, M., COSTAMAGNA, L., and DI MARIO, G. (1988) The Variscan skarn ores in South West Sardinia; their relationships with the Cambro-Ordovician strata-bound deposits. *Rendiconti della Società Italiana di Mineralogia e Petrologia,* **43** (in press).

BAKOS, F., and VALERA, R. (1972) Le mineralizzazioni fluoritiche di Santa Lucia (Sardegna Sud-Occidentale). Atti della giornata di Studio sulle Fluoriti Italiane. *Associazione Mineraria Subalpina,* **3**, 299–323.

CARMIGNANI, L., COCOZZA, T., GANDIN, A., and PERTUSATI, P. C. (1986) The geology of Iglesiente. IGCP *Project* n. 5. *Newsletter, Special issue,* 31–49.

DIETRICH, J. E., ORLIAC, M., and PERMINGEAT, F. (1969) L'agardite, une nouvelle espèce minérale, et le problème du chlorotile. *Bulletin de la Société francaise de Minéralogie et Cristallographie,* **92**, 420–434.

DUNN, P. J., and ROUSE, R. C. (1975) Wroewolfeite, a new copper sulphate hydroxide hydrate. *Mineralogical Magazine,* **40**, 1–5.

FEHR, T., and HOCHLEITNER, R. (1984) Agardite-La. Ein neues Mineral von Laurion, Griechenland. *Lapis,* **9**, 22 and 37.

PEACOR, D. R., and DUNN, P. J. (1982) Petersite, a REE and phosphate analog of mixite. *American Mineralogist,* **67**, 1039–1042.

PEACOR, D. R., DUNN, P. J., RAMIK, R. A., STURMAN, B. D., and ZEIHEN, L. G. (1985). Philipsburgite, a new copper zinc arsenate hydrate related to kipushite, from Montana. *Canadian Mineralogist,* **23**, 225–258.

PERCHIAZZI, N., and PREITE, D. (1986) Libethenite e vesuviana della miniera di Sa Duchessa (Ca). *Rivista Mineralogiaca Italiana,* **9**, 188–191.

PIRET, P., DELIENS, M., and PIRET-MEUNIER, J. (1985) Occurrence and crystal structure of kipushite, a new copper-zinc phosphate from Kipushi, Zaire. *Canadian Mineralogist,* **23**, 35–42.

PROCELLINI, G. (1983) La miniera di Sa Duchessa (Sardegna). *Rivista Mineralogica Italiana,* **8**, 26–29.

SARP, H., and BERTRAND, J. (1985) Gysinite, Pb(Nd,La)$(CO_3)_2(OH)\cdot H_2O$, a new lead, rare-earth carbonate from Shinkolobue, Shaba, Zaire and its relationships to ancylite. *American Mineralogist,* **70**, 1314–1317.

URAS, I. (1951) Studio sulla mineralizzazione della miniera di "Sa Duchessa." *Periodico di Mineralogia,* **20**, 117–134.

WILLIAMS, S. A. (1982) Theisite, a new mineral from Colorado. *Mineralogical Magazine,* **46**, 49–50.

WISE, W. (1978) Parnauite and goudeyite, two new copper arsenate minerals from the Majuba Hill Mine, Pershing County, Nevada. *American Mineralogist,* **63**, 704–708.

OSARIZAWAITE FROM THE SILVER HILL MINE ARIZONA

Craig S. Stolburg
3231 Woodmont Drive
San Jose, California 95118

INTRODUCTION

Osarizawaite was first described by Yasuro Taguchi before a meeting of the Mineralogical Society of Japan in 1961. The name osarizawaite originated from the Osarizawa mine, as well as the surrounding mining area. It occurs in a Miocene green tuff and siliceous shale complex. Within this complex many oxidized veins were found which contained osarizawaite. These veins are composed chiefly of anglesite and limonite with the following assemblage of secondary minerals: linarite, azurite, malachite, brochantite, chalcocite, covellite, sulfur, quartz (chalcedony), kaolinite and hydrous oxides of manganese.

The original osarizawaite was first encountered as a green powdery crust coating the surface of some of the previously mentioned minerals. Almost without exception, all of this material was either a compact mass or scattered grains showing a distinct hexagonal outline.

At about the same time as the Japanese discovery a second discovery was made, this one in Western Australia on Mt. Edgar Pastoral Station. The Australians recognized this as a new mineral and decided to name it after the Mt. Edgar locality. However, the Japanese name prevailed as the accepted mineral name. Unlike the occurrence in Japan the Australian material, pale green, friable aggregates of minute crystals, was found associated with barite and quartz while associated with a similar assemblage of linarite, "limonite," kaolinite, jarosite, cerussite and manganese oxides.

From 1961 to 1970 the two previously mentioned localities remained the sole sources for osarizawaite. In 1970 a specimen of osarizawaite was found as a green crust on sandstone at Alderley Edge, Cheshire, England (Embrey, 1978). Some four years later osarizawaite was reported from the Church Hills, Millard County, Utah, as a coating on quartzite breccia (Sayre, 1974). In February of 1973 a specimen of unknown composition was found by the author at the Silver Hill mine, Pima County, Arizona, and was subsequently analyzed in July, 1975, at the U.S. Geological Survey, Menlo Park, California; it was determined to be osarizawaite.

LOCATION

The Silver Hill mine is located in the Waterman Mountains approximately 56 km (35 miles) northeast of Tucson, Arizona, near the town of Silver Bell (Fig. 1). This area is part of the Sonoran Desert. The mine can be reached by negotiating a narrow road passable only with four-wheel drive.

GEOLOGY

The Waterman Mountains are the resistant remnants of formations uplifted as a result of high-angle thrust faults. The age of these rocks ranges from Precambrian through Cretaceous. The structural complexity of the Waterman Mountains resulted from intense stress and shearing during movement of the Paleozoic strata through the overlying Cretaceous beds (Ruff, 1952).

The main orebody of the Silver Hill mine is found between the lower Mississippian Escabrosa Limestone and the Lower Pennsylvanian Naco Limestone. During the Cretaceous and Tertiary periods the region was subjected to stresses which produced large, broad northwest-southeast folds. These folds, along with high-angle northwest-southeast faults, in turn created a suitable environment for the deposition of the ore-bearing solutions. These solutions probably entered the limestones and quartzites some time during the middle Tertiary period (McClymonds, 1952).

MINERALOGY

Osarizawaite is a lead copper aluminum sulfate having the formula $PbCuAl_2(SO_4)_2(OH)_6$ and is the aluminum analog of beaverite. It belongs to the alunite group (Taguchi, 1961; Cortellezzi, 1977) and crystallizes in the hexagonal system. Based upon the work done by Dr. Taguchi and by R. C. Morris (1962), the chemical and crystallographic structure of osarizawaite has been fairly well documented. Since the initial discoveries in Japan and Western Australia, numerous new localities have been found to contain osarizawaite. Like the original localities, all subsequent specimen material has been in the form of a greenish powder associated with a silica, clay and/or goethite matrix. The one exception has been a single small but well crystallized specimen from the Silver Hill mine in Pima County, Arizona (Fig. 3). This specimen was analyzed by Richard Erd of the U.S. Geological Survey in Menlo Park, California.

An analysis of this specimen was found to correspond to the X-ray pattern for osarizawaite, showing the following unit cell dimensions: $a_o = 7.02$Å, $c_o = 17.16$Å, Vol $= 722$Å^3. These measurements were made from a single crystal using X-ray precession photographic techniques. Analysis of the matrix material indicates quartz, goethite and kaolinite which closely follows what was found at both the Japanese and Australian localities, and to some degree some of the other reported locations.

The osarizawaite specimen was collected from a large stope on the main adit level about 77 meters from the portal. It was found loose in the debris at the bottom of this stope. The location has been further confirmed by recent finds of additional specimens by David Shannon in this same general area.

The primary ore minerals found at the Silver Hill mine were azurite and malachite. From what little information could be gathered on the mine, approximately 16,000 tons of high grade copper ore was mined before operations ceased (H. Courtwright, ASARCO, personal communication, 1975). A reasonable amount of zinc ore may have been

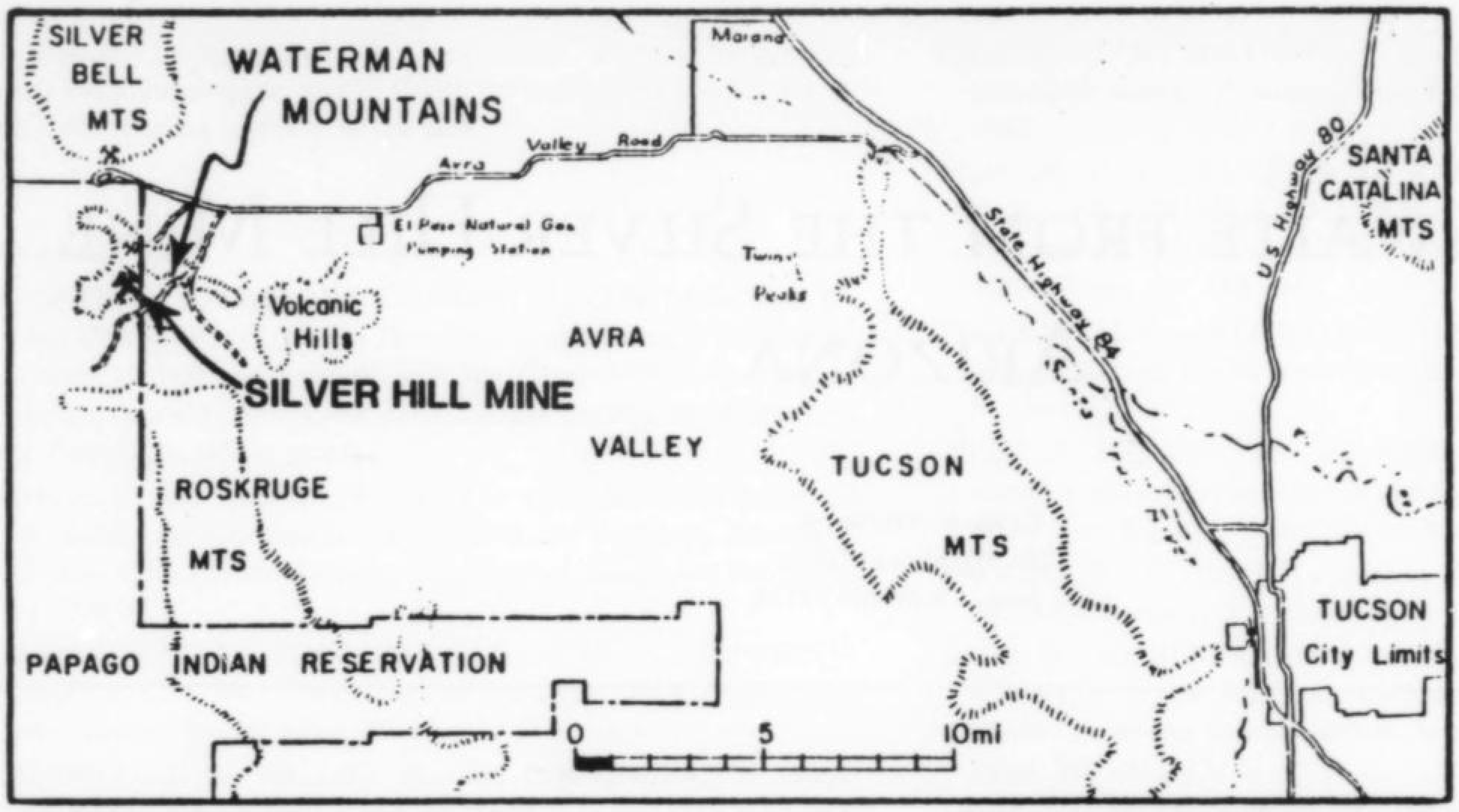


Figure 1. **Location map.**

Figure 2. **Ore bins at the Silver Hill mine.**

mined, judging from a large amount of smithsonite present in the waste pile and in pockets within the mine.

In addition to the minerals already described there are a number of others which form part of the occurrence, including:

Aurichalcite	$(Zn,Cu)_5(CO_3)_2(OH)_6$
Brochantite	$Cu_4(SO_4)(OH)_6$
Calcite	$CaCO_3$
Galena	PbS
Murdochite	$PbCu_6O_{8-x}(Cl,Br)_{2x}$
Plattnerite	PbO_2
Rosasite	$(Cu,Zn)_2(CO_3)(OH)_2$
Willemite	Zn_2SiO_4

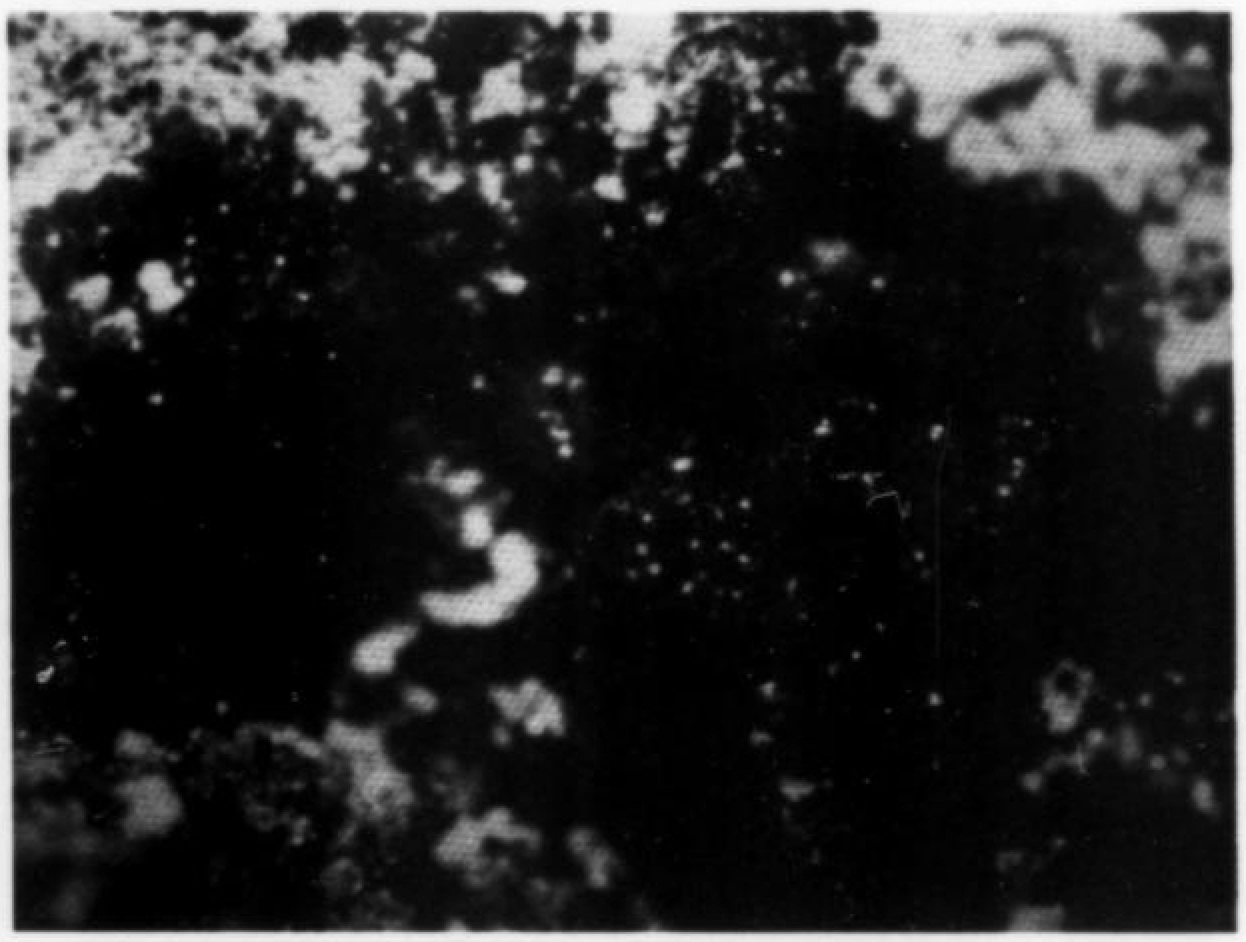


Figure 3. **Osarizawaite, Silver Hill mine.**

Most of the minerals found at the Silver Hill mine are massive in nature, however there are exceptions, the most notable being specimens of aurichalcite and malachite. These can be found in spectacular specimens ranging in size from micromounts to small cabinet pieces.

CONCLUSION

Osarizawaite has most likely been overlooked in Arizona as well as in other parts of the world, however, with new finds being reported at the Tui mine, New Zealand, 1975; Ortiz mine, Argentina, 1977; Whim Creek, Western Australia, 1980; Sierra Gorda, Chile, 1980; Bisbee, Arizona, 1981; and an unconfirmed new find at the Omega mine, Pima County, Arizona, 1986, one can only assume more localities will be discovered in the future.

ACKNOWLEDGMENTS

I would like to especially thank Dick Erd for first identifying the osarizawaite and secondly for reviewing the manuscript for this article. Special thanks to Dave Dozer for taking the mineral specimen photo and finally to David Shannon for information on where he found his osarizawaite specimens. Additional thanks to Dick Thomssen for his review of the manuscript and his helpful suggestions.

BIBLIOGRAPHY

ANSIN, R. L. (1975) Minerals of the Tui mine, New Zealand. *Mineralogical Record*, **6**, 26–31.

ANTHONY, J. W., WILLIAMS, S. A., and BIDEAUX, R. A. (1982) *Supplement (1982) to Mineralogy of Arizona*. Tucson, Univ. of Arizona Press, 260–261.

CORTELEZZI, C. R. (1977) Occurrence of osarizawaite in Argentina. *Neues Jahrbuch Mineralogie, Monatshefte* **1977**, 39–44.

EMBREY, P. G. (1978) Fourth supplementary list of British minerals. *Mineralogical Magazine*, **42**, 169–177.

GUISEPPETTI, G., and TADINI, C. (1980) The crystal structure of osarizawaite. *Neues Jahrbuch Mineralogie, Monatshefte* **1980**, 401–407.

GRAEME, R. W. (1981) Famous mineral localities: Bisbee, Arizona. *Mineralogical Record*, **12**, 259–319.

JAMBOR, J. L., and DUTRIZAC, J. E. (1983) Beaverite-plumbojarosite solid solutions. *Canadian Mineralogist*, **21**, 101–113.

McCLYMONDS, N. E. (1952) Stratigraphy and structure of the southern portion of the Waterman Mountains, Pima County, Arizona. MS Thesis, University of Arizona, 157 p.

MORRIS, R. C. (1962) Osarizawaite from Western Australia. *American Mineralogist*, **47**, 1079–1093.

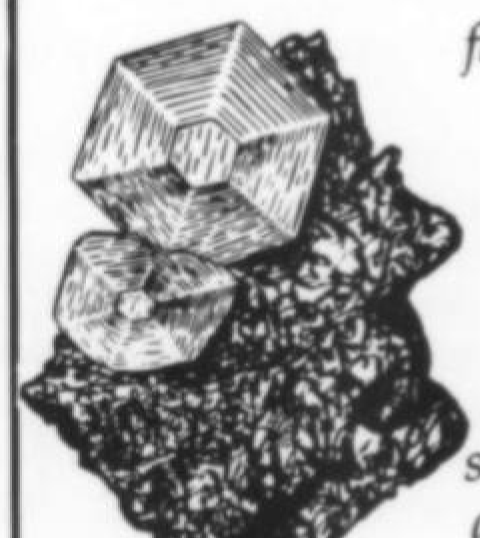
NICKEL, E. H. (1980) Ring crystals of osarizawaite from Whim Creek, Western Australia. *American Mineralogist*, **65**, 1287–1290.

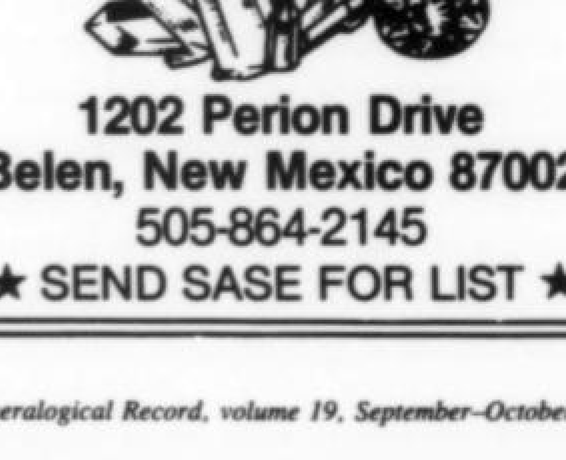
PAAR, W. H., BURGSTALLER, J., and CHEN, T. T. (1980) Osarizawaite-beaverite intergrowths from Sierra Gorda, Child. *Mineralogical Record*, **11**, 101–104.

RUFF, A. W. (1952) The geology and ore deposits of the Indiana mine area, Pima County, Arizona. MS Thesis, University of Arizona, 64 p.

SAYRE, R. L. (1974) Geology and mineralization of the Church Hills, Millard County, Utah. *Utah Geological and Mineral Survey, Special Studies*, **47**, 1–22.

TAGUCHI, Y. (1961) On osarizawaite, a new mineral of the alunite group, from the Osarizawa mine, Japan. *Mineralogical Journal*, **3**, 181–194.





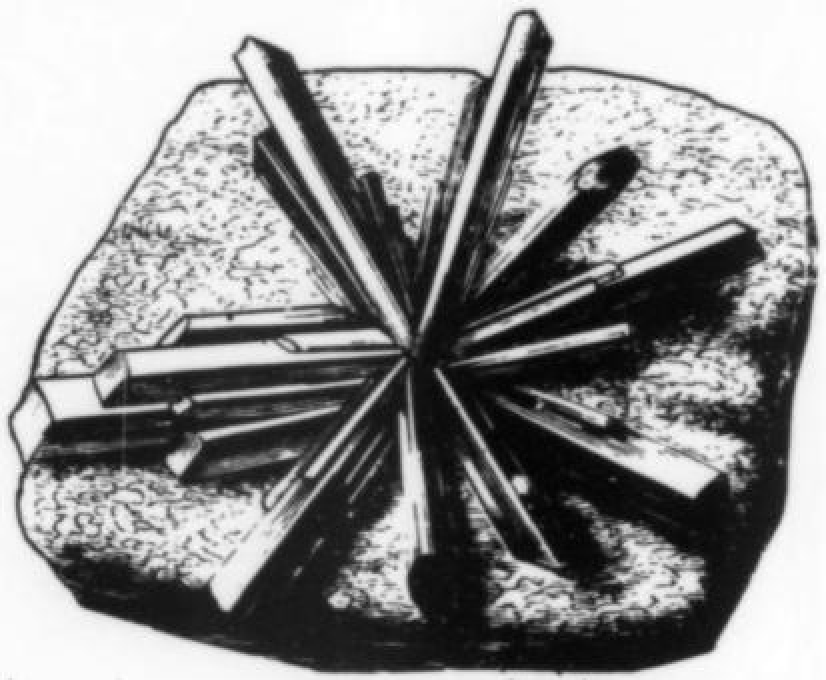
Mineralogical Record

Show Schedule

Dates subject to change and error. Confirm before travelling.

Sept. 16-18	Denver, CO
Sept. 24-25	The Hague, Neth.
Sept.	Houston, TX
Oct. 9	Brend, Neth.
Oct.	Franklin, NJ
Oct. 7-9	Torino, Italy
Oct. 8-9	Pasadena, CA
Oct. 14-16	Detroit, MI
Oct. 14-16	Munich
Oct. 28-30	Rhode Island
Oct. 31- Nov. 3	GSA – Denver TBA
Nov. 5	Zwijndrecht, Neth.
Dec. 4	Amsterdam, Neth.
Dec.	Hotel Pullman, Paris

MAGAZINES! *See Us There!* BOOKS!



A NOTABLE PROBERTITE FIND AT BORON, CALIFORNIA

James Minette
Mine Manager
U.S. Borax
Boron, California 93516

INTRODUCTION

A significant find of clusters of long radial crystals of probertite in shale was made in March, 1987, at the Boron, California, open pit mine of the U.S. Borax Company. The find, in the footwall calcium borate zone, has provided the most aesthetic specimens of the mineral ever found.

GEOLOGY

The Boron open pit and earlier underground mines of U.S. Borax exploit the huge Kramer borate deposit in eastern Kern County, California. The main ore zone is an east-west trending sodium borate (borax and kernite) lens measuring roughly 1 by 3 km with a maximum thickness of 100 meters.

The deposit was formed from hot springs about 18 million years ago in the middle Miocene (Barnard and Kistler, 1965; Whistler, 1965). Borax crystallized out in a playa lake formed on the downward dropping side of an active fault. The lens is made up of layers of borax of varying richness, alternating with lakebed clays, and minor tuff beds. The borax is surrounded by a halo of green lakebed shales and a calcium borate facies, primarily ulexite.

Post-depositional faulting and folding of the orebody continued until about a million years ago, resulting in major distortion and a general dip to the south. The entire lakebed system was buried by typical arkosic desert alluvium. The deepest ores today lie some 350 meters below the surface, but there is an indication that burial could have been as deep as 600 meters at one time.

The portions of the original orebody subjected to deepest burial underwent low-grade metamorphism to kernite through loss of water (Borax, $Na_2B_4O_7 \cdot 10H_2O \rightarrow$ Kernite, $Na_2B_4O_7 \cdot 4H_2O + 6H_2O$).

The result is that current mining is directed toward both minerals, the stratigraphically and structurally higher borax zone and the deeper kernite zone. The two ores must be processed separately.

PREVIOUSLY DESCRIBED PROBERTITE OCCURRENCES

Probertite, $NaCaB_5O_7 \cdot 5H_2O$, was first described in 1929 from specimens found embedded in kernite in the old underground Baker mine at the eastern end of the Kramer district (Eakle, 1929; Schaller, 1930). It proved to be a widespread but minor (less than 0.5%) constituent of the kernite ores. More recently, probertite was found to be common in the footwall calcium borate facies below areas altered to kernite.

Several other localities in Inyo County, California, have also yielded probertite, mostly in the Death Valley area. Notable occurrences are the Boraxo pit (formerly the Thompson mine) and the Billie mine. These occurrences consist of masses of intimately intergrown probertite crystals, constituting a major ore mineral in both deposits.

Extensive observation indicates that probertite forms in at least three ways. The most important volumetrically is through low-grade metamorphism of ulexite. This is obvious in the Boraxo and Billie mines and the Boron footwall zone where ulexite beds give way to probertite at depth. Metamorphism through pressure and slightly elevated temperature causes loss of water (Ulexite, $NaCaB_5O_9 \cdot 8H_2O \rightarrow$ Probertite, $NaCaB_5O_9 \cdot 5H_2O + 3H_2O$) (Morgan and Erd, 1969). Apparently the temperature and pressure conditions to drive the reaction are very close, if not identical, to those needed for the borax-to-kernite transition.

The formation process was decidedly different in the kernite-zone probertite, as no ulexite of any significance existed in the unaltered borax zones before metamorphism. The most likely scenario is that the water driven off the borax (containing dissolved borax) reacted with calcium in the minor dolomite and/or saponite/hectorite clays to form probertite. Much work needs to be done on this problem.

A third manner of formation has been observed in seasonal surface deposits in Death Valley. Extreme temperatures found there have apparently dehydrated surface ulexite to probertite in microcrystals (R. C. Erd, personal communication). It is interesting to note that kernite has been found in the same environment. Surface rock temperatures in Death Valley reach the 200°F range. It is obvious in this occurrence that high temperature alone, and not pressure, drives the reaction.

From the collector's view, one point was obvious: none of the prior known occurrences produced good display specimens. The Death Valley ores contain massive intergrown rosettes to 12 cm or more. The Boron specimens are imbedded in very hard shales or kernite and cannot be successfully removed. A couple of 3-cm sprays were found in borax formed from rehydrated kernite pods. These were partially exposed with moderate success by dissolving the borax with cold water. Other than this, display-quality probertite has been essentially unknown.

1987 DISCOVERY

One area being mined at Boron in March of 1987 was a deep trough of ore between two fault zones in Extension 18. The ore dips steeply to the east from the Central Jenifer fault zone and was bounded on the east by the nearly vertical East Jenifer fault. Within this north-south fault trough, the borax ore dips gradually to the south where the deepest borax ores give way to kernite. Final borax mining on the footwall of the northern end exposed small pockets of water on the footwall which hampered mining with rubber-tired equipment.

A small sump, 5 by 7 meters across and 3 meters deep, was dug in the footwall calcium borate zone to catch the water. Excellent golden

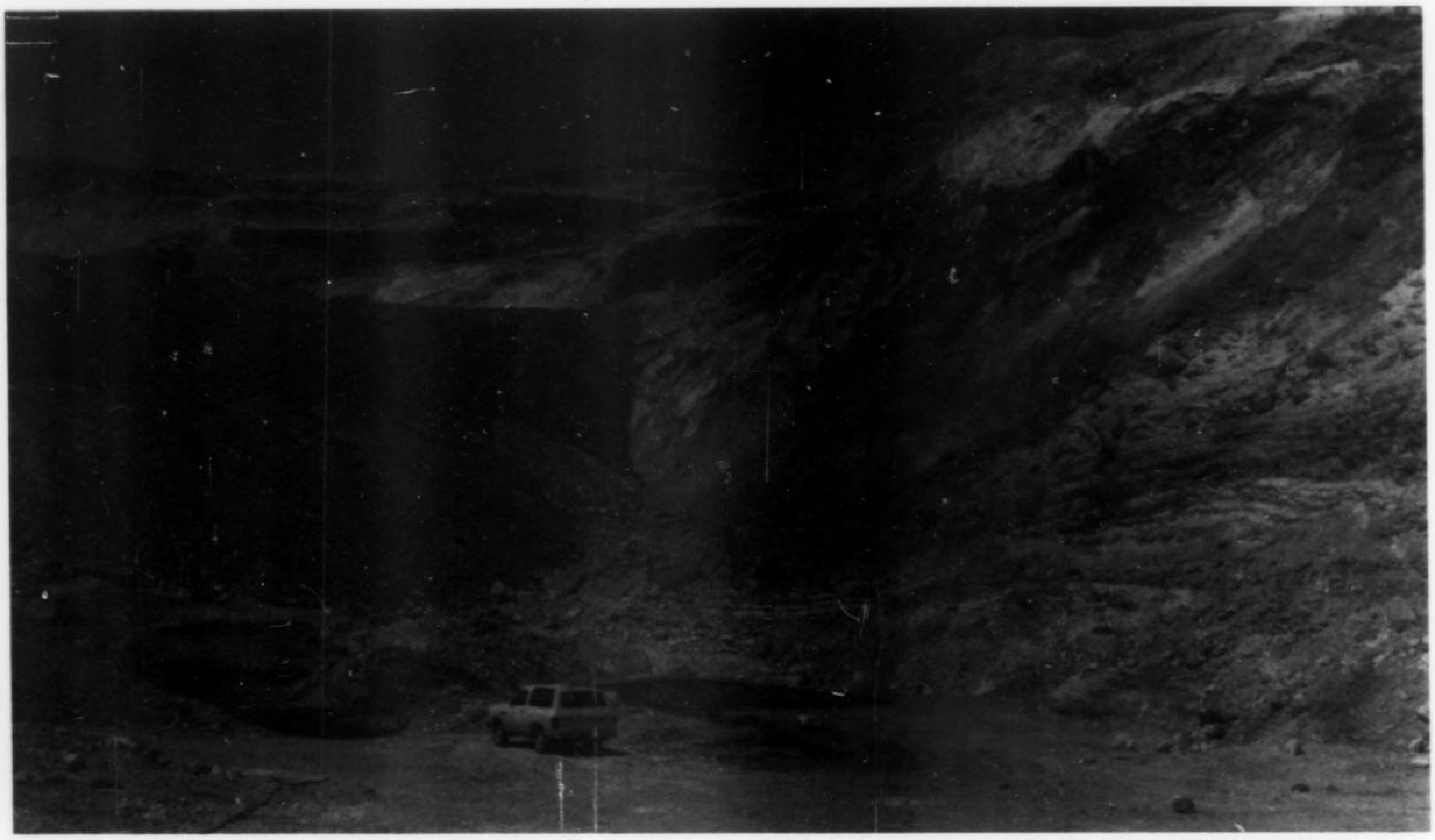


Figure 1. **Looking north in Extension 18, Boron open pit. East Jenifer fault plant on right, probertite-bearing sump to left of vehicle.**

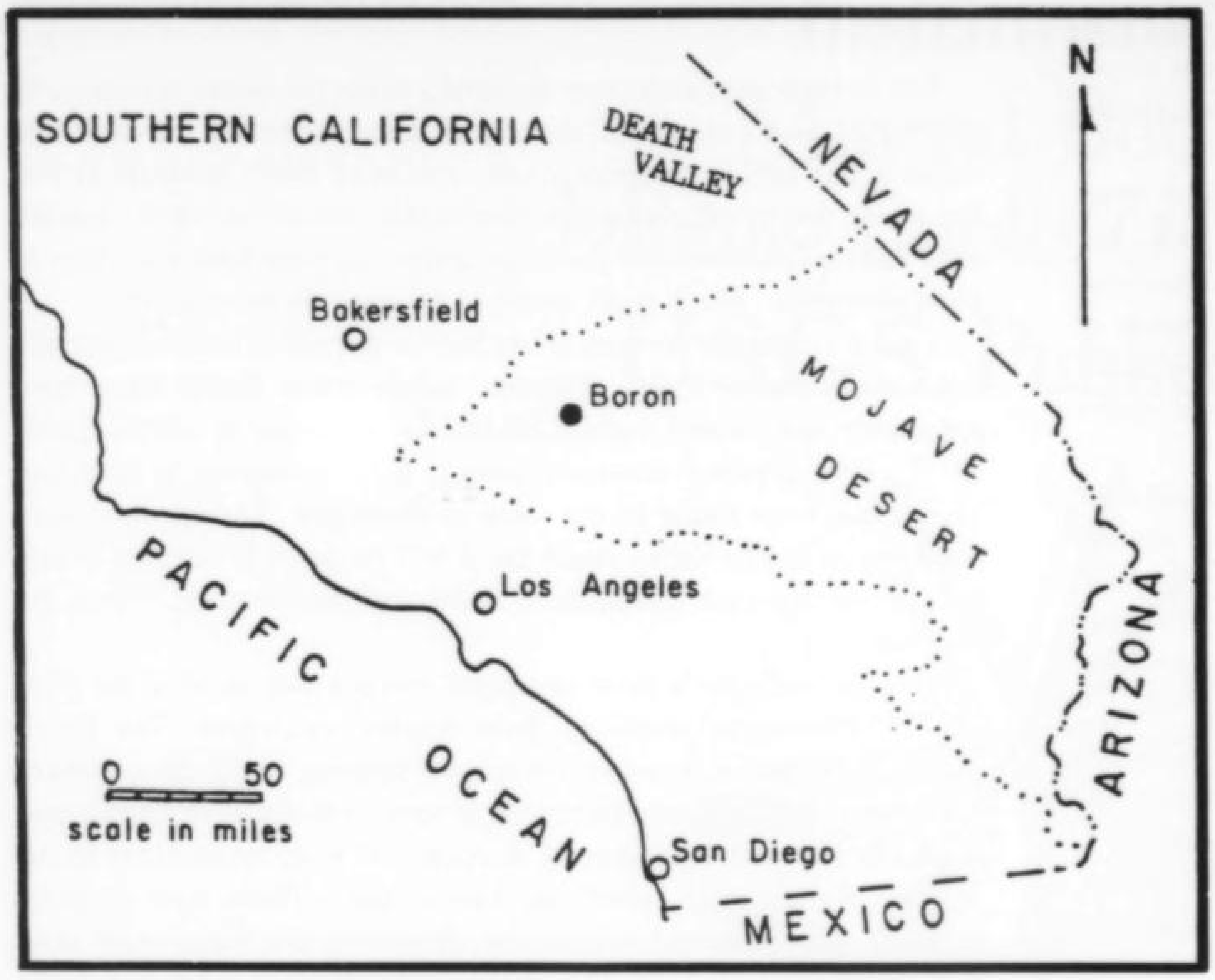


Figure 2. **Location map.**

colored ulexite* was noted in the excavated pile. The following weekend the author and his wife, Dawn Minette, collected some of this material; included were some radiating coarse needles in green shales. More importantly, the shale was just soft enough that cleaning the specimens was possible.

Probertite was suspected, so a sample was immediately taken to Vince Morgan, a retired Senior Scientist with U.S. Borax and a world expert in borate mineralogy. He confirmed optically that it was probertite.

Inspection of the sump walls showed a lens of probertite-bearing shale up to 1 meter thick which pinched out after a short distance to the north and east. Its extent to the south is unknown, as it passed into the wall and floor of the sump.

A few notes on the origin of this probertite lens are in order. It was found at the bottom of a roll between two faults. There is more moisture in the area than is normally seen in footwall clays, so they are softer and more amenable to large crystal growth.

It is possible that some of the moisture was derived from the ulexite-to-probertite alteration. However, a lack of soft clays in all other probertite areas indicates the water was more likely from an outside source. The fact that ulexite was found both above and below the lens is anomalous. However, the underlying ulexite veins are of the fiber-

---

*Known locally and among rockhounds as "television stone" or "T.V. rock" due to its fiber-optic qualities when polished.

Figure 3. **Probertite-bearing lens, Extension 18, Boron open pit.**

Figure 4. **An 11-cm fan of probertite crystals. Vince Morgan photo; author's collection.**

optic variety. This is considered a secondary growth, probably in cracks opening up related to the fault system. It is most likely a post-probertite formation.

The probertite lens was found about a hundred meters north of the main kernite orebody. However, one lone pod of kernite (altering back to borax) was noticed just above the footwall in the sump area. This indicates that at the time of formation, temperature and pressure conditions were just barely high enough for both kernite and probertite to form. Later uplift favored borax and ulexite, hence the secondary borax rim around the kernite pod, and ulexite below the probertite. It may also be possible that the fault zone itself produced abnormally high local pressure-temperature conditions that were later reduced.

Several boxes of the probertite-bearing shale were collected for cleaning, yielding about 20 flats of specimens showing several growth habits. All specimens are of radiating habit, showing the same simple crystal forms described in the original 1929 description. The habit of the aggregate varies as noted below.

The commonest aggregate habit consists of sprays wherein the crystal terminations coalesce into rounded, warty, semi-botryoidal shapes These give rise to some rather grotesque looking groups up to 25 cm across.

The second commonest aggregate habit consists of radiating fans and hollow horn-shaped groups with the outside showing individual crystals and the inner side having more of a rough botryoidal surface. Many of these fans and horns are quite aesthetic. Individual sprays reach 11 cm in size, with complex groups measuring over 30 cm tall.

A third aggregate habit consists of relatively long *en echelon* rows of overlapping fans. The largest of these reaches 25 cm.

The fourth, and least common aggregate habit consists of radiating sprays of individual crystals, with individual terminations. Only a

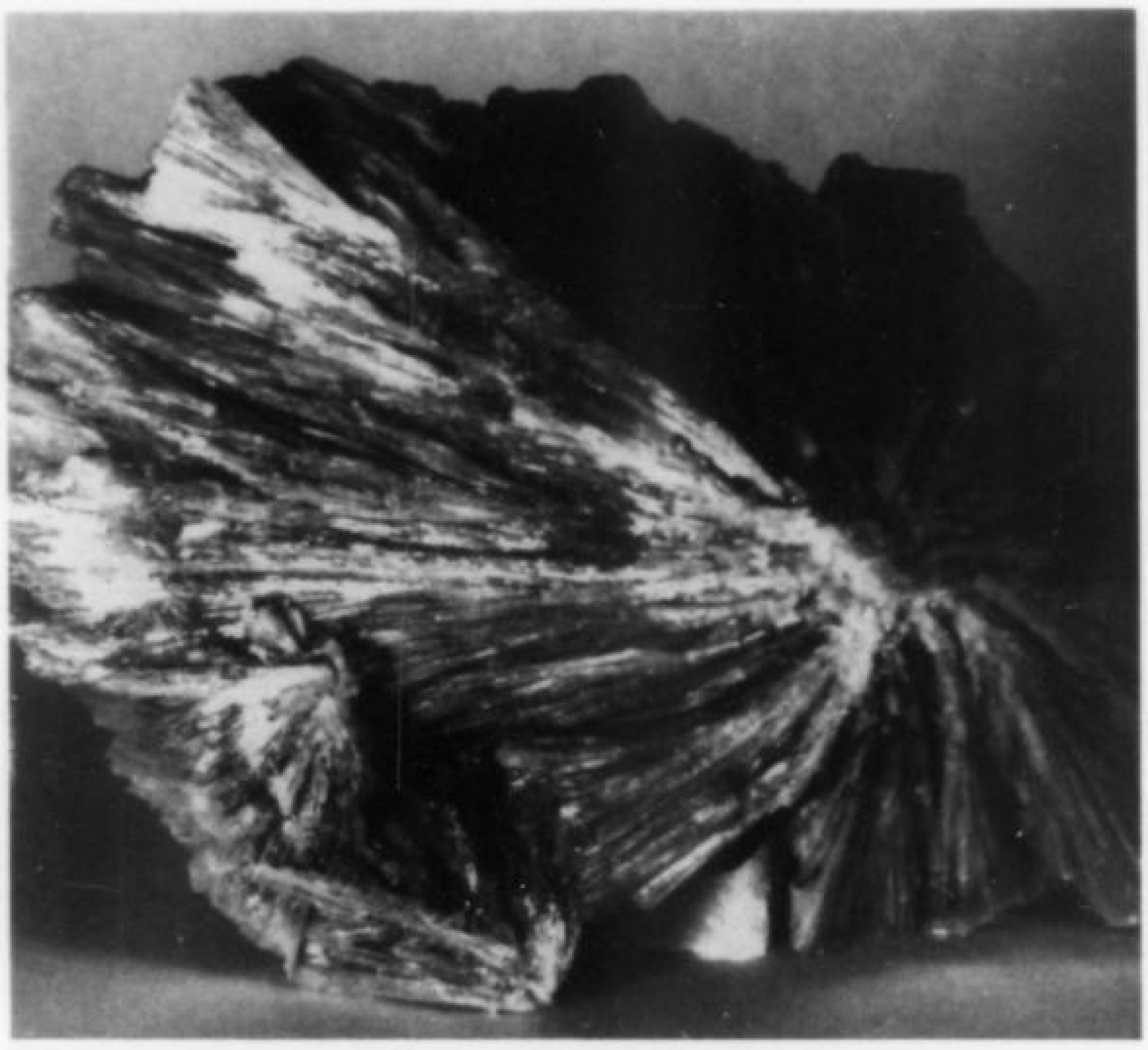


Figure 5. **Radial group of probertite crystals, 12 cm across, hollow on the back side. Vince Morgan photo; author's collection.**

handful of these survived cleaning because they are very fragile. Individual crystals reach 4 cm long by 2 mm wide.

None of the above habits have sharp terminations; all are quite rounded, even the individual crystals. A fifth habit (only two specimens found) has sharp terminations. Both specimens were in small open pockets (no clay) with free-growing crystals to 1 cm long by 1 mm thick and sharp, brilliant, dome terminations.

Color of most specimens varies from black to gray due to mud inclusions. A few are gray-tan and translucent where mud is less noticeable. Color cannot be considered a strong aesthetic feature of this mineral.

SPECIMEN PREPARATION

Preparation and preservation of the specimens was crucial in this dig; they were almost unrecognizable as good specimens when found. Considerable experimentation was done before the best technique for shale removal was found. Long soaking in water weakened the specimens and they simply fell apart. No soaking at all, just picking with dental tools and needles, proved partially successful, but was limited due to local spots of hard clay in most specimens.

Short soaking in water, from 15 minutes to an hour, followed by repeated cycles of rinsing and dental tool picking proved the best. After several cycles, noticeable weakening of the specimens becomes evident. Deciding when this point has been reached is a judgment call based on experience. When the weakness point was observed, the specimens were dried and lightly sprayed with a clear acrylic or similar clear spray paint. This spray gave just enough bonding to the already cleaned areas that the last deep crevice cleaning could be done safely. Several great cabinet specimens became nice miniatures before this lesson was learned. Several specimens, particularly larger ones, required some repair work. Preparation of the probertite was much like that required for fossils.

PROGNOSIS

The sump gradually flooded so that by June collecting was impossible; later back-filling with calcium borate-bearing clays from the hanging wall has buried the area under 35 meters of fill. Very long-term mining plans envision use of the calcium borates as ore once the great sodium borate body is exhausted, in 50 years or so. At that time the pod might be exposed again, but for now, at least, this find stands as the best yet for probertite.

ACKNOWLEDGMENTS

Special thanks must go to the author's wife, Dawn Minette, for spotting an unusual and collectible mineral and for specimen preparation. Vince Morgan aided immeasurably with critical review of the manuscript, mineral identification, and many hours of discussion on the origin and history of the mineral. Vince also supplied the photos used in this article.

REFERENCES

BARNARD, R., and KISTLER, R. B. (1965) *Second Symposium on Salt.* 133–150.

EAKLE, A. S. (1929) Probertite, a new borate. *American Mineralogist,* **14**, 427–430.

MORGAN, V., and ERD, R. C. (1969) Minerals of the Kramer borate district, California. *Mineral Information Service,* **22**, no. 10, 167.

SCHALLER, W. T. (1930) Borate minerals from the Kramer district, Mohave Desert, California. *U.S. Geological Survey Professional Paper* **158-I**, 137.

WHISTLER, D. P. (1965) A new Hemmingfordian (Middle Miocene) mammalian fauna from Boron, California, and its stratigraphic implications within the Western Mojave Desert. *Program Abstracts, Fifth Annual Graduate Symposium in the Geological Sciences,* Univ. of California, Riverside.

The Commission on

NEW MINERALS AND MINERAL NAMES

of the International Mineralogical Association;
Its history, purpose and general practice

Pete J. Dunn[1]
Department of Mineral Sciences
Smithsonian Institution
Washington, D.C. 20560

Joseph A. Mandarino[2]
Department of Mineralogy
Royal Ontario Museum
Toronto, Ontario, Canada M5S 2C6
and
Department of Geology
University of Toronto
Toronto, Ontario, Canada M5S 1A1

Introduction

This paper was prepared at the request of the editor of *The Mineralogical Record* to inform the collector community of the history, purpose, and general practices of the Commission on New Minerals and Mineral Names of the International Mineralogical Association. This Commission periodically publishes *Rules of Procedure* for professional mineralogists (Nickel and Mandarino, 1987). The Commission also plays a critical yet unseen role in collectors' activities, in deciding what is a valid new mineral and what is not, in redefinitions, revalidations and discreditations of mineral species, and the occasional changes in mineral nomenclature.

The IMA and its Commissions

The International Mineralogical Association (hereafter referred to as IMA) is an association composed of the professional mineralogical societies of all interested nations. The IMA meets every four years in various countries (the 1986 meeting was in the USA; the 1990 meeting will be in China). At these quadrennial meetings, the formal business of the IMA is tended to, executive actions are ratified, and official plans are made for activities over the next four years. Additionally, the IMA meeting is a sharply focused gathering of professional mineralogists and petrologists, comprising a very busy, intensive, one-week, international dialogue in all the active fields of mineralogical and petrological research. It is, in a sense, a super-meeting, where nearly all attendees are mineralogists, and all lectures, symposia, poster sessions and presented papers are focused on mineralogy, rather than generally on all of geology as is the case at most professional meetings of national societies. In fact, the administrative activities of the IMA are only a small part of the overall agenda.

Although a quadrennial meeting serves the needs for personal contact and administrative functions, the science of mineralogy is a dynamic one! New developments are constantly arising, presenting new challenges and requiring solutions to their attendant problems. Hence, the IMA needs to have standing and active Commissions which will tend to their specialities on a regular basis. A Commission is a group of scientists, each chosen to represent his or her country's national society in the relevant specialty. There are a number of such Commissions, such as the Commission on New Minerals and Mineral Names, the Commission on Ore Mineralogy, the Commission on Museums, and many more. Each Commission has its own internal procedures, and meets at intervals it deems necessary to conduct its business effectively. Some Commissions have interaction among all their members only every few years, some annually, some irregularly. The Commission on New Minerals and Mineral Names (hereafter the Commission), by far the most active of all these Commissions, acts formally at least once a month. Members receive material from the chairman every month and from the vice-chairman almost every month. In addition, the secretary sends matters for consideration about six times per year.

Mineral Nomenclature Prior to the Creation of the Commission

Prior to the formation of the IMA, much chaos reigned in the mineralogical literature. The second edition of An Index of Mineral

---

[1] United States member, Commission on New Minerals and Mineral Names, IMA.

[2] Chairman, Commission on New Minerals and Mineral Names, IMA.

Species and Varieties Arranged Chemically by Hey (1955) contains approximately 25,000 entries, but only about 2000 of these could be assigned to valid species. Various national mineralogical societies have attempted to clarify the nomenclature, but these attempts were not very successful because they were done on a national rather than an international level. In choosing between two names for the same mineral, it is easy to lose one's objectivity by preferring the "home-grown" or familiar name instead of the "foreign" one. Nevertheless, there were some valiant attempts at solutions to the many problems. For example, the Mineralogical Society of America (MSA) appointed a nomenclature committee which subsequently published two reports (*American Mineralogist*, **8**, 50–52 (1923) and *American Mineralogist*, **9**, 60–63 (1924)).

Some years later, a joint United States–United Kingdom committee was formed and reached some agreements. Although these were approved subsequently by the MSA (*American Mineralogist*, **21**, 188–191 (1936)), the U.K. society (The Mineralogical Society) did not approve them. Interestingly enough, many years later, the IMA, through its Commission on New Minerals and Mineral Names (CNMMN), approved almost all the recommendations of that early joint committee, and went on to reach agreement on more than forty such problems. However, the multiple-name problem for some valid minerals still exists. Some are probably not solvable because of variations in language structures, but it is to be hoped that progress will continue in resolving the existing problems. Just recently the Commission has cleared up some of these problems, and has decided in favor of allanite instead of orthite, in favor of talmessite over belovite, and in favor of vesuvianite over idocrase. A complete list is given by Nickel and Mandarino (1987).

Dr. Michael Fleischer (1951 and 1961) published the results of his judgment on the validity of new minerals published during the 20-year period just prior to the formation of the IMA. He concluded that of the 583 proposed new names, 106 presented minerals which were identical with known minerals, 97 were just varieties, and 69 were based on insufficient data. Thus, of the 583 new names, 311 were considered valid new species by Fleischer. This rather low validity value of 53.5% is, in itself, an excellent justification for establishing an international body to screen new mineral proposals. Fleischer (personal communication, 1987) estimates that if the Commission had not screened descriptions and proposals, there might have been many hundreds of invalid and unnecessary names published in the last 25 years.

The History of the Commission on New Minerals and Mineral Names

By 1957, there were stirrings of a recognized need for some international controls concerning new minerals and nomenclature. The IMA was formed in 1959, with Professor Robert Parker of Zurich as its first president. The Commission on New Minerals and Mineral Names held its first meeting at the joint International Geological Congress/International Mineralogical Association (IGC/IMA) meeting in 1960 in Copenhagen. The officers of this Commission were Dr. Michael Fleischer (U.S.A.) (chairman), Dr. Max H. Hey (U.K.) (vice-chairman), and Dr. Francois Permingeat (France) (secretary). The first rules and procedures of the Commission were established at this meeting. The next meeting of the Commission was in 1962 at the IMA meeting in Washington, D.C.; the members met in the Smithsonian Institution, and voted in person on some proposed new minerals. Roquesite, $CuInS_2$, was the first IMA-approved species. Shortly thereafter, the Commission started conducting its affairs by formal written vote, using regular postal services. In the beginning, there were many rejections of new minerals by the Commission until, gradually, the standards which must be met for approval became well known. These have been published several times since then, and the most recent version is given by Nickel and Mandarino (1987) and Mandarino (1987). Dr. Fleischer served as Chairman for 15 years, and was succeeded by Dr. Akira Kato of Japan, who served 8 years, until 1983.

The Structure of the Commission on New Minerals and Mineral Names

The Commission is led by three officers: the chairman, vice-chairman and secretary, all of whom have significant and demanding responsibilities. They are nominated to office by Commission members, and then installed by vote of the official delegates to the quadrennial IMA meeting. Although they are non-voting members of the Commission, they frequently comment on various proposals.

The chairman handles all new mineral proposals, and also functions as the chief executive in administrative matters. The present chairman is Dr. Joseph A. Mandarino of the Royal Ontario Museum in Toronto, Canada. He has served since January of 1983.

The vice-chairman handles all proposals for discreditations, redefinitions, revalidations, nomenclature changes, and some administrative duties. The present vice-chairman is Dr. Ernest H. Nickel of the CSIRO in Wembley, Australia. He has served since July of 1984.

The secretary handles all proposals for mineral groups, oversees the special subcommittees of the Commission, and functions as the administrative arm of the Commission. The present secretary is Dr. Charles E. S. Arps, of the National Museum of Geology and Mineralogy, in Leiden, The Netherlands. He has served since July of 1986.

The voting members of the Commission are appointed, one from each country, by their national societies or associations, and are chosen because of their substantial expertise in the species aspects of mineralogy, systematics, nomenclature and various specialties. There are presently 22 voting members of the Commission.

The Work of the Commission

The growth in the number of mineral species has been enormous; of the roughly 3300 published mineral species, about half have been described in the last 25 years, an average of 66 per year. Compare this to the 1940–1950 period when 164 new names were proposed, but only 77 were valid species (Fleischer, 1951), averaging approximately 8 per year, and the comparison is vivid, being an eightfold difference! Recent compilations were given by Dunn (1978) and Dunn and Ferraiolo (1983) in the *Mineralogical Record*. Largely due to technological advances which permit scientists to work on tiny crystals, the number of new minerals continues to increase, as shown by Skinner and Skinner (1980). The number of new species approved each year presently varies between 55 and 80. Although an even greater number are considered, not all are approved. There were some years in the early 1980's during which over 100 proposals per year were considered. In the database of one of the authors (J.A.M.), as of 29 July 1987, there were 3242 valid published species. The Commission approved 1136 of these since 1962. This represents 35.04% of the mineral kingdom and very dramatically points out how much the Commission has done in just 25 years.

The review of a proposed new mineral is a controlled and disciplined one, requiring that certain standards be met, and that the proposers convince their peers of the correctness of their arguments, in advance of publication of a new name. The Commission serves as a referee of sorts, its members functioning as judges of all new minerals and their names. The review process is intended to be a critical one, and all members are urged to be very frank and complete in their criticisms. The passage of a mineral proposal through the Commission is akin, in a sense, to the running of a gauntlet; ideally only the best proposals survive.

All members are asked to evaluate all new mineral proposals and vote on them on a monthly basis. Unlike other Commissions, the Commission on New Minerals and Mineral Names conducts *all* of its business *formally*, in writing. In addition, separate written procedures are used for discreditations, redefinitions, revalidations, nomenclature changes, and administrative matters, and these require another 15–20 votes per year. The responsibility demands much time and effort from each member.

The work of the Commission is largely defined by the investigating scientists who submit proposals. Less commonly, an officer or a member may initiate a proposal to be voted on by the members. These usually are suggestions for procedural and/or administrative changes in the way the Commission works. However, the bulk of the Commission's work is in response to externally generated proposals.

This distinction is made here because some collectors are misinformed; they think that the solution to all problems which exist with old or incompletely described species, or nomenclature, is the Commission's responsibility, when in fact this is not so. Most of the problems which exist in the definitions of already published minerals have evolved over a long period of time, and it will take a long time to solve them all. What is needed, in almost every case, is an investigation of type material by a competent scientist willing to pursue the matter, submit his conclusions for approval, and then publish his results. The Commission's role is to judge the merits and results of the investigation, and the conclusions reached, *prior* to publication.

New Mineral Species

All proposals, as defined above, are submitted by scientists to the responsible officer. We here consider, as an example, a new mineral proposal.

The chairman, upon receiving a proposal for a new mineral species, reads the proposal and evaluates it for completeness. The information which should have been supplied was listed by Mandarino (1986, 1987), and previously by Fleischer (1970) and Donnay and Fleischer (1970). A guide for collectors was given by Dunn (1977). We present on the following page a flow-chart showing the processing of a new mineral proposal.

If the proposal is clearly incomplete, lacking critical data, it is returned to the author(s) for additional work. If it is reasonably complete, it is logged in, granting a priority for the author(s) for this species. Should the mineral be subsequently discovered by other scientists, the first logged-in proposal has priority. In the few cases where a mineral was previously described, but not named, the previous author(s) has no priority.

Very few proposals are complete in all details, and the chairman usually corresponds with the authors about missing details, or asks for more data. He may also consult with outside experts. The chairman also considers the proposed mineral name, and may suggest that the authors consider the nomenclature guidelines of the Commission (Nickel and Mandarino, 1987). If the chairman is not satisfied with the proposal, the author of the proposal can insist that it be voted on anyway; in such cases, the chairman usually appends his own opinion of the proposal. After this interaction has taken place, the chairman prepares a formal abstract of the mineral. In addition to the data, there may be supporting arguments from the authors, and comments from the chairman. This abstract is sent to the voting and non-voting members of the Commission for their consideration; all are encouraged to vote and to comment in detail. In the case of proposed new "ore minerals," abstracts are also sent to advisors belonging to the Commission on Ore Mineralogy (COM) for their opinion. Additionally, proposals for new minerals belonging to specific mineral groups for which the Commission has special subcommittees are sent to them *prior* to consideration and voting by Commission members. The voting members then consider the proposal together with the review comments of the advisory subcommittee.

The Commission's formal rule is that all information concerning a proposal of a new mineral is confidential. This includes all data, mineral names, names of authors, the fact that it has been considered, or is being considered, and the status of any proposal (approved, disapproved, suspended, etc.). The abstract itself, personally prepared by the chairman, is a document that is the *property of the Commission*; it is not to be distributed by the authors, either before or after approval. Although not always well understood, there are very good reasons for such confidentiality, and a few of these are given here. A mineral name should not be used, at all, until it is a valid one; *any* other usage can create confusion, not understanding. The right of publication or verbal announcement of *approved* mineral species is entirely the right of the scientist who has submitted the proposal. The process of critique and evaluation of a proposal may convince an investigator to change his initial interpretation. Prudent and experienced scientists, who will delay the release of critical data until it is approved, have the right to presume it will not be prematurely disclosed. In some instances, strong critique can convince a writer to withdraw the proposal entirely, even after approval. Also, the discovery of additional samples may permit the scientist to obtain better data, perhaps invalidating part of the original proposal. Most importantly, for the most fully frank and open discussion and strong critique to take place, it must be in an environment wherein the possibility of embarrassment is limited. In short, the submission of the proposal, and the information contained within it, are proprietary matters for the investigating scientist(s), until approval, and then until his subsequent decision to release partial or entire information on the species.

When the members of the Commission receive the proposals, they evaluate them critically. In addition to the scientific data and argument, they evaluate relations to known or unnamed species, evaluate the proposed name for appropriateness or problems, and really try to be of assistance to the proposer. Sometimes a Commission member will have additional data, or insights, which can be provided to the investigator. Commission members may solicit confidential reviews by experts of their choice. Approximately two months are permitted for this evaluation and voting process. When their evaluation is completed, the voting members cast ballots in which they may approve or disapprove the mineral, or abstain from voting. Simultaneously, and separately, they also vote on the proposed name. The ballots are returned to the chairman.

The chairman tallies the voting at the end of the deadline for voting. Sometimes, especially near holidays when postal delays are common, he may have to wait a little longer until a minimum number of votes have been received. To be an approved species, more than two-thirds of those voting must have voted "yes." Approval of a name requires that more than half of those voting have voted "yes."

If the voting has been rather straightforward, the chairman formally notifies the authors of the approval or disapproval of the species and name and provides them with the combined critiques of their proposal. It is possible to have either the species or the name approved, while the other has been disapproved. In the optimum case of approval of both the species and the name, no other interaction with the Commission is necessary, and the authors are free to publish. In cases where the mineral was not approved, the authors are invited to submit additional data in support of their species, if they choose to resubmit their proposal after considering the critique. They may choose not to. In cases where the name was not approved, the authors are invited to submit a modified name or a different one. In instances where a mineral was not approved, but the name received enough votes for approval, the name is not really approved; otherwise we would have a name without a mineral!

Sometimes, however, the voting is not wholly conclusive, and a member or members may request suspension of voting while a critical matter is addressed by the authors; this may result in a whole new round of voting if the chairman agrees to suspend voting. Alternatively, there may not be a specific member's call for suspension but, after a comprehensive review of all the critiques, the chairman may recognize a problem with the proposal. He may then suspend the voting until this concern is addressed. Similarly, although the name may have been approved by over half the members, the composite of their comments may indicate to the chairman a problem with the name which was not readily apparent to him or any one of the members. The chairman may request that the authors consider these comments and give consideration to another name. Resubmissions are then subject to the same procedures as the original proposal.

Steps Involved in the Approval of
A New Mineral Proposal

- I. Author submits proposal
- II. Chairman
  - A. Requests check list if it is not present
  - B. Carries out data base searches
    - 1. Chemical composition
    - 2. X-ray powder diffraction data
    - 3. Other
  - C. If identity with other mineral is indicated:
    - 1. Informs author
  - D. If mineral appears unique:
    - 2. Proposal is checked for completeness and accuracy
      - a. If data are wrong or missing, inform authors
      - b. If proposal is complete, abstract is prepared and copies sent to:
        - (1) Members of the CNMMN
        - (2) Advisors from the Commission on Ore Mineralogy (COM)
        - (3) Author
- III. Members of CNMMN
  - A. Assess data and suitability of name
  - B. Send votes and comments to chairman
  - C. May suggest suspension of voting
- IV. COM Advisors
  - A. Assess Data
  - B. Send comments to chairman
- V. Chairman
  - A. Assesses requests for suspension of voting
    - 1. Invokes suspension
      - a. Informs author and members
      - b. Sends comments to author
        - (1) Requests author's response to comments
    - 2. Rules out suspension
  - B. Compiles results of voting
    - 1. Sends comments and results of voting to author and members of CNMMN
      - a. Informs author of results
        - (1) Mineral and name approved
          - (a) Author must publish mineral's description within two years
        - (2) Mineral approved but name not approved
          - (a) Author asked to submit another name
        - (3) Mineral not approved
          - (a) Author asked for response and encouraged to submit new proposal after deficiencies are corrected
  - C. Two years later
    - 1. If description has not been published asks author for status of mineral

---

Authors of an approved new mineral and name have two years in which to publish it. After that, if the description has not been published or if a written extension from the chairman has not been given, approval is rescinded, and the authors have no rights to either the species or the name.

Discreditations, Redefinitions, Revalidations, Mineral Groups and Nomenclature Relations

Proposals to discredit, redefine or revalidate minerals are sent to the vice-chairman of the Commission. For each of these kinds of proposals it is critical that the appropriate type material be examined. If it is not available, then a neotype may be proposed, as defined by Dunn and Mandarino (1987). If the original authors of the mineral in question are alive, they must be consulted and their opinions, if any, made known to Commission members prior to voting. Guidelines as to which redefinitions require Commission approval were given by Nickel and Mandarino (1987). The procedures for consideration, voting and approval for these proposals are practically the same as those for new minerals.

Proposals concerning mineral groups are handled by the secretary of the Commission. Such proposals usually are much more involved and complex because they can encompass relatively large numbers of minerals, such as the amphibole and pyrochlore groups, for example. In order to provide the best possible consideration of a mineral group, it is customary to appoint an international subcommittee of experts on the particular group under consideration. A consensus must be reached first within the subcommittee and only then does the Commission vote on each aspect of the subcommittee's recommendations. Consequently, the task of revising the nomenclature or definition of a mineral group usually takes years rather than months.

The work of the vice-chairman is very important to the science, because much of the confusion which exists is caused by poorly described minerals. Thus, *formal* discreditations, redefinitions and revalidations do much to strengthen our mineralogic nomenclature. Similarly, the work of the various mineral group subcommittees set up and supervised by the secretary does much to clarify the nomenclature of specific mineral groups.

Benefits to the Science and the Collector

The work of the Commission on New Minerals and Mineral Names is significant in a number of ways. First and foremost, it sets a high standard for the designation of species status for naturally occurring elements or compounds. By forcing investigators to meet the Commission's standards, the overall quality of the published data is substantially enhanced, and descriptions are made more complete, thus facilitating the recognition of the species. By conforming to a discipline, there is more uniformity in the data published, permitting more insights into group relations. Thus, the entire integrity of systematic mineralogy is enhanced.

The Commission also serves as a sieve, to keep from the mineralogical literature and collectors a preponderance of superfluous names, and mineral names for substances which are only partially described. Poorly or inaccurately described minerals are excluded before they attain status in the literature, and thus the various published compendia of mineralogy more accurately reflect the true state and number of mineral species.

The collector also benefits from the above-noted advantages to the science. Additionally, sound and complete descriptions facilitate identification. Even if the collector does not have the laboratory facilities with which to verify one's own specific specimens, at least there is the knowledge that it can be done, has been done on at least one specimen, and has been approved by a competent authority. The designation "approved by the Commission on New Minerals and Mineral Names, IMA" indicates to the collector that the newly seen mineral name is a real one, and not the fabrication of an overly active imagination. This mark of approval further benefits the collector by assuring him that a body of scientists is very concerned about the validity of mineral species, and has taken the time and effort to evaluate each one critically.

Acknowledgments

We wish to thank Michael Fleischer, Ernest H. Nickel, Charles E. S. Arps, John S. White, Jr., and Carl A. Francis for critical readings which improved this presentation.

REFERENCES

DONNAY, G., and FLEISCHER, M. (1970) Suggested outline for new mineral descriptions. *American Mineralogist*, **55**, 1017–1019.

DUNN, P. J. (1977) From unknown to known: The characterization of new mineral species. *Mineralogical Record*, **8**, 341–349.

DUNN, P. J. (1978) New Minerals, 1973–1977: a perspective. *Mineralogical Record*, **9**, 363–365.

DUNN, P. J., and FERRAIOLO, J. A. (1983) New Minerals, 1978–1982: a perspective. *Mineralogical Record*, **14**, 211–214.

DUNN, P. J., and MANDARINO J. A. (1987) Formal definitions of type mineral specimens. *American Mineralogist*, **72**, 1269–1270. *Mineralogical Record*, **19**, 227–228.

FLEISCHER, M. (1951) Ten years of new mineral names. *American Mineralogist*, **36**, 630–631.

FLEISCHER, M. (1961) Ten more years of new mineral names. *American Mineralogist*, **46**, 463.

FLEISCHER, M. (1970) Procedure of the International Mineralogical Association Commission on New Minerals and Mineral Names. *American Mineralogist*, **55**, 1016–1017.

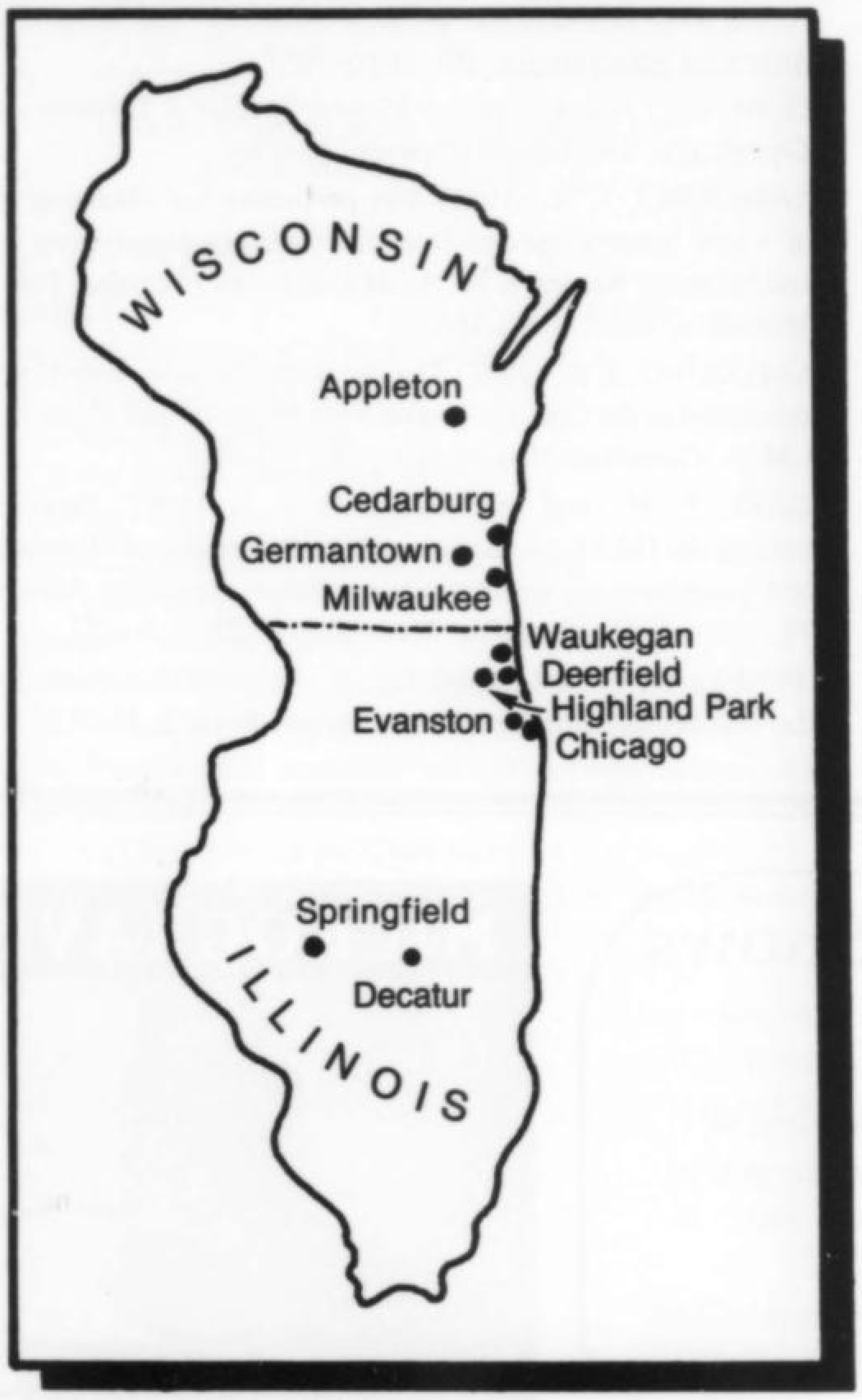
HEY, M. H. (1955) *An Index of Mineral Species & Varieties Arranged Chemically*. The British Museum, London.

MANDARINO, J. A. (1986) The procedure for obtaining approval of a new mineral species from the Commission on New Minerals and Minerals Names, I. M. A. *Abstracts and Program, 14th Annual Meeting of the I.M.A.*, 165.

MANDARINO, J. A. (1987) The check-list for new mineral proposals submitted to the Commission on New Minerals and Mineral Names, I.M.A. *Canadian Mineralogist*, **25**, 775–783.

NICKEL, E. H., and MANDARINO, J. A. (1987) Procedures involving the IMA Commission on New Minerals and Mineral Names, and guidelines on mineral nomenclature. *American Mineralogist*, **72**, 1031–1043; *Canadian Mineralogist*, **25**, 353–377.

SKINNER, B. J., and SKINNER, C. W. (1980) Is there a limit to the number of minerals? *Mineralogical Record*, **11**, 333–335.



WISCONSIN
Appleton
Cedarburg
Germantown
Milwaukee
Waukegan
Deerfield
Highland Park
Evanston
Chicago
Springfield
Decatur
ILLINOIS

Microminerals

Bill Henderson

Last May, my wife, Audrey, and I attended a meeting of the Micromounters of New England. With about 50 members, they meet eight times a year, seven of those being at members' houses. These are really hands-on meetings, with swapping, identifying, looking at and talking about minerals being the business of the day. Microscopes and lights are everywhere.

The meeting we attended, however, was their annual one. Besides the above activities, they had a guest speaker—Joe Mandarino, who spoke about computer drawing of crystals, and about Mont St-Hilaire minerals and the book on Mont St-Hilaire minerals on which he is working. Additionally, there were many microminerals which could be purchased, and enormous numbers of giveaways. The latter, of which the lion's share were contributed by Steve and Janet Cares, are surprisingly good, and would do very well in any collection.

A few of the specimens we were given or swapped for are shown in the first few figures of this column. The first (Fig. 1) is one of several excellent specimens of the very rare hexagonal calcium aluminum phosphate, perhamite. These were collected by Gene Bearss of Sanford, Maine, at the Emmons mine, Greenwood, Oxford County, Maine. The crystals shown are lightly coated with a brown material which makes them easier to photograph. Most are snow-white and in sheafs of tabular crystals rather than large groups. These are by no means the first fine micros obtained from Gene, as he is a very industrious and knowledgeable field collector.

Also at the show was Mike Swanson (Greenfield, Maine), who had for exchange a number of rare and well crystallized goodies. First of these were transparent, honey-brown crystals of eulytite, a bismuth silicate, from Schneeberg, Saxony. The crystals show the trigonal tristetrahedron, the usual form for the mineral at Schneeberg, but they are much larger than ordinary, and very well formed (see Fig. 2). Most texts describe eulytite as occurring in minute crystals. Also obtained from Mike were nice, tan-colored cubes of chlorargyrite with octahedral modifications (Fig. 3) from the Poor Man's lode in Owyhee County, Idaho. He also had for trade brownish red crystals of hancockite from Franklin, New Jersey; gray-black meneghinite from the Cottino mine, Luca, Italy; and sharp, yellow-green crystals of liebigite from Jefferson County, Colorado.

Mildred and Wally Watson of Clay, New York, had a number of species from Mont St-Hilaire, Quebec. Of these, one of the best is the clear, colorless, hexagonal plates of gmelinite shown in Figure 4. The gmelinites are perched on pyrrhotite, and the two are found in hornfels. Interestingly, the same association of gmelinite and pyrrhotite is found at Boron, California, in basalts associated with boron mineralization. The latter is not too surprising, considering that gmelinite is frequently found in basalts, and pyrrhotite is most frequently found in basic and ultrabasic rocks. However, why the two minerals should be associated in a hornfels is another question.

Marcelle and Charlie Weber, from Guilford, Connecticut, also had Mont St-Hilaire species at the meeting. Not surprising, since they make six to ten trips a year to the quarry. The jet-black, equant crystal of anatase shown in Figure 5 was obtained from them. This, too, is found in the hornfels, and is associated with bright apple-green dolomite. Much rarer is the cubic, raspberry-red villiaumite crystal obtained from them and shown in Figure 6. Villiaumite is usually found in miarolytic cavities in nepheline syenite, and it is in small vugs and stringers in this type of rock that it is found at Mont St-Hilaire, associated with aegirine, feldspar and eudialyte. Since villiaumite, NaF, is water-soluble, it must be collected soon after exposure, before the next rain. The Webers also have really fine behoite, $Be(OH)_2$, in radiating, colorless crystals with brown tips (Fig. 7), as well as columnar, brown crystals of kupletskite, the Mn end-member of a series with astrophyllite (Fig. 8). Marcelle Weber (1172 West Lake Avenue, Guilford, CT 06437) has superb material to exchange, but only for equally good specimens.

Still another mineral found in the hornfels, especially in association with the black anatase, is bright apple-green dolomite in rhombohedrons. Steve and Janet Cares, of Sudbury, Massachusetts, had this one.

Anyone wishing to join this small but very active group with members from most of the northeastern states can do so by writing Janet Cares (18 Singletary Lane, Sudbury, MA 01776). Dues are only $4.00 a year.

Continuing on the subject of minerals from Mont St-Hilaire, I would like to show some specimens personally collected in the recent past. First of these are crystals of mangan-neptunite shown in Figures 9–10. These vary in color, the smallest being honey-brown and larger ones being more orange-brown. Most of them (Fig. 9) are twinned, while a few are not. The twinned crystals tend to be equant or short columnar, while untwinned ones are more elongated. Twins are V, X or W-shaped, much like those of neptunite from the Benitoite (Dallas) Gem mine, San Benito County, California. Most are off matrix, while a few such as that in Figure 9 are on analcime or aegirine. Collecting these was an experience, as the crystals were found in an almost vertical, 30–60 cm wide chimney on the outward-sloping edge of a very high, vertical quarry face. It was raining, and reaching into the chimney allowed extremely sharp aegirine needles to fall into one's gloves. These were of some concern, as they readily entered the water-tenderized epidermis at every movement. The best crystals were found at home by carefully sorting fine gravel scooped from the sides and bottom of the chimney. More firmly attached wall material seemed to have fewer crystals of the mangan-neptunite.

On another trip, snow-white to straw-yellow, radiating crystals of lemoynite were collected (Fig. 11). Ugly but rare, the crystals are only occasionally terminated, and most specimens were obtained only as broken-open spheroids such as the one shown. Equally ugly is the sooty, red-black group of platy pyrophanite crystals shown in Figure 12. This species has turned up only fitfully over the years. On another rainy day, quite a cold one, too, we collected what we call "siderite hole" material. This is a vuggy rock composed of mostly white, platy albite plus siderite rhombs. This time, through the rain water filling and coating the vugs, we could see white puffballs such as those shown in Figure 13. These were later shown to be franconite in extremely nice groups for the mineral. At Mont-St-Hilaire, many species occur in such white balls of fluff, so it is important that the material be properly identified each time such things turn up. Luckily, thus far, we have not seen two minerals as puffballs at the same time and in the same place: Still, hochelagaite (formerly UK50) does occur in a matrix similar to that of the franconite.

The last few specimens shown were also collected in the rain by the author at Mont St-Hilaire. The material brought home initially

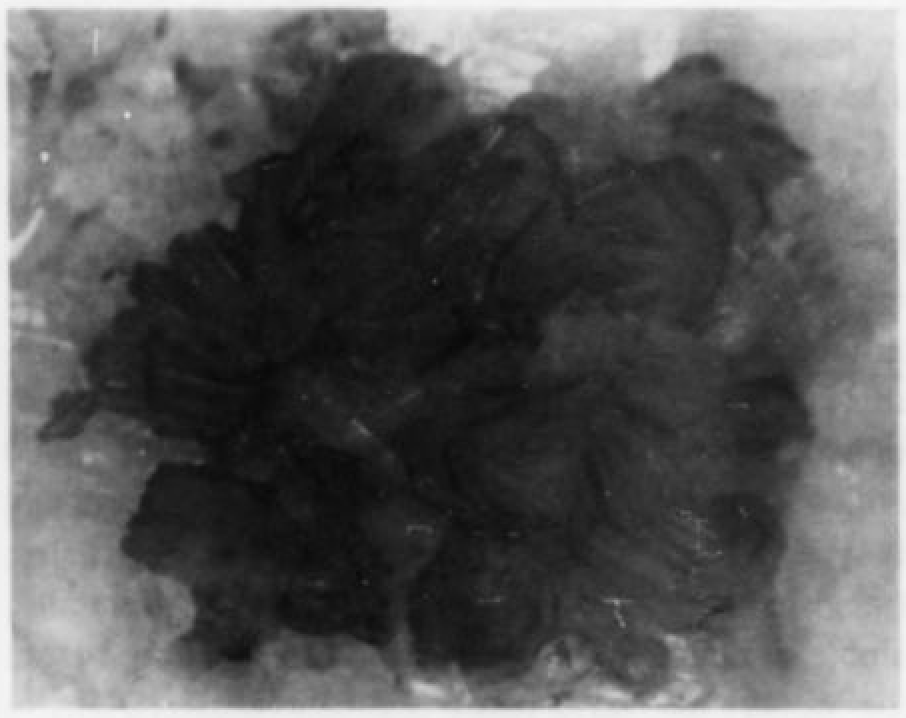


Figure 1. **Perhamite, a 3.5-mm group of white, hexagonal crystals on albite from the Emmons mine, Greenwood, Oxford County, Maine.**

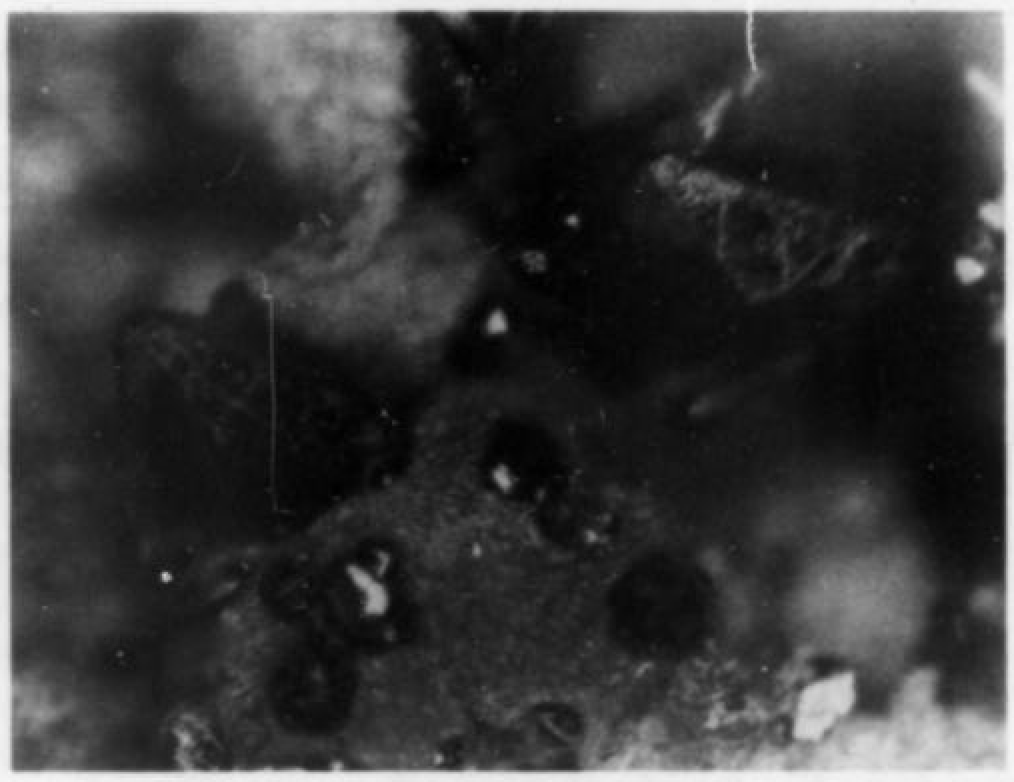


Figure 2. **Honey-colored, tristetrahedral crystals of eulytite to 0.5 mm, from Schneeberg, Saxony.**

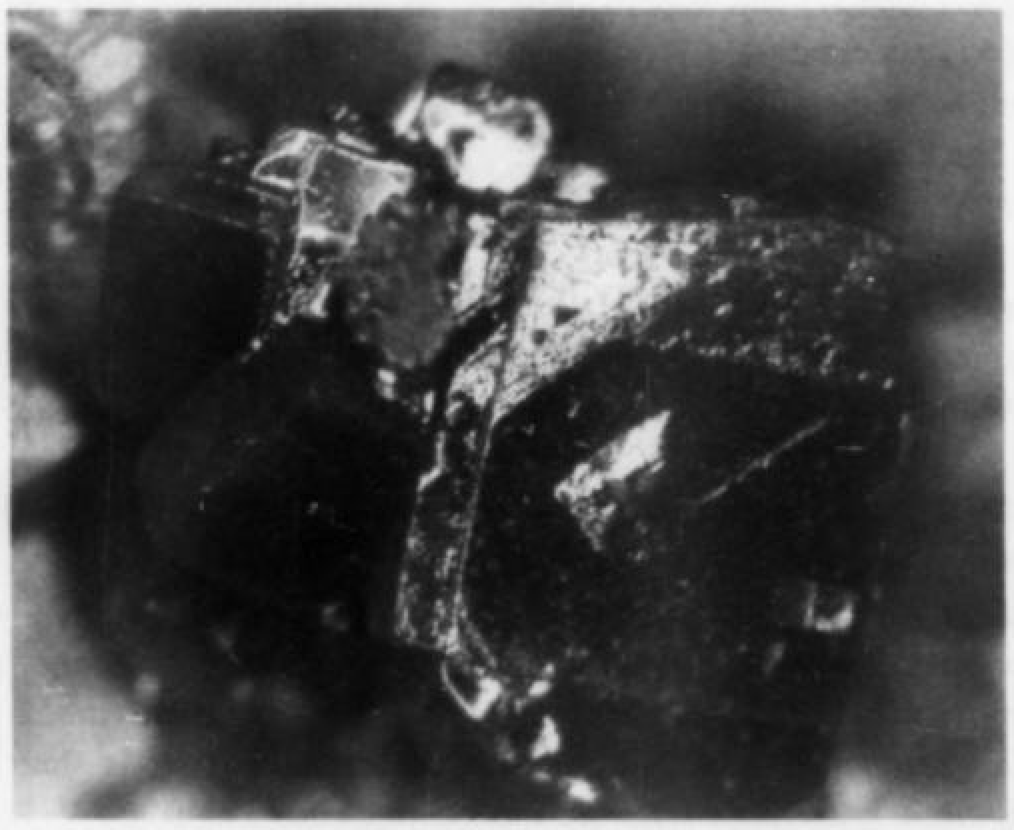


Figure 3. **Tan cubes and cuboctahedrons of chlorargyrite from the Poor Man's lode, Silver City district, Owyhee County, Idaho. Field of view, 1.8 mm.**

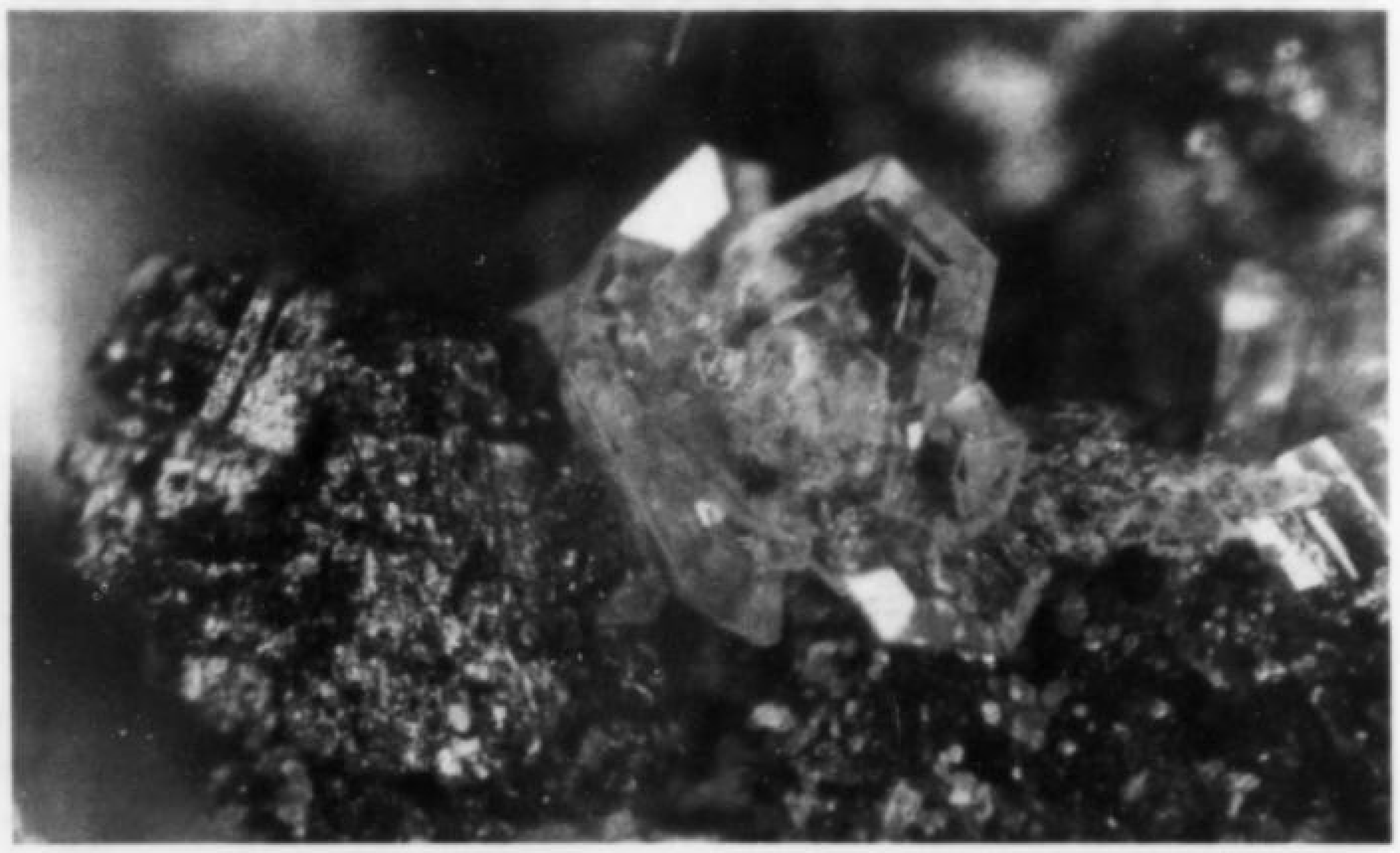


Figure 4. **Clear, colorless crystals of gmelinite on pyrrhotite, from Mont St-Hilaire, Quebec, Canada. Field of view, 2.5 mm.**

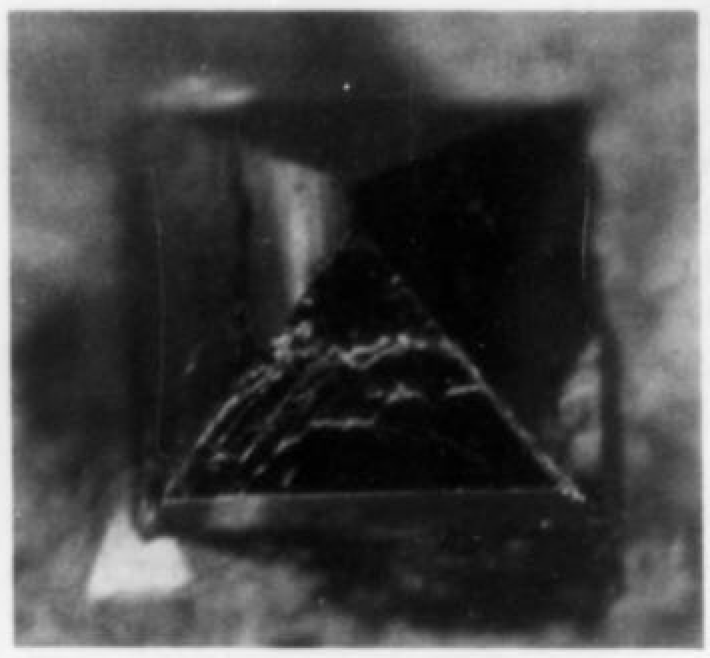


Figure 5. **A 0.5-mm, jet-black, equant crystal of anatase viewed down the *c* axis, from Mont St-Hilaire, Quebec, Canada.**

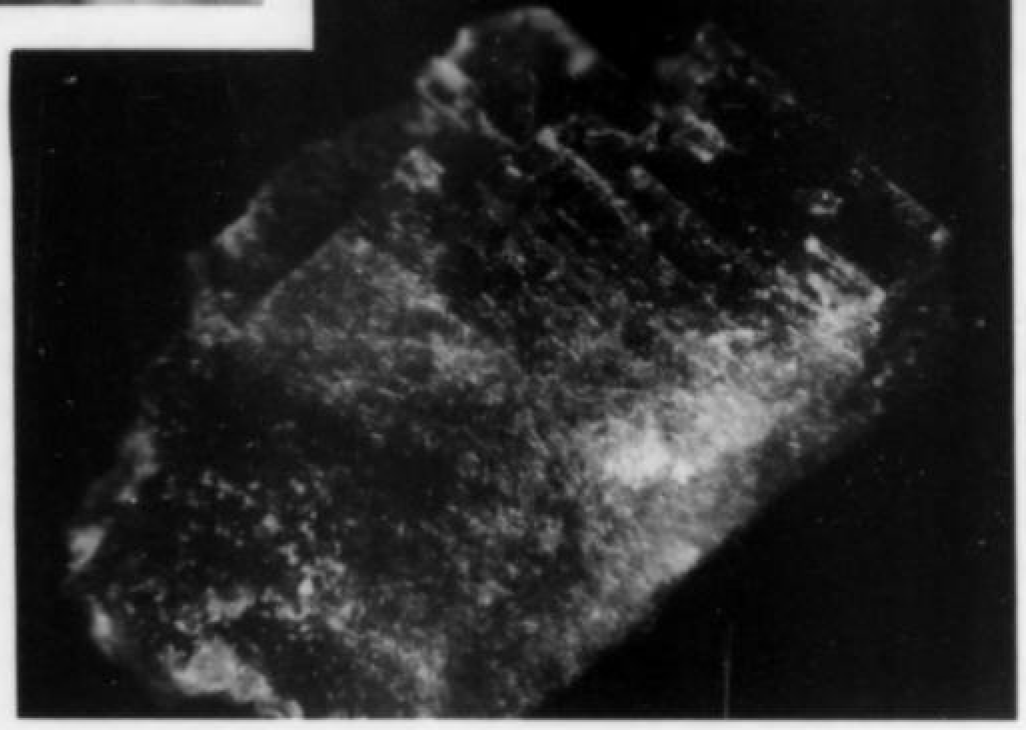


Figure 6. **Raspberry-red, 3.0-mm crystal of villiaumite from Mont St-Hilaire, Quebec, Canada.**

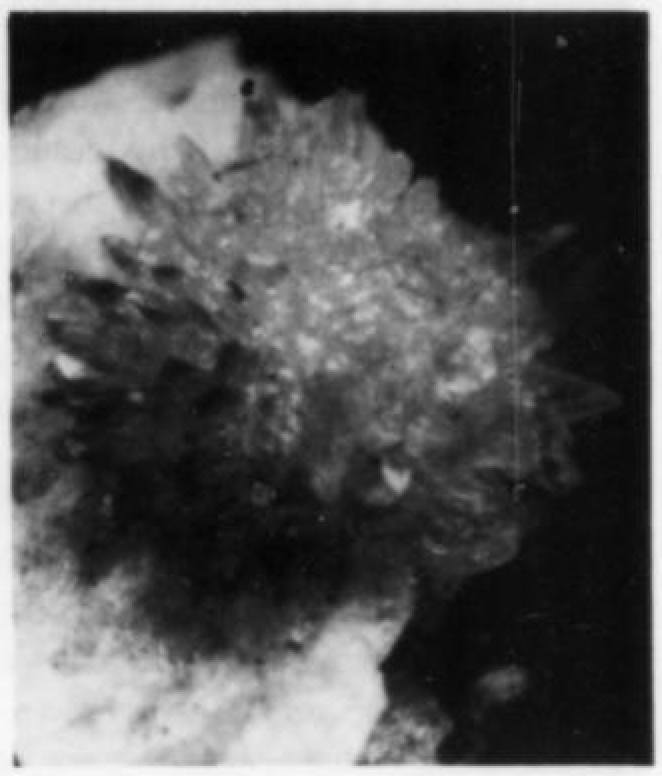


Figure 7. **Radiating crystals of behoite, colorless with brown tips, from Mont St-Hilaire, Quebec, Canada. Size of group, 1.5 mm. Weber collection.**

showed a few crystals and fragments of grossular embedded in calcite veins, really quite humdrum and unpromising stuff. However, etching with dilute hydrochloric acid revealed a veritable garden of micromineral species sufficient for many evenings of study. Fine orange-brown grossulars such as those in Figure 14 are by far the most abundant. These show trapezohedron faces, often heavily striated (Fig. 15). The striations result from alternation between dodecahedron and trapezohedron faces. Some of the crystals (Fig. 16), instead of being of uniform composition, are merely hollow shells of grossular filled with calcite and albite. This is a not too uncommon phenomenon with members of the garnet family. The large, calcite-filled shells of grossular from East Woodstock, Maine, for instance, are world famous collector's items.

With the grossular are green to brown, sometimes mottled green and brown, tetragonal crystals, varying in habit from equant to columnar. Two are shown in Figures 17 and 18. These are vesuvianites, a common associate of grossular in skarn deposits. Much less common and smaller than the above two minerals are pale grey, transparent, wedge-shaped crystals of titanite (Figs. 19 and 20). There are also several other less photogenic species present; a complete list of the species found is given below. I'm indebted to George Chao and Joe Mandarino for confirming the identities of several of these minerals.

Figure 8. Brown, radiating crystals of kupletskite, from Mont St-Hilaire, Quebec, Canada. Field of view, 2.5 mm. Weber collection.

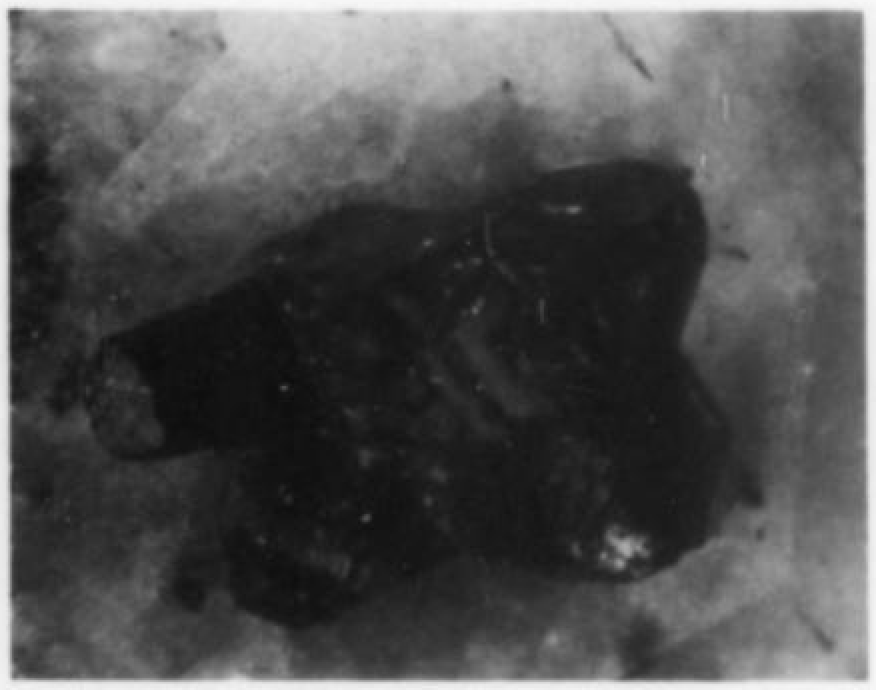
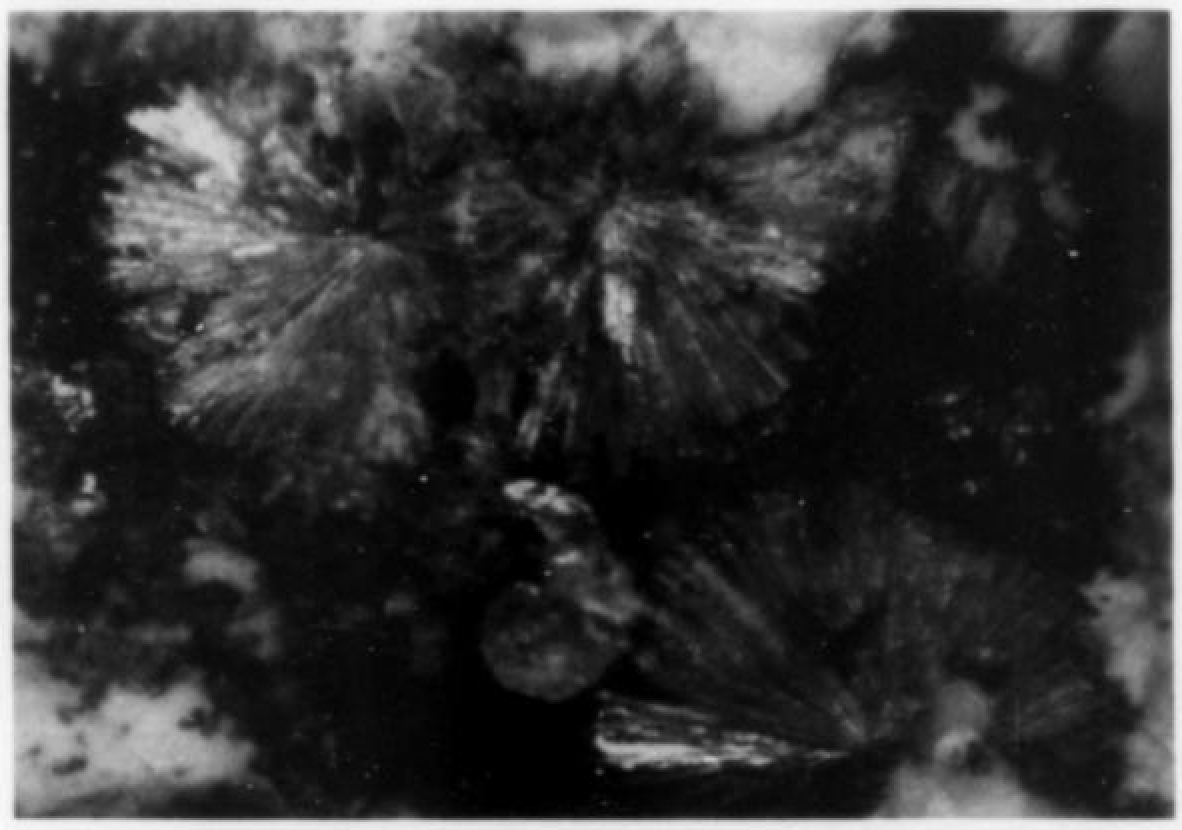


Figure 9. X-shape twin of orange-brown mangan-neptunite, 1.5 mm across, with black neptunite and albite, from Mont St-Hilaire, Quebec, Canada.

Figure 10. A columnar crystal of yellow-brown mangan-neptunite on albite, from Mont St-Hilaire, Quebec, Canada. Length of crystal, 1.6 mm.

Figure 11. Straw-yellow, occasionally terminated, radiating crystals of lemoynite on feldspar. The field of view is 5.6 mm. From Mont St-Hilaire, Quebec, Canada.



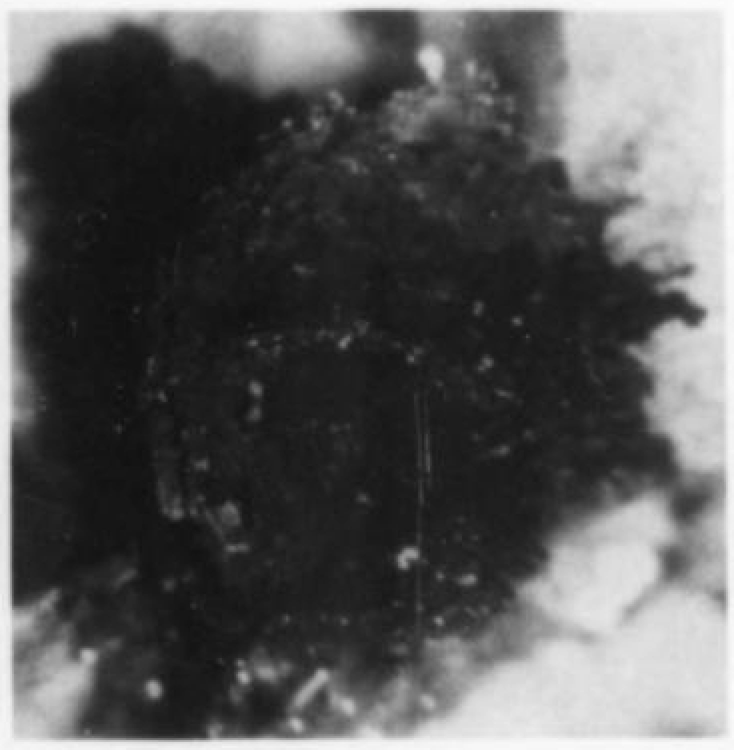


Figure 12. Sooty black, tabular crystals of pyrophanite, some showing hints of red on thin edges, on albite, from Mont St-Hilaire, Quebec, Canada. The field of view is 8.0 mm.

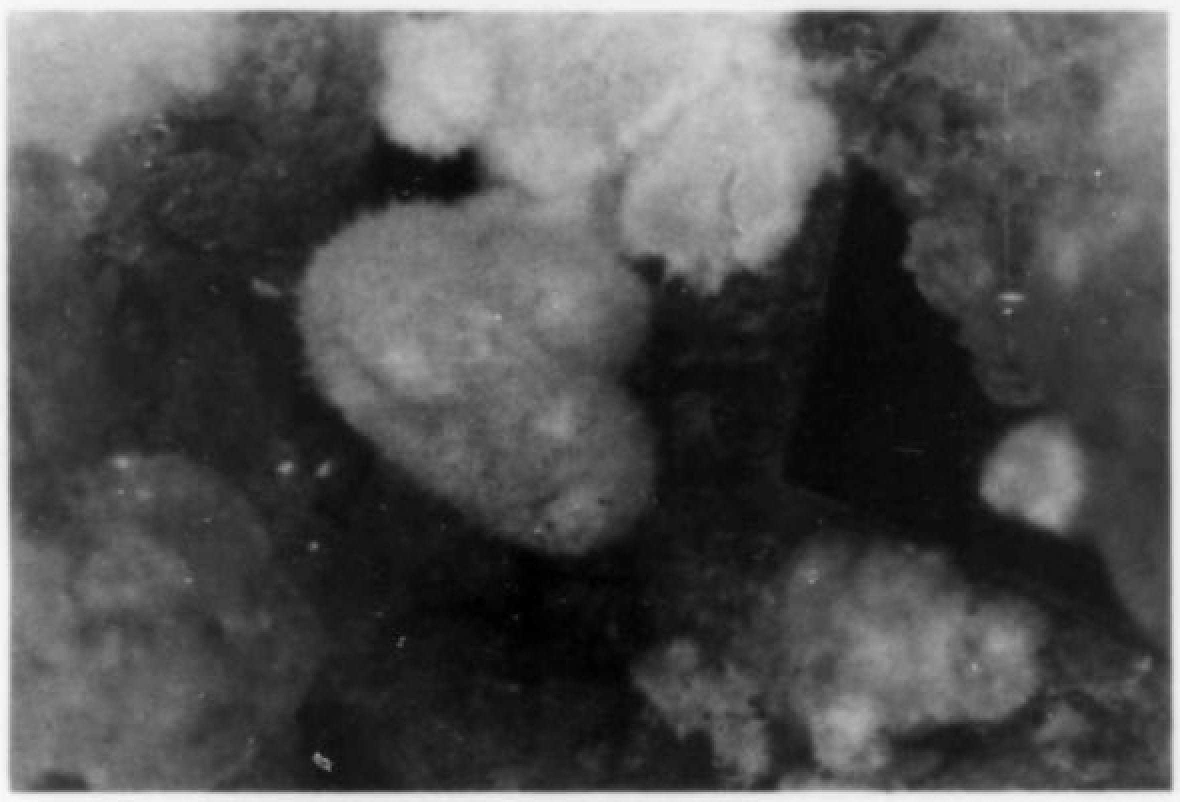


Figure 13. Snow-white, radiating crystals of franconite in puff balls, associated with tan rhombs of siderite on white to colorless analcime, from Mont St-Hilaire, Quebec, Canada. Field of view, 9.4 mm.

Figure 14. Orange-red, trapezohedral crystals of grossular on albite, from Mont St-Hilaire, Quebec, Canada. The large crystal is 4.4 mm in diameter.

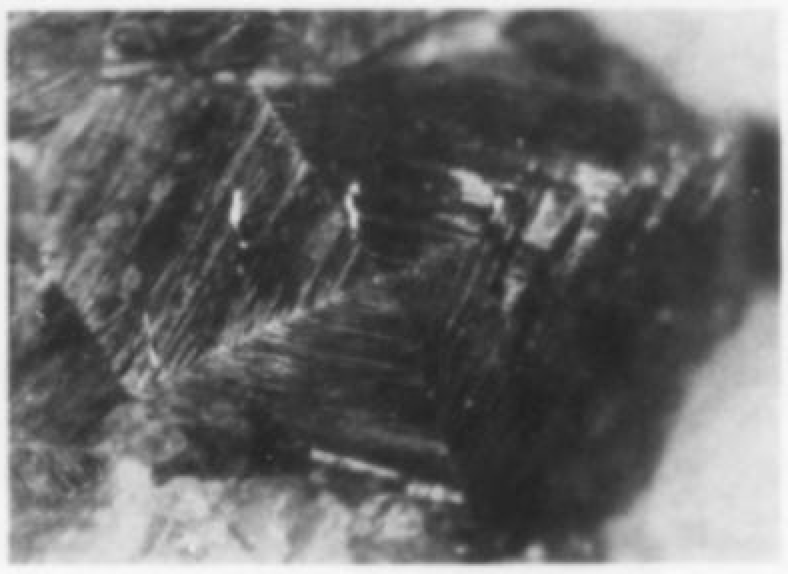


Figure 15. Striations on red-brown crystal of grossular caused by alternation between faces of the dodecahedron and trapezohedron. Field of view, 2.4 mm. From Mont St-Hilaire, Quebec, Canada.

Figure 16. **Thin shell of orange-red grossular covering albite and calcite, with tiny, dark green amphibole crystals and larger, white albite crystals. Field of view, 1 cm. From Mont St-Hilaire, Quebec, Canada.**

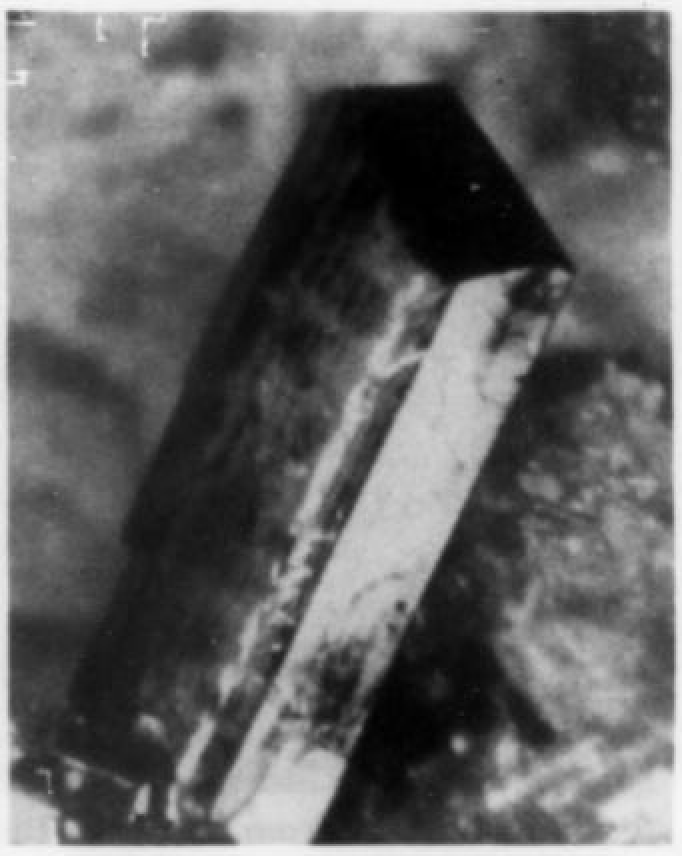


Figure 17. **Mottled yellow-brown to dark green, columnar crystal of vesuvianite, 1.4 mm long, with grossular, on albite, from Mont St-Hilaire, Quebec, Canada.**

Figure 18. **A doubly terminated, short columnar crystal of vesuvianite, brown to dark green in color, 1.2 mm long, from Mont St-Hilaire, Quebec, Canada.**

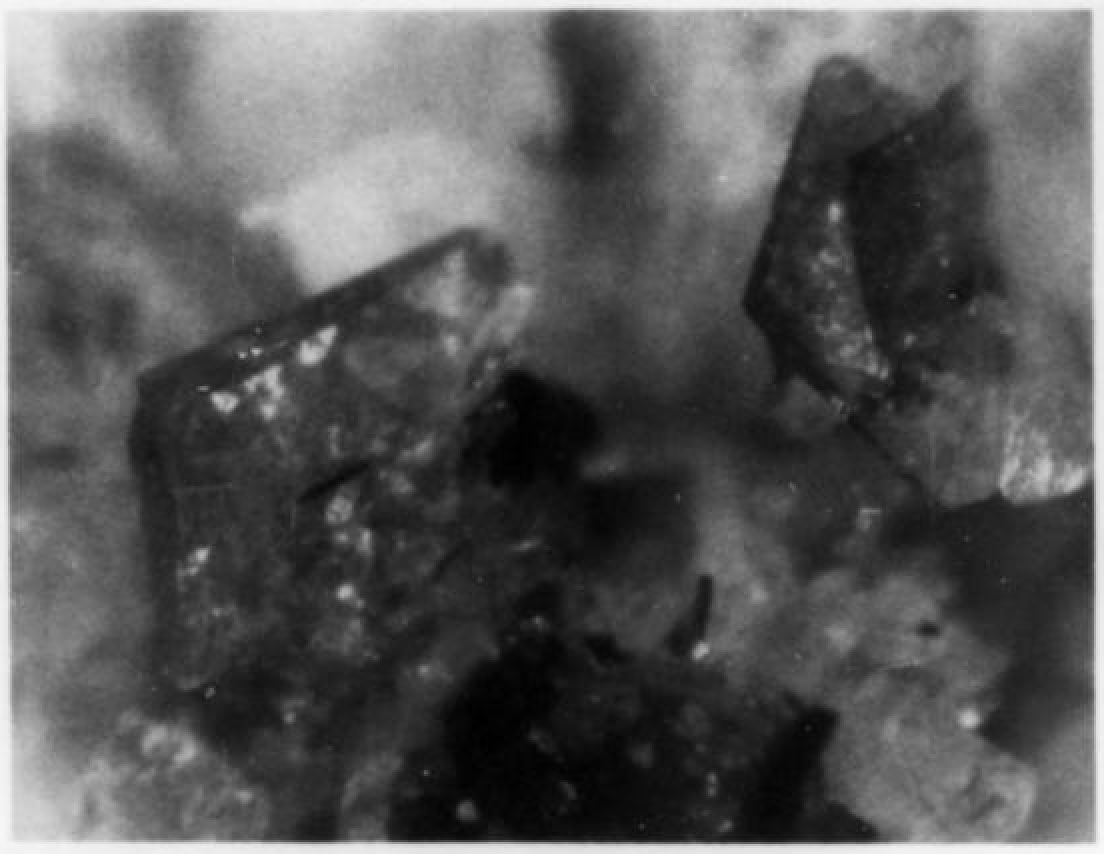


Figure 19. **Tiny, pale violet crystals of titanite, with dark green amphibole, albite and grossular. The field of view is 2.0 mm. From Mont St-Hilaire, Quebec, Canada.**

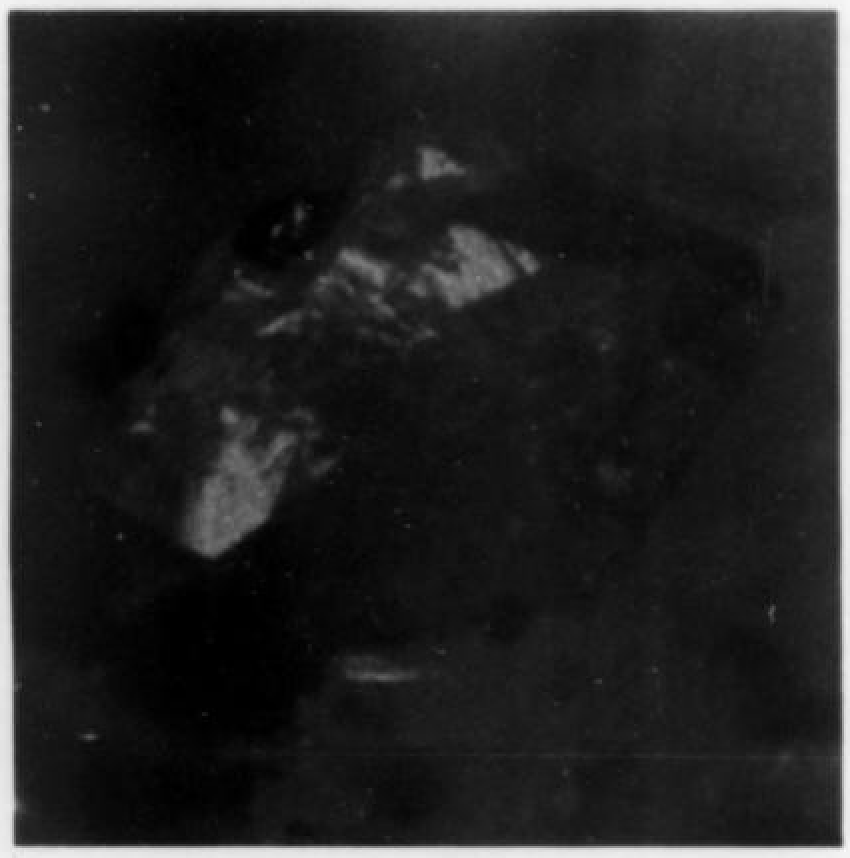


Figure 20. **Pale violet, wedge-shaped crystal of titanite, 0.8 mm across, on albite, from Mont St-Hilaire, Quebec, Canada.**

Mont St-Hilaire Skarn Minerals Assemblage

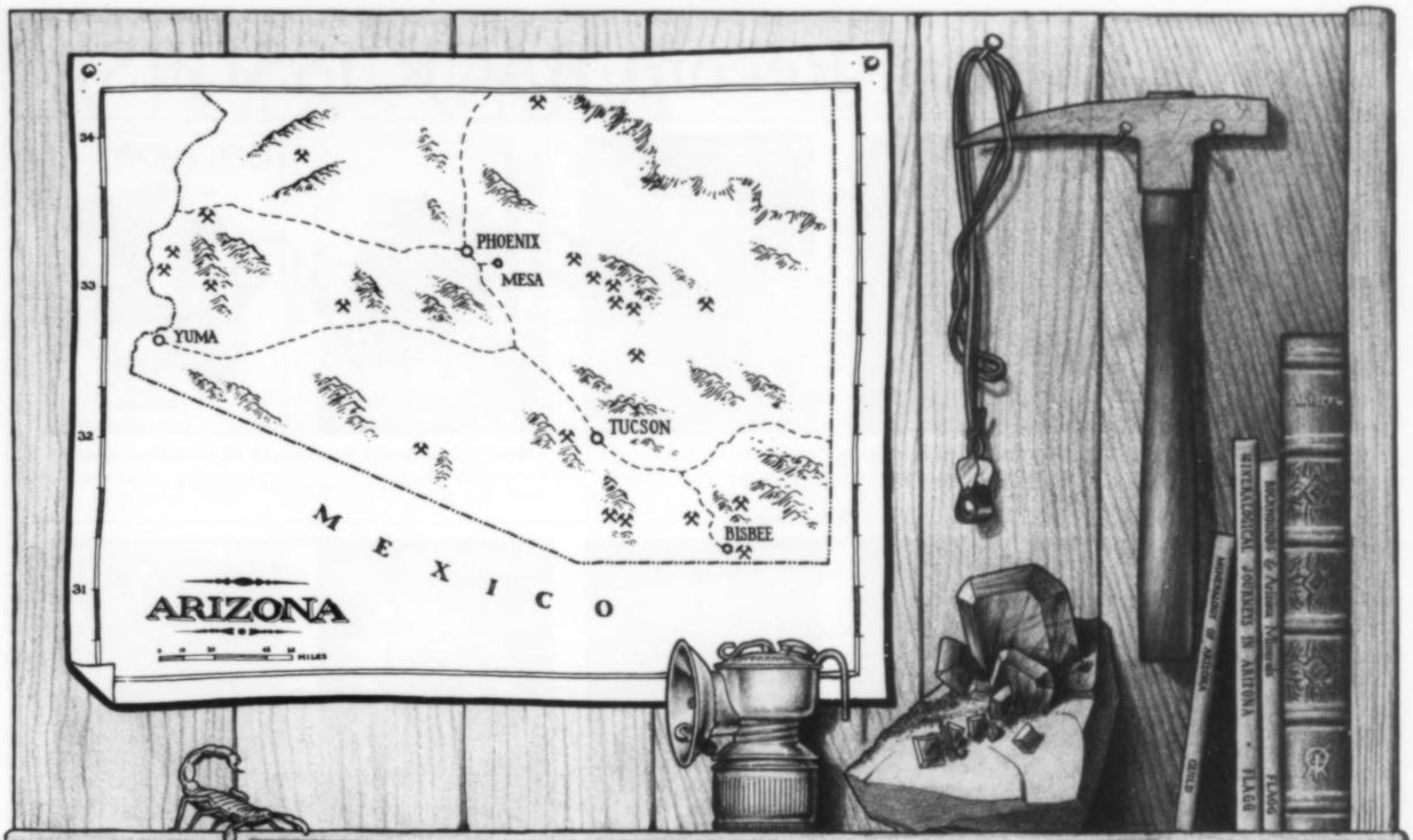
Amphibole
Calcite
Diopside
Epidote
Goethite
Grossular
Pyrrhotite
Quartz
Titanite
Vesuvianite
Zircon

The goethite occurs in hairlike crystals oriented on calcite. The pyrrhotite occurs as elongate, corroded crystals. The zircon forms minute, pale orange, short columnar crystals.

There is a moral to the above story. That is, whenever there is even a suspicion that goodies may lie under calcite or carbonate vein fillings, go for the acid bottle. Very pleasant surprises may await.

Good hunting!

Wm. A. Henderson, Jr.
174 East Hunting Ridge Road
Stamford, CT 06903



SOUTHERN ARIZONA DEALERS

Bitner's, Inc.
42 West Hatcher
Phoenix, Arizona 85021
(602) 870-0075

De Natura
Les & Paula Presmyk
P.O. Box 1273
Gilbert, Arizona 85234
(602) 892-0779

Fosters
Wayne Richards
& Sarah Foster
1511 E. Edgemont Ave.
Phoenix, Arizona 85006
(602) 265-1567

Kino Rocks & Minerals
6756 S. Nogales Highway
Tucson, Arizona 85706
9-11:15/Noon-5:30
(Closed Sun.)
(602) 294-0143

Michels Minerals
Harold & Wilma Michel
1030 W. Tenth Street
Mesa, Arizona 85201
(602) 969-0105

Midwest Minerals and Mining
Stan Esbenshade
1501 W. Kilburn
Tucson, Arizona 85705
(602) 293-8474

David Riley Minerals
529 W. Pepper Place
Mesa, Arizona 85201-7209
(602) 898-0740

David Shannon Minerals
David, Colleen & Mike
1727 W. Drake Circle
Mesa, Arizona 85202
(602) 962-6485

Maudine & Bob Sullivan
Geological Specimens Int'l.
3202 Saguaro West Trail
Tucson, Arizona 85745
(602) 743-0081
See us at the major
shows only

Mineralogical Record BACK ISSUES!

v.8/#6 California Issue Benitoite, Gold, L.A. County Museum, Himalaya mine **$7**

v.9/#3 Kalahari rhodochrosite, Paterson-NJ, Brumado district-Brazil, Bosch Coll. **$7**

v.9/#5 Turkish Kämmererite, Afghan pegmatites, Chuquicamata-Chile **$7**

v.10/#5 Thomas & Wah Wah Ranges-Utah (famous for Topaz, Red Beryl, etc.) **$7**

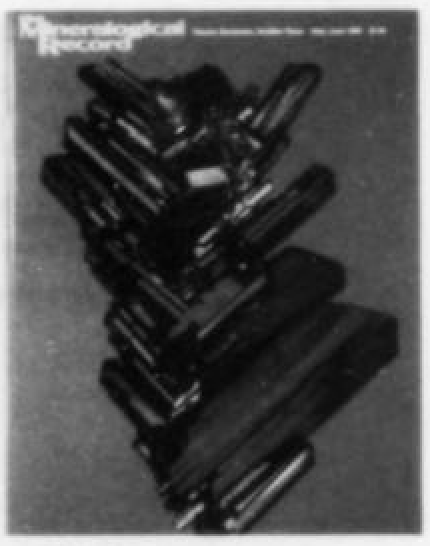
v.10/#6 Colorado-II Issue Locality Index, Amazonite, Mt. Antero, Sweet Home **$7**

v.12/#4 Mineral Fakes, Mineral Fraud, Leadhills-Wanlockhead England **$7**

v.16/#1 Nevada Issue Getchell, Comstock, White Caps, Steamboat, etc. **$9**

v.16/#3 Colorado-III Issue Leadville, Rico, Pikes Peak Cresson Vug, CSM Museum **$9**

v.16/#5 Tourmaline Issue History, Mineralogy, Calif., Elba, Nepal, Pakistan, ME **$12**



v.17/#3 Knappenwand, Laurium, Tucson Show, Senaite-Brazil, New Zealand, Italy **$9**

v.17/#4 Tip Top-Black Hills, Stoneham-Colorado Barite, Tuscany-Italy **$9**

v.17/#5 Black Hills types, Urucum pegmatite-Brazil, Perkins Sams collection **$9**

v.17/#6 Bleiberg-Austria, Oklahoma, Romania, Australia, Author's Guide **$9**

v.18/#1 Gold-II Issue Australia, Breckenridge, Venez., CA, GA, AL, NC, England **$14**

v.18/#2 Elk Creek Barite, Teyler's Museum, Taxco-Mex., Germany, Quartz **$9**

v.18/#3 Minerals of the United States-Books List, Photographer's guide **$9**

v.18/#4 Carrara-Italy, Marburg Museum, Spain, 79 mine Aurichalcite **$9**

v.18#5 Peking Museum, Colorful Vanadium Minerals, Cal. Inesite, Kunzite **$9**

v.18/#6 Stereo Issue-includes stereo viewer! Calcite, Pyrite, Morgan Hall **$9**

v.19/#1 Mineral Museums of Eastern Europe Full-color 72-page book-issue **$12**

All Prices
are
Postpaid

Order From: Circulation Manager
Mineralogical Record
P.O. Box 35565
Tucson, Arizona 85740

Supplies
are
Limited

What's New in Minerals?

George W. Robinson
National Museum of Natural Sciences
Ottawa, Ontario, Canada K1P 6P4

Vandall T. King
P.O. Box 90888
Rochester, New York 14609

FIFTEENTH ANNUAL ROCHESTER ACADEMY OF SCIENCE MINERALOGICAL SYMPOSIUM

Each year at the Rochester Mineralogical Symposium, Saturday morning is devoted to a panel discussion focusing on new mineral discoveries made during the preceding year. Since many items discussed at the symposium have previously been reported in the *Mineralogical Record,* reference to them has been omitted here. As in past years, information has been organized geographically, with emphasis on those occurrences that have provided truly new or exceptionally significant finds. While many localities annually provide new, and often very fine specimens to the market, those specimens typically represent a continuing supply of known materials rather than new kinds of materials, and have been so noted here. It is not our intent to underrate these finds by choosing not to discuss them in detail, but rather to streamline the overall presentation, since most readers are likely well-acquainted with them.

The numerous new discoveries made throughout the world each year make it increasingly difficult for anyone to keep current, and it is only through the cooperative effort of the many individuals cited herein that the following compendium has been made possible. To all these people we owe our sincere thanks.

Part I: United States

ALASKA

In addition to the clear green fluorites from Zarembo and Kuiu Islands previously reported in *The Mineralogical Record* (vol. 19, p. 113), Gary McWilliams (P.O. Box 2071, Wrangell, Alaska 99929) describes some additional interesting finds in *Mineral News* (vol. 4, no. 1). These include cubic pyrite crystals in slate from Revillagegido Island, quartz with chlorite inclusions from north of Petersburg, stalactitic quartz with stilbite and heulandite from a small island east of Sitka, and small eudialyte crystals from Prince of Wales Island. Also evident from Prince of Wales Island, were a number of very fine epidote specimens displayed by several dealers at this year's Tucson Gem and Mineral Show.

ARIZONA

Certainly one of the most colorful new finds to have been made anywhere over the past year is the azurite and malachite from Morenci, Greenlee County. There have been several lots of material over the last year, mostly collected by Stan Esbenshade for *Southwestern Minerals,* and marketed by *Bitner's* (42 W. Hatcher, Phoenix, Arizona 85021). The specimens are from the 4800 level of the Old Town workings, and include both stalactites and crystal-lined vugs, somewhat reminiscent of the famous azurite-malachite combinations from Bisbee.

Two new finds of aurichalcite surfaced at the Tucson show. The first of these was made by local collectors at the Southwest mine in Bisbee, and the second by Bob Lane (*The Caveman,* P.O. Box 26154, Phoenix, Arizona 85068-6158), Bob Johnson and Doug Brown at the Isle Royal mine (?) in the Helvetia mining district, Santa Rita Mountains. The Bisbee material consists mostly of rich masses of acicular blue crystals on matrix, forming large, cabinet-sized specimens over 25 cm across. Some very good calcite and aragonite ("flos ferri" habit) specimens were also recovered. Certainly the most interesting of these consist of ivory-colored calcite stalactites with centimeter-sized, water-clear aragonite crystals growing in radial aggregates from their apices. The Helvetia material resembles that from Mapimi, Durango, Mexico, with light blue acicular crystals associated with darker blue spheroidal aggregates of rosasite, transparent-to-white calcite and minor azurite and malachite on a brown gossan matrix.

Evan Jones, of *Bitner's, Inc.,* reported that collectors Mark Hay and Dick Morris made an interesting find of vanadinite in the Castle Dome District, Yuma County. The specimens were described as looking more like pyromorphite than vanadinite, with 3–5 mm olive-green crystals coating rock.

David Shannon (1727 W. Drake Circle, Mesa, Arizona 85202) is presently operating a molybdenite claim near Cleator, Yavapai County. The crystals are similar to those from the Moly Hill mine near Malartic, Quebec, and occur as bright, terminated, silver-gray hexagonal crystals up to 2 cm in quartz. Some other interesting materials recently recovered by Dave include emerald-green metatorbernite crystals to 2 mm on a black matrix from near Crown King, silky white mordenite associated with quartz and an unidentified green mineral from the New Water Mountains near Eagle Eye, Herkimer diamond-like quartz crystals up to 3 cm from Crystal Hill, Japan-law twinned quartz crystals with elbaite inclusions from the Galiuro Mountains, and more of the "c" face amethyst crystals from Four Peaks.

CALIFORNIA

Fred DeVito has reported an occurrence of gyrolite in a roadcut in the Santa Monica Mountains. Some specimens are described as "similar to those from Poona, India" (see *Mineral News,* vol. 3, no. 11, p. 9 for more information). Some additional interesting discoveries recently made by Fred include some bright raspberry-red variscite crystals (1–2 mm) with dark red-brown robertsite crystals (1 mm) in altered phosphate pods from the Stewart mine at Pala; andalusite crystals up to 15 cm long in slate from the unlikely locality of Beverly Hills; and some rather remarkable 2 mm crystals of minium from Crestmore. These deep red crystals occur in cavities with thaumasite. The four specimens that he found might represent the finest miniums ever discovered.

Phil Evanoff of Chillicothe, Ohio, found some impressive, transparent xenotime crystals from The Champion mine in the White Mountains in Mono County. The crystals are up to 2 mm on tabular 3–4 mm woodhouseite crystals.

Pala International (912 S. Live Oak Park Road, Fallbrook, California 92028) is continuing to provide a very fine selection of elbaite specimens from their mining activities at the Himalaya mine, near Mesa Grande, and local collectors have reported still finding hydroxylherderite up to a centimeter at the Blue Chihuahua mine in San Diego County. These crystals are cloudy, but are quite sharp for the species.

Baddeleyite has been found as sharp millimeter-sized crystals on schist from Perovskite Hill in San Benito County. The crystals are tan to brown and can be easily mistaken for distorted, wedge-shaped perovskites or spinels.

Jim and Mary (Fong) Walker (*Ikon Mining and Exploration,* 2030

Shipway Avenue, Long Beach, California 90815) recently collected some very interesting newberryite pseudomorphs after struvite from Mono Lake. These crystals, which average 3–5 cm, are quite sharp, gray to white in color, and occur in a clay-like matrix. Some are twinned and are coated by the rare phosphate mineral, monetite.

COLORADO

Golden brown masses of sicklerite/ferrisicklerite have been found in oxidized heterosite-purpurite at the Hyatt mine, Crystal Mountain district, Larimer County (see article by Mark Jacobson in *Mineral News*, vol. 3, no. 10 for details).

CONNECTICUT

Dr. Bruce Jarnot of Middlebury has found three new occurrences for allanite-(Ce). The first of these is at the nuclear plant site in Haddam Neck, where striated, black, terminated crystals up to a centimeter were collected. The second find was made at the Flat Rock quarry in Waterford. The crystals from here form unstriated, slightly rounded, tabular individuals up to 2 cm. The third locality is a railroad cut near Linkpot, where bladed crystals up to 3 cm were recovered. Some other collecting activities by Dr. Jarnot resulted in the discovery of some free-standing 3-mm phenakite crystals in albite vugs at the Strickland quarry and olive-green bismutite on silvery bismuthinite at the Case quarry in Portland.

IDAHO

The Sawtooth Mountains of central Idaho continue to produce superb specimens for those collectors who diligently pursue them. Geary Murdock (628 Whittier Street, Idaho Falls, Idaho 83401) collected some outstanding Baveno-twinned microcline crystals up to 10 cm near Centerville. Many specimens with smoky quartz and albite were also found, as were some carpholite needles, about a kilometer from Centerville. Geary also had more of the doubly terminated yellow labradorite crystals from Clark County available again this year at the Tucson show.

MAINE

The Russell Brothers prospect on Standpipe Hill in Topsham has recently produced some very sharp, brick-red crystals of monazite-(Ce) up to 3 cm across. This locality is near a housing development and may eventually vanish. Collecting is currently reported as good, and with no restrictions. Access is along the railroad bed.

Dr. Carl Francis, curator of the Harvard Mineralogical Museum, recently reported seeing a very fine specimen of attractive purple amethyst crystals on milky white quartz crystals, reportedly from the Lovell area. Details of the occurrence are presently unknown, but it is rumored that the locality may be worked for specimens this summer.

MARYLAND

Fred Parker of Columbia has collected some outstanding coalingite at the Hunting Hill quarry in Rockville. The mineral occurs as bronze-brown micaceous plates up to 3 cm, which must be considered enormous by any standards! The quarry has also produced some free-standing white prehnite crystals to 3 mm, sharp, gray clinozoisite crystals to a centimeter, millimeter-sized blue mcguinnessite, and tan sprays of pokrovskite up to 2 mm.

MASSACHUSETTS

Good specimens of adularia and fluorapatite continue to be reported from Acushnet, and Larry Venezia (115 Coleridge Street, East Boston, Massachusetts 02128) recently collected some very nice muscovite specimens there which he had available at the Rochester Symposium.

MICHIGAN

Ray Anolin of Windsor, Ontario recently found some very attractive micro vivianite specimens at the Cheney quarry near Bellvue. The crystals, which average 1–2 mm, are brilliant and show deep royal-blue interiors.

MONTANA

Last May, Harvey Gordon (*Sierra Contact Minerals*, 1002 S. Wells Avenue, Reno, Nevada 89502) mined a large quantity of golden calcite specimens from Gallitin Canyon, near Bozeman, Gallitin County. The crystals, which resemble some of the old-time tri-state or Pugh quarry (Custer, Ohio) specimens, occur in solution cavities in Mississippian limestone of the Madison Group. Some of the larger cavities contain slabs of collapsed limestone completely covered with lightly frosted, pale-to-golden yellow scalenohedrons up to 20 cm, though most average about a third that size. Many show twinning on {0001}. In all, about 1000 specimens were recovered.

NEVADA

Foster Hallman and Jon Johnson (*Crystal Tips Mines*, 1985 Clear Acre Lane, Reno, Nevada 89512) had a good selection of smoky quartz and amethyst scepters available from Peterson Mountain, Washoe County, at the Tucson show. Most of the crystals have lightly frosted faces, but this hardly detracts from their overall appeal, considering their size (up to about 25 cm) and perfection of form. They apparently occur in miarolitic cavities in granite.

John Seibel (*Seibel Minerals*, P.O. Box 95, Tehachapi, California 93561) also had a few large smoky quartz crystals from Washoe County available at the Denver show. These crystals which are about 25 cm long, are of good color with lustrous faces, and are somewhat tapered. The only drawback seems to be the fact that there won't be any more, since the locality was uncovered while excavating for condominiums at Incline Village in Lake Tahoe. I wonder what the basement apartments go for?

Jim McGlasson (*Collector's Stope*, 7387 S. Flower Street, Littleton, Colorado 80123) had a number of micromount-sized senarmontite crystals on stibnite crystals from the Dee mine, Elko County. This material was discovered by Larry McIntosh.

NEW HAMPSHIRE

Ken Hollman (P.O. Box 134, Rutland, Vermont 05736) has reported several occurrences of smoky quartz, microcline, albite and other minerals from the Conway area last summer, in addition to amethyst scepters from near Waterville, New Hampshire (see *Mineral News*, vol. 3, no. 11). Other New Hampshire finds include some very sharp 3–4 mm crystals of zircon and allanite-(Ce), that have been reported from a roadcut near Franklin.

NEW MEXICO

Ray De Mark (6509 Dodd Place NE, Albuquerque, New Mexico 87110) has been mining the Blanchard claims near Bingham, and finding lots of interesting and very fine specimens. Among these are large, cubic, purple fluorite crystals up to 8 cm on snow-white quartz, associated with equally large crystals of galena. Among the larger specimens found are some clear gypsum crystals over 40 cm long. There have also been a number of anglesite pseudomorphs after galena and linarite-coated galena cubes up to 5 cm found. Other interesting species being recovered include plattnerite, murdochite, caledonite and attractive micros of antlerite with spangolite, in addition to a probable new mineral presently under investigation.

Al and Betty Tlush (*Carousel Gems and Minerals*, 1202 Perion Drive, Belen, New Mexico 87002) had some unusual new quartz crystals available at the Denver Gem and Mineral Show. These crystals appear to have formed in cavities in a volcanic rock, are of a pale amethystine color and vary from 4 to 8 cm in length. The rhombohedral faces forming their terminations are typically cavernous or skeletal, and many have large, visible fluid inclusions with movable bubbles. A few show scepters. These crystals are being mined by Gerry Sullivan, and come from the Royal Scepter mine, Grant County.

There has been a new find of fluorite in Grant County. The crystals occur as green octahedrons up to 2 cm on a matrix of what appears to be an altered volcanic rock. Some specimens have a thin coating of white quartz. *Grenville Minerals* (P.O. Box 453, Kingston, Ontario, Canada K7L 4W5) has specimens available.

Jerry Clark recently acquired what is perhaps one of the most amazing native lead specimens in captivity! This unique piece consists of a 10 x 20 cm plate of branching "arms" completely covered by orange minium. The locality is the Wilson prospect, in Sierra County.

NEW YORK

There is a continuing supply of excellent quality Herkimer diamonds being collected at both the Middleville and Fonda locations. There have probably been more, better-quality Herkimers on the market over the last two years than ever before . . . perhaps some of the best ever. Kenneth Silvy (4 Mountview Road, Bath, New York 14810) and John Medici (7272 Macbeth Drive, Dublin, Ohio 43017) both have superb material available.

While there have apparently been no major finds elsewhere in the state, the Power's farm uvite locality at Pierrepont, St. Lawrence County, still yields occasional fine specimens to those collectors willing to work for them.

OREGON

Levyne has been collected in some of the best crystals to have been found in recent years at the quarry in Spray. The crystals form sharp, hexagonal plates and are not heavily coated with erionite.

PENNSYLVANIA

Don Smoley (3401 Churchview Avenue, Pittsburgh, Pennsylvania 15227) has found some outstanding micromounts of harmotome/phillipsite and barite. The harmotome/phillipsite crystals form very sharp, symmetrically developed twins up to 5 mm. The barites are transparent, have a vitreous luster, and a pale yellow tint. These minerals occur in nodules that weather out of shale along stream banks near Holidaysburg.

TEXAS

Les Cubit recently collected some outstanding micro crystals of uranophane and haiweeite (a new locality) from Valentine. Identification of the haiweeite has been confirmed by Paul Hlava of Sandia Labs, Albuquerque.

UTAH

John Seibel and Steve Rose (of *Sierra Contact Minerals*) recently recovered a lot of very good sulfate species from the Dexter #7 mine, Calf Mesa, San Rafael Swell. These occur both in a fault zone through a hard, pyritic sandstone and in post-mining rubble that has fallen near the portal and in the area parallel to the fault. Most of the better, larger crystals come from openings along the fault, though many smaller ones and much massive material have formed on the blocks in the rubble. Much of the material may have a post-mining paragenesis, but the overall quality of these unusual species is excellent. Most specimens have at least three or four of the following species present, and many are well-crystallized: coquimbite, halotrichite, romerite, voltaite, copiapite, ferricopiapite and melanterite of several types. Goldichite is rare, and is seen infrequently as singly terminated, lath-like prisms. Some specimens contain an unidentified azure-blue powdery mineral that is presently under investigation. This material is frequently associated with satiny white halotrichite and appears to change color with changes in relative humidity. The locality is one that "moves" every time there is a wet period, and presumably there will be sulfates of some sort available here for some time to come. Those attempting to collect here should wear dust masks and eye protection, as the dust can be more than irritating.

In addition to the Dexter mine sulfates, John and *Sierra Contact* have also recently mined some very good, bright green conichalcite from Gold Hill, and crystals of green grossular from Milford.

There were more of the fine, large gypsum crystals from Deep Creek Wash, near Caineville, Wayne County, to be seen at the Tucson show this year, but rumor has it that they may be the last of the better quality material that will be available.

Patrick Haynes has confirmed the occurrence of torbernite, uranophane and phurcalcite at the Posey mine in the White Canyon mining district of San Juan County. See *Mineral News* (vol. 3, no. 9) for details.

VIRGINIA

Dr. Lance Kearns of James Madison University, in cooperation with Dr. Richard Mitchell, Allan Penick and Bill Ginninne, recently collected what are perhaps the world's largest andalusite crystals in Campbell County. The crystals are typically blocky in habit and up to half a meter in length! Some are partially replaced by kyanite with or without paragonite. Drs. Kearns and Penick also report having recently collected good specimens of dufrenite, rockbridgeite, kidwellite and strengite from the Dixie mine in Rockbridge County.

WASHINGTON

Bart Cannon (1041 NE 100th Street, Seattle, Washington 98125) has found another new locality for the rare species armenite, and furthermore, in crystals! The locality is approximately 16 km northeast of North Bend, Washington County. The armenite forms small, clear-to-white glassy hexagonal crystals on matrix.

Part II: Canada

BRITISH COLUMBIA

It appears that the Rock Candy mine near Grand Forks may once again become an active specimen producer. This has been made possible through the cooperative efforts of Joe Nagel at the Geological Museum of the University of British Columbia, *Cominco, Ltd.*, and Bob Jackson (P.O. Box 2652, Renton, Washington 98056), the new owner of the property. All parties involved deserve the support and thanks of the mineral collecting community for keeping this important locality for fine barite and fluorite specimens active (see *Mineralogical Record*, vol. 12, p. 99–101). Further details regarding access, special projects and marketing of specimens are given in *Mineral News* (vol. 3, no. 12).

For the past few years, private collector Sid Baker (Monte Creek, British Columbia, Canada V0E 2M0) has been finding an impressive assemblage of zeolite minerals in the Kamloops group of Tertiary basalts around Monte Creek, Kamloops district. Some very good specimens of both common and uncommon species have been found, including ferrierite, heulandite, mordenite, natrolite, stilbite, offretite, apophyllite, levyne, cowlesite, chabazite, phillipsite, analcime, erionite, paulingite and thomsonite. Associated with some of these are lustrous brown hemispheres of siderite and aragonite, which also make attractive specimens.

Some very fine Japan-law quartz twins were collected last summer by David Joyce (*Northern Crystals*, 386 Park Avenue, Newmarket, Ontario, Canada L3Y 1V5), Brad Wilson (*Grenville Minerals*) and D. Van Dieren from a skarn deposit on Foley Mountain, near Hope. The best of these rival their Japanese counterparts as 10-cm, water-clear crystals. Some crystals have various amphibole and sulfide inclusions, and are associated with microcline, calcite, and goethite pseudomorphs after siderite (?). A few sceptered crystals were also found, along with one very unusual Japan-law twin with sceptered crystals!

MANITOBA

The Stall Lake mine, near Snow Lake, is not usually considered among the top specimen-producing localities in Canada. In fact, until recently, only a few rather mediocre garnet crystals have been found. As with any working mine, however, one never knows what the next blast might unearth. Last year some exceptionally well-formed crystals of cordierite were obtained by Rod Tyson (10529 133rd Street, Edmonton, Alberta, Canada T5N 2A4). The largest of these is an impressive 21-cm, doubly terminated, blue-gray crystal in quartz. So far there have been very few specimens recovered, but who knows that the future holds?

NORTHWEST TERRITORIES

Thanks to the cooperation of *Strathcona Minerals,* Rod Tyson has been able to provide a continuing supply of very fine pyrite specimens from the Nanisivik mine, which is located on the remote, western end of Baffin Island. The morphology of these crystals is mind-boggling, and is the result of the combined effects of epitaxy and pseudomorphic replacement of (twinned) marcasite crystals by pyrite. One totally new find, made by Fred Bailey of *Nanisivik Mines,* was an occurrence of pyrite pseudomorphs after pyrrhotite crystals. A few of these are very sharp, and clearly show the hexagonal symmetry of the pyrrhotite, but most are unfortunately associated with decomposing marcasite and do not appear to be stable.

Joe Nagel reports a new occurrence of native silver from the Narsuk claim near Coppermine. The specimens consist of thickly intergrown, arborescent masses of millimeter-sized crystals in a white calcite matrix, and make quite attractive specimens after removing the calcite with dilute acid.

ONTARIO

The Grenville metasediments of Renfrew County have provided collectors with fine specimens of titanite, zircon and apatite for nearly a century. Last year construction on highway 515 approximately 4.5 km south of Foymount, near Yukes Lake, uncovered a calcite vein-dike that yielded a number of very good zircon crystals, some of which are up to 10 cm in length. Associated species include fluorapatite, titanite, microcline and pyroxene crystals. Good specimens of titanite, microcline, zircon and fluorapatite were also collected at the nearby Smart mine, in Lot 31, Concession X, Sebastopol Township. Some individual crystals of microcline up to 10 kg have been found. An article on this area appeared in the *Mineralogical Record* (vol. 13, p. 209–213).

QUEBEC

There are a number of new mineral discoveries to report from Quebec. The now-famous Poudrette quarry on Mont St-Hilaire has once again yielded a number of new, exciting finds over the past year, and once again, the majority of these were made by dedicated local collectors Gilles Haineault (*Collection Haineault,* 2266 St-Alexandre, Longueuil, Quebec, Canada J4J 3T9) and Laszlo Horvath (*Monteregian Minerals,* P.O. Box 2096, Dorval, Quebec, Canada H9S 3K7). Among some of these discoveries were more bright orange-pink crystals of serandite with acmite, dark and lustrous prismatic crystals of smoky quartz, large free-standing crystals of carletonite up to 5 cm, 3-cm crystals of leucophanite and donnayite crystals of equal size that look more like pale yellow weloganites from the Francon quarry! In fact, these "donnayites" are complexly zoned, and appear to have cores of actual weloganite, rimmed by strontianite and a "donnayite-like" mineral, which is enriched in rare earth elements. Other species noted from the locality for the first time this year include: carbocernaite (formerly UK #40) which occurs as tiny, irregular yellow grains in cavities in the igneous breccia; hypersthene, which was found as gray-green to brown prisms up to 2 mm in hornfels; corundum, also found in the hornfels as small, granular light brown masses in fine-grained albite; erythrite, which was found as a pale purple crust of tiny crystals in pegmatite; dravite, which occurs as very dark brown prisms up to 2 cm in hornfels; spertiniite, which was found as tiny blue blebs on a copper sulfide mineral in sodalite xenoliths; and gobbinsite, which occurs as steep, spike-like tetragonal pyramids up to 2 mm across, associated with serandite and tetranatrolite in cavities in sodalite syenite. A few good specimens of monteregianite-(Y), ilmenite, catapleiite and bright green dolomite with anatase were also found, as were numerous specimens of the more commonly encountered species like analcime, siderite, natrolite and albite.

While there has been very little specimen production at Asbestos over the last two years, the mines further north in the Thetford area have produced a few specimens of calcite, apophyllite and hydromagnesite (*Mineral News,* vol. 3, no. 11).

Recent collecting at the Lac Nicolet antimony mine, in South Ham Township, Wolfe County, by both *Grenville Minerals* and the National Museum of Natural Sciences, Ottawa, has produced some of the finest kermesite, valentinite and native antimony specimens ever found in North America. A few specimens contain valentinite crystals up to a centimeter long, and kermesite sprays up to 3 cm in length. A very few specimens of native antimony crystals were also found as millimeter-sized crystals lining vugs in massive antimony. Most all the specimens exhibit various combinations of valentinite and kermesite with small, radial sprays of stibnite and quartz, which make exceptionally attractive micromounts. An article on this classic Canadian locality is currently in preparation.

A number of both working and abandoned traprock quarries in the Drummondville area have produced some reasonably good specimens of quartz (some amethyst), calcite, datolite and prehnite. These minerals occur in pockets between pillows in the basalt. Nearly all the quarries in the area contain some evidence of such mineralization, particularly those near Saint-Cyrille and south of Saint-Wenceslas.

Some very good specimens of tremolite/actinolite have been collected from a new roadcut on Saint-Andrews road near Cantley. The crystals have sharp terminations, and form lustrous, tabular prisms up to 10 cm long. Matrix specimens up to 25 cm across have been collected. Associated minerals include diopside, titanite and microcline. At another nearby roadcut on highway 366 near the west end of McGregor Lake, some good crystals of albite were found associated with tremolite. Lastly, in the same general area near Wilson's Corners, Michel Perreault (BG No. 55, RR No. 2, Wakefield, Quebec, Canada J0X 3G0) collected some very well-formed diopside and phlogopite crystals up to about 7 x 10 cm.

There has been a continuing supply of fluorapatite in calcite from the Yates mine near Otter Lake. Despite heavy collecting by literally hundreds of collectors throughout the year, the locality is still producing good specimens, as demonstrated by the selection available from *Grenville Minerals* at the Tucson show. (See the article in *Mineralogical Record,* vol. 12, p. 359–363.)

The Parker mine near Notre-Dame-du-Laus is presently under claim by Michel Perreault, who collected some very fine clusters of spinel and forsterite crystals last year. The spinel crystals form sharp, shiny black octahedrons, often modified by dodecahedral faces, and are intimately associated with brown-green crystals of forsterite and phlogopite. Most of the spinel crystals average about a centimeter across, though a few approaching 4 cm have been found. Most of the forsterites tend to be friable and partially replaced by serpentine. Nevertheless, they do show excellent morphology, and make desirable specimens, considering their average size of 3 to 5 cm. *Grenville Minerals* has already marketed most of the first specimens to have been produced, but hopefully Michel will be mining more in the future.

Because of the renewed interest in zirconium and the rare earth elements, there has been a corresponding renewal of interest in the Kipawa complex of alkalic rocks in Timiskaming County. Geological exploration in the area last fall resulted in the discovery of what is probably the largest and best specimens of vlasovite ever found. These consist of pure, glassy, pale brown-to-yellow masses up to 10 cm across in syenite. Some of the vlasovite is altered to a white, powdery phase, particularly along fracture planes, that appears to be a mixture of apophyllite, gaidonnayite, gittinsite and quartz. Many rich, smaller pieces of vlasovite were also found, and are available to collectors through *Cureton Mineral Company* (P.O. Box 5761, Tucson, Arizona 85703). In addition to the vlasovite, some rather impressive terminated crystals of brick-red thorite up to 7 cm were also collected. Good specimens of eudialyte, agrellite, zircon, mosandrite and hiortdahlite were abundant. This collecting was made possible only by special, advance permission granted to the Geological Survey of Canada and the National Museum of Natural Sciences by *Unocal Canada, Limited,* which currently controls the property. Collecting by the general public is presently not permitted.

YUKON

There is a continuing supply of excellent phosphate minerals available from the Rapid Creek–Big Fish River area. Perhaps the most recent of this material is available from Michel Brunet (6105 Honfleur, St-Leonard, Montreal, Quebec, Canada H1P 1N5), and includes some very fine specimens of lazulite, whiteite and ludlamite, as well as most of the other species from the area.

Part III: Other World Occurrences

ARGENTINA

Jorge Alfonso Alba (Nunes del Predo 742, Andagala, Catamarca, Argentina) has reopened the famous rhodochrosite locality near Catamarca. Many gem-quality stalactites which have been eagerly sought by both collectors and lapidaries have been produced. The venture is a family operation.

AUSTRALIA

Good specimens of native bismuth and molybdenite from Wolfram Camp, Queensland, were available from Dehne McLaughlin (22 Lanton Terrace, Moil, N.T. 5792, Australia) at the Tucson show.

BRAZIL

Although there are no major new discoveries of large, gem-quality tourmaline, beryl or topaz crystals to report as in years past, there certainly have been a number of smaller mineralogically interesting finds. Brazil has always been one of the best sources of collector-quality quartz crystals, and with the ever-growing popularity of that species, it has continued to supply quantities of very fine specimens. About three tons of clear quartz crystals were removed from a huge pocket at the Pedra Alta mine, near Conselheiro Pena, Minas Gerais. Many of these crystals are slightly tapered, and colorless to pale smoky in color. Alvaro Lucio had a good selection available at the Tucson show. Smoky quartz crystals of nearly every possible shape and habit from the Divino das Laranjeiras and Salinas areas were available from numerous dealers. Also from Salinas were more of the interesting, tabular, color-zoned beryl crystals. The crystals are typically shortened along [001] and have pink cores with pale blue rims. These were available from the *Rocksmiths* (Box 157, Tombstone, Arizona 85638), who also had some very fine, lustrous schorl crystals from Pedra Redonda, Minas Gerais. Rock Currier (*Jewel Tunnel Imports,* 1212 S. Mayflower Ave., Arcadia, California 91006) also had some interesting crystals of quartz with very complex terminations from Corinto, Minas Gerais. Probably the most significant of the recently found quartz specimens, however, is Rock's 25-cm Japan-law twin from Minas Gerais.

There were also some new rose quartz crystals found last summer at Taquaral, in Minas Gerais. Carlos Barbosa (Rua Cel. Roberto Soares Ferreira No. 586, Bairro Vila Bretas, 35030 Gov. Valadares, Minas Gerais, Brazil) and others had specimens available at the Tucson show. Some of these are associated with small, brown eosphorite crystals, roscherite and collinsite, and are much like earlier lots from this occurrence, which can only be worked in extremely dry seasons, because it is in a river bed.

Larry Conklin (17 St. John Place, New Canaan, Connecticut 06840) was fortunate to acquire a small lot of some most unusual quartz crystals from an undisclosed locality in Bahia (the miner who supplied the specimens suggested he would lose his job if he revealed the location). The small, clear crystals are doubly terminated and might be described as having amethyst "inclusions." Actually these consist of dark, royal-purple color zones concentrated near the centers of the crystals, often with a flame-like radial distribution of the deep purple color.

As a final note on quartz, there continues to be a good supply of very fine amethyst geodes available from Rio Grande do Sul.

Perhaps one of the finest individual specimens from Brazil to surface at the Tucson show was a single, superb, gem-quality aquamarine crystal about 15 cm long and of rich, blue color. This specimen is from a single small pocket found at the Cajiu mine, near Almenara, Minas Gerais, and was available from Pierre LaVille (P.O. Box 699, Station P, Toronto, Ontario, Canada M5S 2Y4). There were about a dozen other crystals from the pocket, but none as spectacular as the one described.

Some additional interesting discoveries, all of which are available from Carlos Barbosa, include lustrous, 3-mm crystals of schneiderhohnite with bright yellow sprays of karibibite from the Urucum mine, near Galileia, Minas Gerais; platy, hexagonal, purple-red crystals of gibbsite from Serro, Minas Gerais; acicular, white tufts of moraesite on quartz and muscovite crystals from Linopolis, Minas Gerais; and purple anhydrite from Brumado, Bahia. Perhaps Barbosa's best find, however, was a xenotime specimen from Sabinopolis. This remarkable specimen consisted of a "castle turret" of several dark brown, resinous, parallel growth terminations and a sharp, 2-cm, doubly terminated crystal nestled across the "turrets." The overall size of this specimen is 3.5 x 3.5 x 6 cm. Several more typical, malformed, light brown aggregates of xenotime were also available.

A young collector sharing Carlos's room had several very fine color-zoned blue-tipped green elbaite crystals from the Cruzeiro mine in Minas Gerais. Some of these have an attractive crystallized mica coating the base of the specimens. Individual crystals up to 8 cm were available. Additional noteworthy specimens included rutilated quartz crystals up to 12 cm from Ibitiara, Bahia, color-zoned blue and green elbaite from Barra de Salinas, some excellent red tourmalines from the Genipapo mine, Aracuai, and several large smoky quartz crystals.

BURMA

Every now and then there are a few collector-quality crystals that seem to find their way into lots of gem rough from the Mogok area. William Pinch (82 Kensington Court, Rochester, New York 14612) was fortunate to obtain a very fine 1.5-cm padparadscha corundum crystal last year. Bill also reports having seen some nice, dark red spinel crystals in marble from the same area over the last year.

CHINA

Each year there seems to be an increasing variety of mineral specimens available from China, along with an increasing number of dealers supplying them. There is a continuing supply of very fine cinnabar and stibnite crystals on the market, in addition to smaller lots of azurite and orpiment specimens. A few "newer" items evident at the Tucson show this year included realgar crystals, hematite "roses," aquamarine crystals (some with pink cores and blue rims), dolomite and fluorite. Unfortunately, many of these specimens are heavily damaged, but considering the tremendous upgrade in quality of cinnabars currently available, compared to some of the first ones to reach the Western market, there is at least some hope the same trend may prevail with the other species.

CZECHOSLOVAKIA

Probably one of the most significant new discoveries of the entire year is the suite of silver minerals from Kuber Schacht, Pribram, Bohemia, that have been recently described in both the *Mineralogical Record* (vol. 19, p. 116) and *Mineral News* (vol. 3, no. 9). However, there appears to be some confusion as to exactly what these specimens are, and how to label them. Unfortunately, there doesn't appear to

WEW

Figure 1. **Orpiment crystals with calcite, 11 cm across, from China. Edward Tripp specimen.**

be any clearcut answer. Simple tests that could normally be applied by most collectors such as specific gravity, streak, hardness, tenacity and crystal morphology tend to give ambiguous results due to overlap of these properties for the species in question. Nor do more sophisticated means of analysis clarify matters. A preliminary qualitative energy-dispersive microprobe analysis of two specimens labelled "dyscrasite" and "silver pseudomorph after dyscrasite" showed both to consist of several phases, including silver, possible dyscrasite or antimonian silver, and silver with variable amounts of mercury, suggesting an amalgam or possibly moschellandsbergite. There were also obvious areas of silver chloride present, probably leftover from calcite dissolution with HCl. All this on less than a square millimeter! Nevertheless, specimens like these from Pribram have not been available to North American collectors for several decades in spite of continued mining, and it is impossible to speculate on their future availability. Collectors interested in these specimens should perhaps adopt the philosophy "buy now and figure it out later."

Neil Hubbard (122 Cordery Road, Evington, Leicester, England LE5 6DF) has acquired some relatively large crystals (up to 2 mm) of the rare zeolite mineral, paulingite. Individual clear-to-milky white dodecahedra occur in cavities in basalt from Vinarice.

FRANCE

Victor Yount (Route 5, Box 188, Warrenton, Virginia 22186) reports there has been a small find of some rather nice sky-blue fluorite from Le Bure, Tarn. The crystals form cubes up to about 3 cm, and are associated with clear crystals of quartz. Both Victor and Frank Melanson (*Hawthorneden*, R.R. 1, Eldorado, Ontario, Canada K0K 1Y0) have had specimens available.

Alain Carion (92 Rue St.-Louis en l'Ile, 75004 Paris, France) had

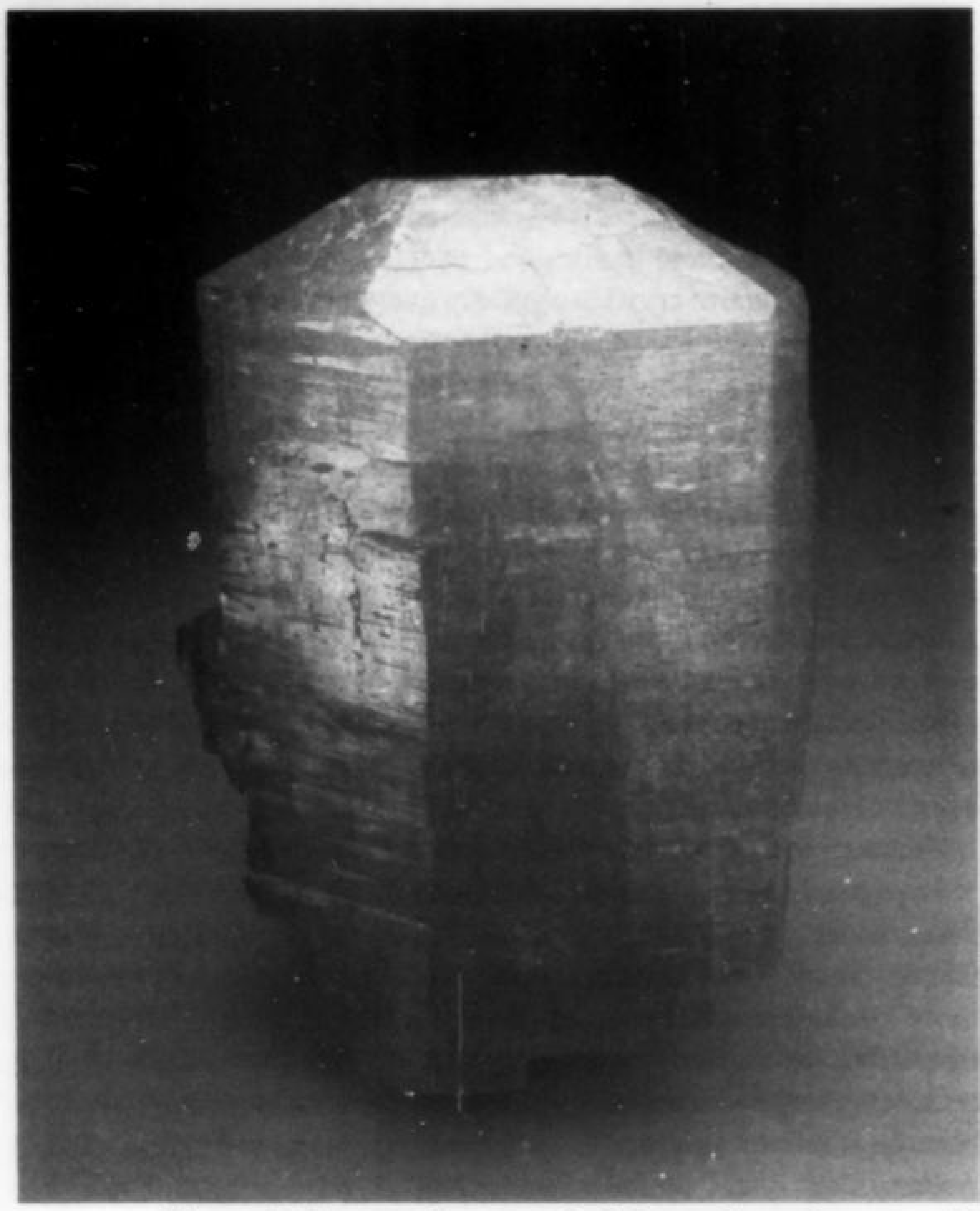


Figure 2. **Sturmanite crystal, 3.8 cm, from the N'Chwaning mine, Cape Province, South Africa. Rob Smith specimen.**

WEW

two new items of interest from France at the Tucson show: aragonite from Gergorie, and barite from Four La Brouque, Puy de Dome. The aragonite forms clear white sprays of acicular crystals up to about 1.5 cm on a gossan matrix, and the barite exists as sharp, very well formed, blocky, yellow-gray, single crystals up to about 8 cm.

Neil Hubbard has recently collected some interesting phillipsite and tacharanite from Espallion, Aveyrun. The phillipsite forms transparent 1–3 mm crystals coating large vugs in basalt. Cottony, snow-white tacharanite botryoids to 5 mm occur on the phillipsite.

GREAT BRITAIN

Neil Hubbard has been extraordinarily active and has found many good things for micromounters. The Gravel Hill quarry, Perranporth, Cornwall, has produced a large suite of iron phosphates, including acicular, tan, terminated, 1–2 mm ferrostrunzite crystals with sharply terminated, black to green, 1–3 mm crystals of beraunite. The orange to red, completely oxidized variety of beraunite ("eleonorite") is also found in certain parts of the quarry, as gemmy micro crystals coating resinous diadochite. Phosgenite has shown up in a variety of habits at several localities as heretofore unnoticed mirco crystals. Phosgenite comes from Wheal Penrose, Porthleven and Tregardock, St. Teath, both in Cornwall. Some additional rare minerals found in micro-sized specimens include tan, scaly crystals of waylandite from Wheal Phoenix, Liskeard, Cornwall; blue-green cornubite crystals on green, botryoidal cornwallite from Bedford United quarry, Tavistock, Cornwall; tiny cleavages of vesignieite from Bardon quarry, Coalville, Leicestershire; and several sharp hydrocerussite crystals from the Merehead quarry, East Cranmore, Somerset.

Neil has also obtained some interesting material from Wales and Scotland. Clear micro crystals of aragonite with anatase have been found at the Hendre quarry, Glyn-Ceiriog, Clwyd, Wales, as have fine micro linarite crystals at the Eaglebook quarry, at Nantymoch, Dyfed, excellent micro dickite crystals on quartz crystals from Pant-y-gaseg, Trwynbychan, Anglesey, and sharp, gray, twinned "bipyramids" of witherite from the Pen-y-Clun quarry, Llanidloes, Dyfed. In Scotland, the Loanhead quarry near Beith, in Strathclyde has produced some very exciting micros of transparent, golden orange-brown grossular crystals.

GREECE

There is a continuing supply of tapered, green, prismatic quartz crystals from Mega Xhorio, Seriphos. Gilbert Gauthier (7 Avenue Alexandre III, Maisons-Laffitte, France 78600) mined the material originally along with a Greek engineer friend. Most of the tapered, cigar-shaped crystals were found loose in pockets, with almost no point of attachment. A new discovery includes some crystals that are part amethyst and part translucent milky crystals, along with the more familiar green crystals, some of which have orange tips, due to inclusions of an iron mineral. Some very good andradite and hedenbergite crystals have also been found. Both Gilbert and *Galas Minerals* (1419 N. Commons Road, Turlock, California 95380) had some very good specimens available at the Tucson show.

Frank Melanson reported obtaining a very good dark purple amethyst specimen from Drama, in northeast Greece. The crystals are about 4 cm in size, and resemble those from Due West, South Carolina.

ICELAND

Dr. Carl Francis of Harvard University has reported a new locality for epistilbite at Skardscheidi, Bogarfjardur.

ITALY

Micro minerals are being found in considerable supply in Italy. Two new finds worthy of mention are the orange to brown anatase crystals from Bregaceto, Genoa, Liguria, and the beautiful green epidote from Laso Palino, Piemonte. In addition, there have been more of the outstanding, large anhydrite crystals from Boccheggiano, Tuscany, seen on the market over the last year. Plates of superb 3–4 cm crystals, sometimes associated with calcite, galena, quartz and sphalerite have been seen.

MADAGASCAR

Bob Jenkins (*The Adit*) and Montreal collector, Dr. Donald Doell, were able to acquire a small lot of rhodizite crystals from Ibity Mountain (Mount Bity?), Antsirabe, at the Tucson show.

Also evident at Tucson was a continuing supply of the beautiful celestine geodes from Sakoany, Majunga. Paul Obeniche (1 rue Paul Cezanne, 75008 Paris, France) had some very fine specimens, but is uncertain just how long the supply will last. Apparently, the contract miners were paid a bonus based on weight of production, and as a result, many lower quality (denser) geodes were collected. Hopefully priorities will change.

Gilbert Gauthier has obtained more of the exceptional zircons from Tranomaro. The largest of these is 5 cm long.

MEXICO

John Whitmire (2383 Olivia Avenue, Yuma, Arizona 85365) had some new quartz crystals from Cananea, Sonora, at the Tucson show. For the most part, these are very clean, water-clear, tapered crystals 5–8 cm long.

David Shannon reports having recently collected some unusual cristobalite from Obregon, Sonora. The specimens consist of centimeter-sized orange spherules in matrix.

Jim Kaufman (*Jim's Gems*, 1581 Route 23, Wayne, New Jersey 07470) had a supply of some new, bright orange calcite, which has been sought by both mineral collectors and lapidaries alike. Unfortunately, the real locality for this material is known only to the miners who collect it, with virtually every northern border province having been suggested as its source.

MOROCCO

Alain Carion had some interesting new material from Morocco at the Tucson show. These minerals are from a fluorite mine at El Hamman, and include green, purple and blue fluorite cubes up to about 3 cm, associated with calcite, quartz, pyrite and chalcopyrite in various pleasing combinations. Alain also had a number of interesting pseudomorphs from the same locality, such as pyrite after pyrrhotite and goethite after anhydrite, among others. There was a good selection of ferruginous quartz and amethyst geodes with goethite crystals from Tichka available at Alain's booth, too.

NAMIBIA

Tsumeb is continuing to produce some very nice things. Last May, there was a very good lot of dioptase crystals found on the 30th level, and in November, some very nice, large groups of rhombohedral calcite crystals and a very unusual plumbian aragonite specimen were found. The aragonite is unlike most others from Tsumeb, in that the crystals have rather short prisms, and thus look more like the commonly seen twinned cerussites than aragonite. The overall dimensions of the specimen are approximately 15 by 15 cm, with individual crystals about 2 cm. In December, some very large (7 cm) tennantite crystals were found on the 37th level. Also near the end of the year, some very good azurite crystals and specimens of azurite with malachite were recovered. All these and others were available from Julius and Miriam Zweibel (*Mineral Kingdom*, 812 N. Ocean Blvd., Suite 204, Pompano Beach, Florida 33062) at the Tucson show.

Bill Pinch reports that there is a continuing supply of good epidote crystals available from Rehoboth, in addition to some new aquamarine crystals with tourmaline inclusions from the Erongo Mountains.

NEW ZEALAND

Micromounters have been excited to see the new lepidocrocite crystals from Para Para, Golden Bay, South Island. While perhaps not as good as the old time German specimens, they represent a species that is rarely seen in crystals.

PAKISTAN

There continues to be a good supply of very fine elbaite specimens from Gilgit division available on the market, along with good aquamarines, spessartines, and epidotes, though it is difficult to know just how much is really new. Sharon Cisneros (*Mineralogical Research Co.*) had a lot of new green fluorite crystals from Gilgit division, at the Denver show. These are predominantly octahedral in habit, and are similar in color to the Westmoreland, New Hampshire, material. Perhaps the most significant of the new finds from Pakistan, however, is what is most assuredly the world's largest crystal of pollucite. This specimen consists of an 8 x 8 cm trapezohedral crystal modified by cube faces which was recently obtained by Herb Obodda (Box 51, Short Hills, New Jersey 07078) and now resides in the collection of the Sorbonne in Paris. The exact locality is not known, but is presumably in Gilgit division. Several smaller crystals are known.

PERU

While there is certainly not the quantity of new material available from Peru as there has been in the recent past, a few small lots of good pyrite, quartz, chalcopyrite and other minerals continue to turn up here and there. Bill Pinch recently obtained a terminated 3-cm crystal of pyrargyrite from Millotingo in one such lot.

Rock Currier reports collecting a 2-cm manganaxinite crystal off the dumps at Pachipaque near Huanzala. The bladed rhodonite crystals from there are reported to be nearly as good as the bladed micro crystals from Franklin, New Jersey.

ROMANIA

There are still some very good stibnite and barite specimens trickling out of the Baia Sprie area in a somewhat slow, but continual supply.

SOUTH AFRICA

From the N'Chwaning mine, there have been more very good sugilite crystals and some large, amber-brown crystals of sturmanite up to 5 cm in diameter. These were available from Don Knowles (*Golden Minerals,* 13030 West 6th Place, Golden, Colorado 80401) at the Denver show, and Rob Smith (*African Gems and Minerals,* 404 Silbro House, 225 Jeppe Street, Johannesburg, South Africa) and several other dealers at the Tucson show. The Wessels mine near Kuruman has also produced some interesting, pale pink scalenohedral rhodochrosite. The etched crystals are translucent and measure up to several centimeters. Minute, acicular crystals of gageite have been noted on the matrix of some specimens.

S. T. D. Minerals (22 Spring Hill Road, Hyde Park, Massachusetts 02136) has been actively importing minerals from South Africa. Some recent acquisitions include some of the finest chondrodite crystals to be seen since production ceased at the famous Tilly Foster mine, in southern New York. While perhaps not as large as the Tilly Foster crystals, the quality is every bit as good, and the associate species are strikingly similar. These new specimens are from the Phalabora mine, Transvaal, and consist of 5-mm transparent orange chondrodite crystals associated with sharp rosettes of clinochore and magnetite crystals. Many superb micromount specimens were produced.

Dr. Mark Feinglos of Durham, North Carolina, reports finding a new specimen of the rare platinum mineral, genkinite, from the 330 level of the Onverwach mine in the Lydenberg district, Transvaal. Mark's keen eye and comprehensive knowledge of the ore minerals prompted his interest to have the platy, metallic gray crystals on his specimen checked out by microprobe analysis, which confirmed their identity. Genkinite is an exceedingly rare species, having originally been described from a single specimen in the William Pinch collection (*Canadian Mineralogist,* vol. 15, p. 389–392).

SPAIN

Victor Yount reports that some very good cassiterite crystals similar to those from Schlaggenwld, Bohemia, have been found at Orense. The crystals are up to about 2 cm in size, and are available from Jesus Talaban in Madrid. Victor also has a few new aragonite twins from near Minglanilla. These are a bit different in habit than previous ones, as they tend to form balls of crystals that radiate outward from the middle of a larger, dominant, central crystal.

SRI LANKA

With the discovery of gem-quality sillimanite crystals in the gem gravels near Ratnapura, collectors have begun paying closer attention to these deposits as a potential source of both mineral specimens and unusual gemstones. Herb Obodda recently acquired two such interesting gemstones of the rock-forming silicates: colorless cordierite in stones up to 10 carats and colorless to pale tan enstatite in stones up to 5 carats.

SWITZERLAND

There is a continuing supply of small, but good smoky quartz specimens along with the occasional pink fluorite and eisenrose from the alpine localities near Cavradi and Grimsel Pass. Frank Melanson was able to acquire good crystals of quartz from a number of localities showing fenster, faden and gwindel habits.

U.S.S.R.

Bryan and Kathryn Lees (*Collector's Edge,* 402 Gladiola Street, Golden, Colorado 80401) had an interesting selection of Siberian gold specimens available at the Denver show last September. These consist chiefly of thumbnail to miniature sized nuggets, some of which show crude octahedral faces.

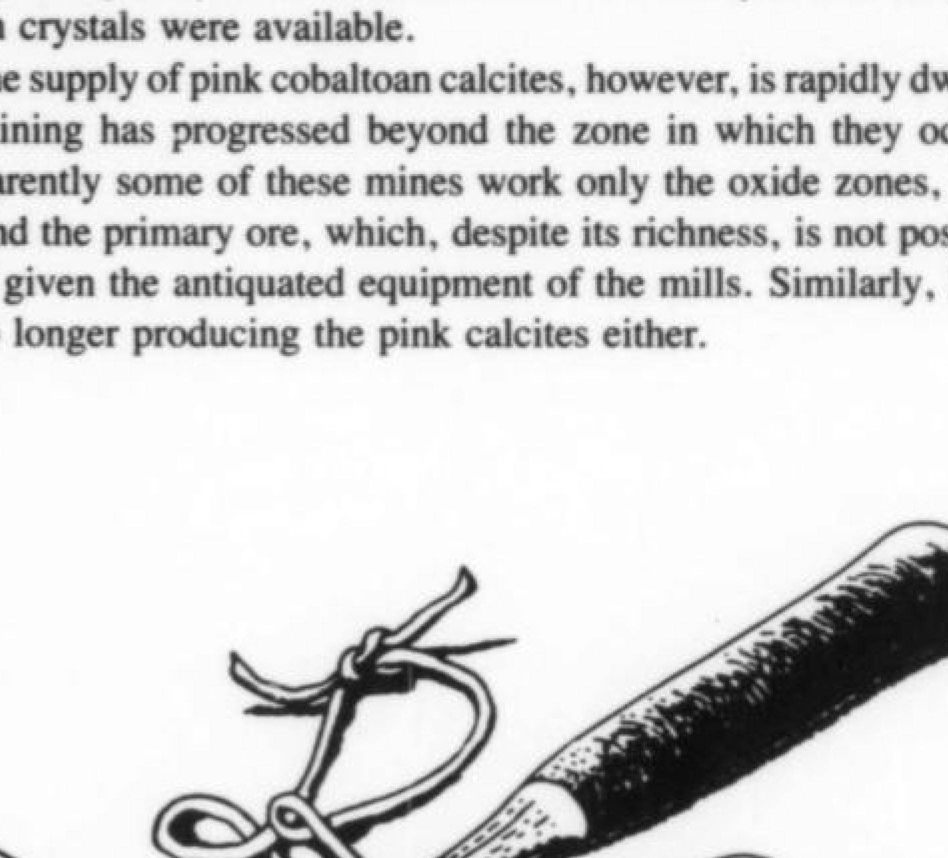
YUGOSLAVIA

There were more very fine Trepča specimens to be had at the Tucson show last February. Keith B. Christy (P.O. Box 22551, Billings, Montana 59104) and Ted Parkevich (4244 Mayflower Blvd., Whitehall, Ohio 43213) had some excellent specimens.

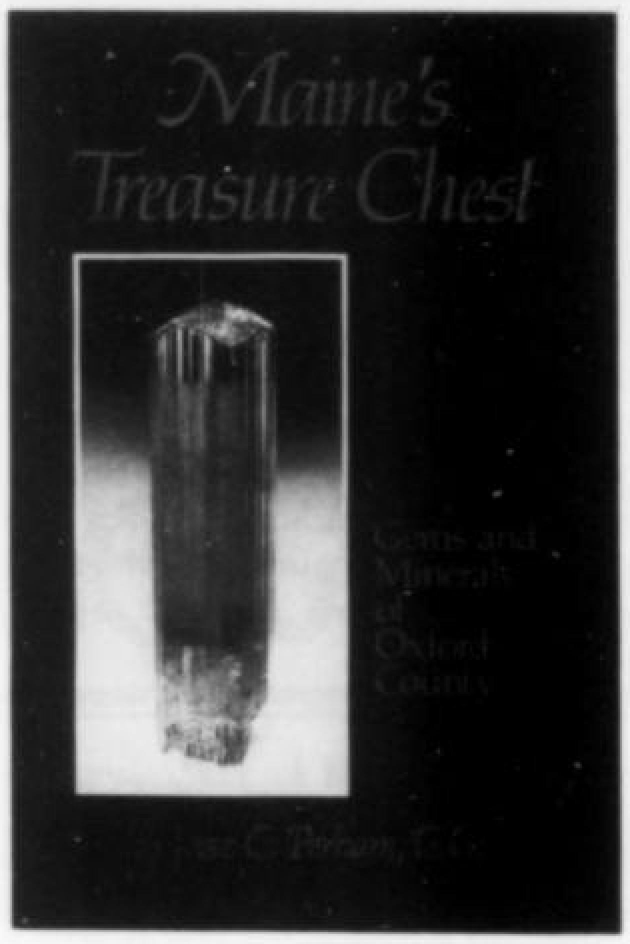
ZAIRE

Gilbert Gauthier has continued to supply some exceptional single crystals of malachite on chrysocolla from the Mashamba West mine in Mashamba. The crystals are very sharp, and up to a centimeter in size. Also from Mashamba West, Gilbert acquired what is probably the best find ever of the rare mineral vesignieite. Hand-specimens nearly completely covered with 0.4–1.0 cm botryoids of dark olive-green crystals were available.

The supply of pink cobaltoan calcites, however, is rapidly dwindling as mining has progressed beyond the zone in which they occurred. Apparently some of these mines work only the oxide zones, leaving behind the primary ore, which, despite its richness, is not possible to treat given the antiquated equipment of the mills. Similarly, Mupine is no longer producing the pink calcites either.



Book Reviews



Maine's Treasure Chest: Gems and Minerals of Oxford County

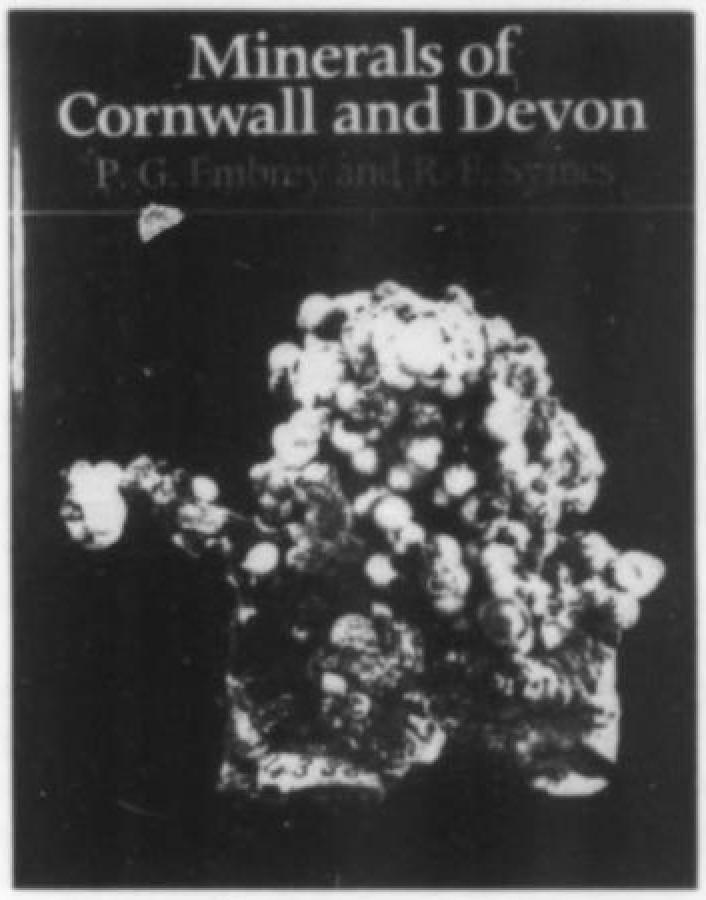
by Jane C. Perham (1987), published by Quicksilver Publications, West Paris, Maine. Available from Mineralogical Record Bookstore, 1601 Fairview Dr., Suite C, Carson City, NV 89701; Softcover, 269 pages, $18 postpaid.

People who *use* books, as opposed to those who just collect them, know that later editions usually improve upon the first. This is certainly the case with Jane Perham's collecting/mining history of Oxford County pegmatites. The first edition of *Maine's Treasure Chest* appeared just two months prior to the August 1972 discovery of the gem tourmaline bonanza at Newry. For the author, the euphoria over Maine's single most important mineral find must have been tempered with a measure of frustration! The new edition has more text, much of it devoted to the Newry find, but other sections have been revised as well. The discussion of Mount Mica, America's first tourmaline mine, includes new information. The biographical sketch of the writer's father, Stanley Perham (1907–1973), a beloved central figure in Maine mineral circles, is more complete but remains understated. A signature of two dozen color photographs is a welcome addition and the clarity of the black and white photographs is substantially better. The book is not without errors—it's most serious problem is its lack of professional editing. However, Perham writes with sincerity and a lack of pretention. The book competently surveys nineteenth century mineral activities but I value it most for its record of the recent past which is not readily accessible elsewhere. Having digested this second addition, I'm already looking forward to the third!

Carl A. Francis
Harvard Mineralogical Museum
Cambridge, Massachusetts

Minerals of Cornwall and Devon

by P. G. Embrey and R. F. Symes (1987) published jointly by the British Museum (Natural History) and Mineralogical Record Inc.; available from the Mineralogical Record Bookstore, 1601 Fairview Dr., Suite C, Carson City, NV 89702; Hardcover, 154 pages, 9 x 11 inches, $32 postpaid.



This surpasses anything that has been published on the minerals of Cornwall and Devon. That which follows will amply demonstrate the fact that it is a magnificent work. This is not to be wondered at when it is a appreciated that both workers were colleagues in the Mineralogical Department of the British Museum (Natural History) where a wonderful collection of choice mineral specimens from Cornwall and Devon is housed. In addition, the authors have a long acquaintance with the mining fields of southwestern England, particularly their geological and mineralogical character, and with the ancient and modern methods employed to exploit their mineral wealth. For a long time they have also assiduously researched the major collectors and mineral dealers whose activities have been largely responsible for the preservation of those beautiful specimens whose photographs, in color, adorn the pages of the work under review, and for that of many other specimens in many museums of the world.

Not surprisingly, *Minerals of Cornwall and Devon* is far from being a collection of excellent photographs of minerals set in a matrix of rather gray, matter-of-fact mineralogical details. Its lively construction is such that the minerals seem to acquire a vital quality. One becomes aware of the nature of their birth, where they were born and who were their mineralogical neighbors. One learns of those who uprooted them and of those who acquired them, and of those who sold them. One is also provided with the means of discovering much more about all these topics and related ones.

In more detail the structure of the book is as follows:

Chapter 1. The geology of south-west England

A very readable account of the general geology of the region, followed by an excellent potted version, albeit in parts a controversial one, of the mineralization. This chapter, in common with the following two, is graced by well-chosen illustrations.

Chapter 2. The mines and mining

The chapter opens with a potted history of the mining and beneficiation methods employed in southwestern England. Then follow brief notes on some of the more famous mines and interesting specimen localities in each of the five mining areas considered in the text. The maps and photographs in this successful chapter greatly facilitate appreciation of the written word which, because of the magnitude of the subject, must have been very difficult to write.

Chapter 3. Collectors and dealers

Hitherto a largely neglected topic, but one that is full of interest as presented by the authors who have researched the subject in great detail.

Chapter 4. The minerals

This chapter consists of 75 magnificent photographs, in color, of hand specimens. All but seven of the subjects are in the British Museum (Natural History); the remainder are housed in the County Museum, Truro. Each photograph is accompanied by a very informative caption. The presentation is marred somewhat by the fact that five of the most spectacular photographs occupy double pages.

Following chapter 4 is a list of more than 1100 references (with annotations and selective bibliography) which largely relate to the minerals, mines or geology of the Southwest: a few are concerned with collectors and dealers. This excellent compilation will prove to be a marvellous aid to any wishing to probe to greater depth any of the topics mentioned in the book under review.

Finally an excellent index is presented.

Beyond doubt, *Minerals of Cornwall and Devon* is a major addition to the literature that is concerned with mineralogy and related subjects. It is a scholarly work that is both easy and entertaining to read. It can be recommended, without reservation, to all who have an interest in mineralogy and associated fields and not solely to those concerned with southwestern England.

That this publication, an amalgam of much knowledge and beauty, can be acquired at such a modest price, is little short of the miraculous.

Dr. K.F.G. Hosking
Camborne School of Mines

(Reprinted by permission from *Rock Bottom*, no. 4, Spring 1988.)

Recent European Publications

by **Michael O'Donoghue**
Curator of Earth Sciences
The British Library
9 Kean Street, London WC2B 4AT

Erz- und Minerallagerstätten des mittleren Schwarzwaldes, *by M. Bliedtner and M. Martin. Geologisch Landesamt Baden-Wurttemberg, Freiburg im Breisgau, 1986, 782 p. Illustrated in black-and-white. Price DM117.*

A most exhaustive book covering the extensive mineral deposits of the central Black Forest region of West Germany. About 3500 mineralized veins can be found in an area of about 3500 square kilometers between Offenburg and Freudenstadt in the north and Freiburg and Donaueschingen in the south. Details of mining history are given in introductory chapters together with notes on mine engineering. Maps and mine plans are given for all major sites.

La Sardegna e i Suoi Minerali, *by A. Pietracaprina and G. Brizzi. Editrice Mediterranea, 07100 Sassari, Italy. pp. 265. Illustrated in color.*

Sardinian minerals are described and illustrated in alphabetical order and there are useful maps. The standard of illustration is very high, some pictures being full-page. There is a mineral identification table and a useful bibliography. Some details of early mining history are given.

Mineralogie, *by Siegfried Matthes. Second, revised edition. Springer, Berlin (1987), xvii + 444 p. Illustrated in black-and-white. DM69.*

This most useful and welcome book differs from the majority of mineral textbooks in that over half is devoted to mineral formation and occurrence. There is an excellent bibliography and the text figures are well-drawn.

Über die Erzlagerstatten des Harzes, *by Conrad Blömeke. Doris Bode Verlag, Dürnberg 2, D-4358 Haltern 4, West Germany (1986), 144 p.*

Only 500 copies of this fascinating reprint were published by the indefatigable Doris Bode [publisher of *Emser Hefte*]. The original work, on the ore deposits of the Harz Mountains, was published in 1885.

Silver from Kongsberg, *by Ole Johnsen. Doris Bode Verlag, Haltern, 1987. pp. 48. Illustrated in color. Available from Mineralogical Record Bookstore, 1601 Fairview Drive, Suite C, Carson City, NV 89701; $15 ppd.*

A short mining history and mineralogy of the famous silver deposits in Norway, which I can assure readers are well worth visiting. There is an excellent bibliography. The book is essentially similar to the article by the same author published in the *Mineralogical Record*'s Silver Issue, except for some illustrations.

Epidotfundstelle Knappenwand, *by Robert Seemann. Doris Bode Verlag, Haltern, (1987) (second edition), 48 p. Illustrated in color.*

One of the finest sites for epidote crystals is the Knappenwand area of the Untersulzbachtal in Austria. This is a short but well-written guide with fine pictures and an extensive bibliography. Essentially similar to the article by the same author published in the *Mineralogical Record*, **17**, 167–181.

Safirul si Rubinul, *by Octavian Birau, Anamaria Ciuhandu and Dorina Andru Vangheli. Editura Facla, Timisoara, (1986). Illustrated in black-and-white, 170 p., Lei 19.50.*

Yes, this is in Romanian and deals with the corundum gemstones. It deals almost entirely with corundum crystallography rather than with deposits but there is no other comprehensive treatise of modern date.

Caleidoscop Mineralogic *by Rodica Apostolescu. Editura Tecnica, Bucuresti, (1987), 246 p. Illustrated in color, Lei 22.50.*

We rarely hear of the minerals of Romania unless we scour Hintze or other early European mineralogies, but this small book gives a welcome indication of a possible opening up of the country in this context. Many of the colored pictures are of Romanian minerals.

Gems of the USSR *by J. P. Samsonov and A. P. Turingue. Nedra, Moscow (1984), 335 p. Illustrated in color, 4 roubles 90 kopecks.*

Though in Russian, the text is well lightened by tables and illustrations and the book is well worth getting. There is no detailed locality information but some sites are marked on fairly large-scale maps.

Pegmatitele din Carpatii Meridionali, *by H. P. Hann. Editura Academiei, Bucharest, (1987), 141 p., 21 photographs. Lei 14.*

Pegmatites from the southern Carpathians in Romania are commonly found through highly migmatized metamorphic terrains of the Sebes-Lotru group. The pegmatites have been investigated and results suggest the coexistence of several genetic types.

Metalogeneza asociată vulcanismului neogen din Nord-Vestul Muntilor Oas, *Editura Academiei, Bucharest (1986), 131 p., 40 photographs, 2 maps. Lei 16.*

The metallogenesis associated with the Neogene vulcanism is studied with reference to the northwestern section of the Oas Mountains, Romania.

Letters

ON CURATING

I was interested to read the article by Peter Embrey in the November-December issue ("Mineral Curators—Their Appointment and Duties") and I do agree that it should provide a sound foundation of professionalism for museum curators. It is good that the IMA has adopted the statement. May I draw to the notice of your readers two publications which help to flesh out Embrey's statement: the Museums Association's *Code of Conduct for Museum Curators* (Duggan *et al.*, 1984) and, of much more specific importance to geological curators, the book *Guidelines for the Curation of Geological Materials*, prepared for the Geological Society of London by the Geological Curators Group (Brunton, Besterman and Cooper, 1985). The introductory sections to each of the five chapters in this book (Acquisition, Documentation, Preservation, Occupational Hazards, and Uses) contain pertinent general recommendations for curators, while within the texts of these chapters are many pieces of vital information and guidance towards good, professional geological curation. While Embrey's article provides a framework, specific approaches by which good curation can be achieved are to be found in the *Guidelines*. This is a practical loose-leaf book, already proving of great value to geologist and non-geologist curators, and it is available from the Geological Society at only US $29.25 (or $16.50 for Fellows or members of the GCG).

Howard Brunton
Dept. of Palaeontology
British Museum (Natural History)

Send orders to the Publications Officer, the Geological Society, Burlington House, Piccadilly, London WIV OJU England; postage free on prepaid orders in dollars or pounds.

CROSS-REFERENCING

Every time I obtain a new specimen, I go through the *Mineralogical Record* and identify all the key references to that particular mineral and location. This information is then included on the back of the identification card. Thus, it is extremely easy to look up all *Mineralogical Record* references directly from the specimen card. By doing this with each and every specimen, I also tend to learn a great deal about specific minerals and their locations. This type of literature research has paid great dividends, and I recommend it to other serious collectors.

Prof. Marvin D. Rausch
University of Massachusetts

ROMANIAN MUSEUM

In the Appendix to Peter Bancroft's *Mineral Museums of Eastern Europe* (vol. 19, no. 1, p. 49) there are some question marks regarding the University of Babes-Bolyai in Cluj-Napoca, Romania. I have a friend in Cluj-Napoca, and he was kind enough to supply some information on the mineral museum there. It was started by Count Miko in 1868. The total collection consists of about 15,000 specimens, 5,700 of which are on public display. It is a general systematic collection arranged according to the Strunz classification.

Gary Danzer
White Sulphur Springs, NY

GOLD INCLUSION

What really caught my attention in the March-April issue was Royal Gould's letter describing a gold crystal inclusion in quartz. I may have seen that specimen for sale at Tucson about 5 years ago. The gold crystal looked like a dodecahedrally modified octahedron, and I may be mistaken but I remember the label said China Lake, California. It was offered for sale by Wright's Rock Shop for $500.

John I. Koivula
G.I.A., Santa Monica, CA

Sometime in the late 1950's I remember seeing one like he describes in the Ferry Building in San Francisco. I believe it was part of the California State Collection.

Don Knowles
Golden, CO

STEREO BY COMPUTER

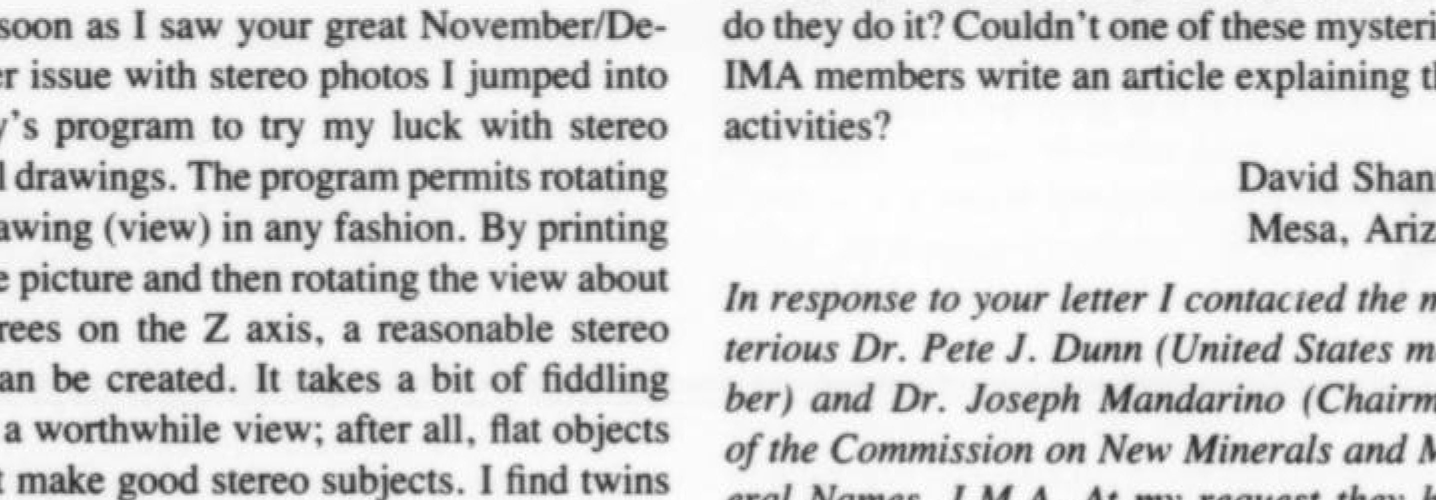
Last summer while attending the IMA general meeting at Stanford University I happened to see Tony Kampf demonstrating Eric Dowty's computer program "SHAPE" for drawing crystals. A trip to the Los Angeles County Natural History Museum to delve further into the program with Tony convinced me that I needed a copy. After a reasonable amount of correspondence with Dowty, I was off and running, relearning all that I had forgotten about crystallography but in a fun manner. I can say that Dowty's program ran with less initial problems than many I have bought from the big boys.

As soon as I saw your great November/December issue with stereo photos I jumped into Dowty's program to try my luck with stereo crystal drawings. The program permits rotating the drawing (view) in any fashion. By printing out the picture and then rotating the view about 8 degrees on the Z axis, a reasonable stereo pair can be created. It takes a bit of fiddling to get a worthwhile view; after all, flat objects do not make good stereo subjects. I find twins or views from an abnormal direction turn out the best.

Peter B. Nalle
Greenwich, CT

The enclosed stereo pair crystal drawing was prepared in about half an hour using SHAPE, modified by MACDRAW. It was printed on a dot-matrix printer; the results are even better with a laser printer.

↓ R. Peter Richards
Oberlin, Ohio



LOST LOCALITIES

I commend the *Mineralogical Record* for its policy of not accepting locality articles that fail to "pin-point" the location (vol. 17, p. 396). Being an avid field collector, I am frustrated by the number of otherwise high-quality journals which continue to perpetuate the problem of "lost localities" through the publication of blatantly inadequate locality data. It seems inconsistent to require full technical descriptive data for a species being described, while at the same time allowing locations to be reported as "near Fleabag Peak, Arizona." Physical constants can always be redetermined from the type specimens, but relocating the exact patch of ground where the mineral was found can prove impossible when the "location" given encompasses 50 square miles! This letter is an open plea to *all* editors and mineralogists to prevent the unnecessary introduction of "lost localities" into the literature.

Speaking of policing the literature, there is an organization called the International Mineralogical Association (IMA) which appears to be doing a fantastic job of keeping the science of mineralogy well organized, keeping mineral names straight, scrutinizing the validity of proposed new minerals, and so on. But who *are* these people, what exactly do they do, and why do they do it? Couldn't one of these mysterious IMA members write an article explaining their activities?

David Shannon
Mesa, Arizona

In response to your letter I contacted the mysterious Dr. Pete J. Dunn (United States member) and Dr. Joseph Mandarino (Chairman) of the Commission on New Minerals and Mineral Names, I.M.A. At my request they have kindly prepared exactly the article you suggested; it appears in this issue. Thank you for the idea! Ed.

SPANISH MINERALS

In your July-August 1987 "What's new in minerals?" Professor Curto i Mila reported on recent discoveries in Spain. This is very pleasing to see, although there were some errors. Motril is in Málaga, not Córdoba; and the scheelite crystals listed as coming from Bejar, Salamanca, are actually from Cáceres, in the Extremadura region.

Joaquin Delgado Gallardo
Seville, Spain

THE QUEST FOR COMPLETENESS

I subscribed to the *Mineralogical Record* about a year ago. It is such a beautiful and educational magazine that I started to buy back issues. To date, I lack seven issues to complete my set. They are expensive and scarce, but I hope to find them. Keep up the good work.

Ervin Deines
Dodge City, KS

We are always pleased to hear of complete sets being assembled. Having complete sets hardbound by a good bindery will help to assure that individual issues will not later be lost or stolen, and that the sets will be recognized as something worth saving by heirs and executors, who might otherwise throw away piles of loose magazines. Ed.

ERRATA

Page 180, Zeolites and Related Minerals from the Table Mountain Lava Flows, Near Golden, Colorado; D. E. Kile & P. J. Modreski: The five periods shown at the top of Table 8 are incorrectly positioned relative to the vertical columns. The corrected figure should show each period oriented directly over a vertical column, such that period one is situated on the far left (over phlogopite and limonite), period two is centered over the next (narrow) column showing first generation minerals, and periods three through five are centered over their respective columns.

D. E. Kile

In the special issue *Mineral Museums of Eastern Europe*, the location of the Ilmen State reservation is wrongly indicated on the map (p. 4); this reservation is near Miass (but not Miask as indicated in the Appendix, p. 50), South Ural. Also, the photo on page 38 shows L. V. Bulgak on the *left* and V. I. Stepanov on the *right*. Finally, the name of Professor A. A. Godovikov on page 36 is misspelled.

Dr. A. V. Voloshin

Ed. Note: Dr. Prof. Alexander A. Godovikov, Director of the Fersman Museum in Moscow, was recently honored by the naming of a new mineral species, godovikovite ($NH_4(Al,Fe)(SO_4)_2$), *which occurs in a coal mine at Kopeysk in the southern Ural Mountains. (Shcherbakova, E. P., Bazhenova, L. F., and Chesnokov, B. V. (1988)* Zapiski Vses. Min. Obshch., *p. 208–211.*

Our listing in the May-June issue, acknowledging organizations which have donated show table space to the Mineralogical Record, should also have included the New Haven Mineral Club. Their kind cooperation has allowed us to be represented at their show for many years.

G. Thomsen

the Ex-

Gallardo
, Spain

SS

d about
cational
ues. To
my set.
hope to

Deines
ity, KS

lete sets
s hard-
assure
lost or
ized as
ecutors,
of loose

als from
Golden,
ki: The
le 8 are
vertical
d show
vertical
d on the
, period
column
periods
heir re-

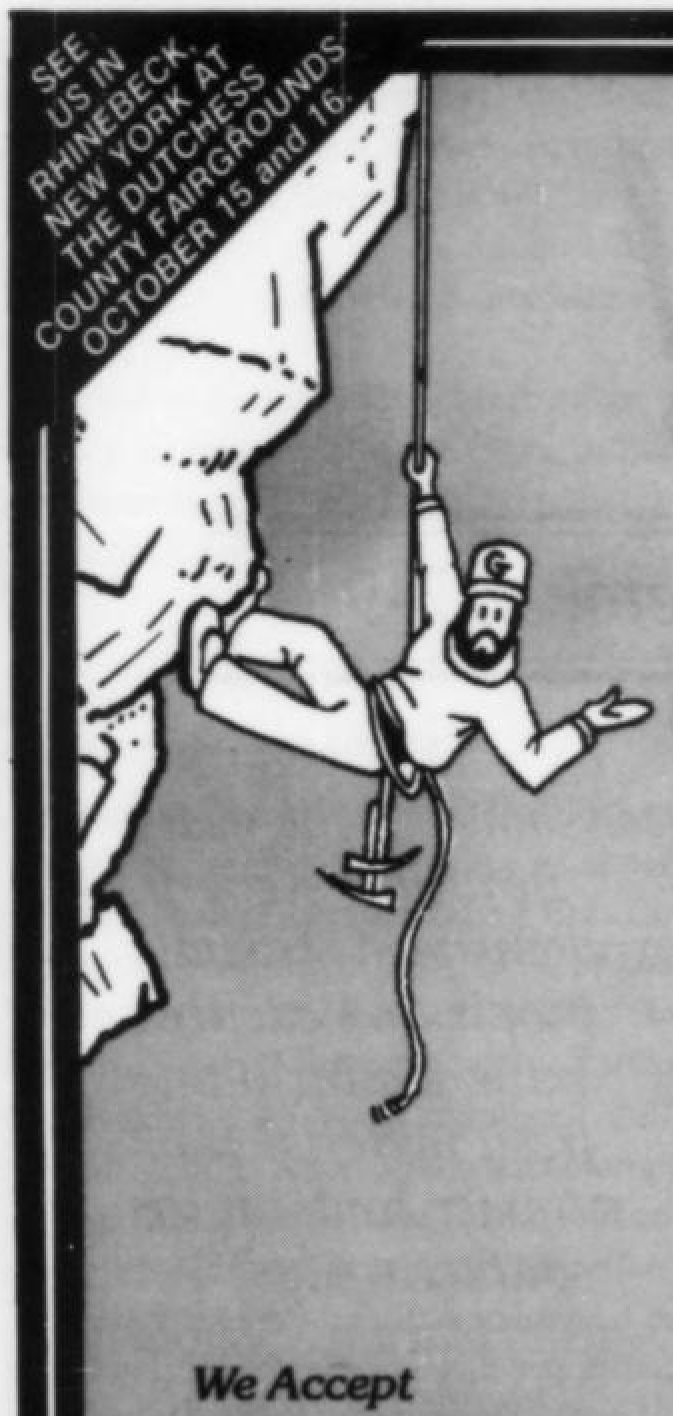
E. Kile

eums of
en State
the map
(but not
p. 50),
8 shows
anov on
essor A.
ed.
Voloshin

Godovi-
in Mos-
ing of a
$_4$(Al,Fe)
at Ko-
ntains.
F., and
es. Min.

cknowl-
ed show
, should
Mineral
owed us
y years.
homssen

tober, 1988



GIRDAUSKAS MINERALS
2 CLEVELAND DRIVE, POUGHKEEPSIE, N.Y. 12601, U.S.A.

Offering:
- Micromounts to Cabinet Specimens
- Rare and Common Species
- Mineral Books and Magazines
- Educational Sets (Including Fluorescents)
- FREE Monthly Listings

WANT LISTS WELCOME!

We Accept
VISA

SERVING COLLECTORS WORLDWIDE: Private Collectors, Schools, Museums

Cureton Mineral Company

We specialize in rare minerals, minerals from old classic locations, and meteorites. We have approximately 2,300 species in stock and welcome want lists of species and meteorites.

Inquiries are welcome and if you will write, we will send our most recent price list. Please indicate if you are interested in species or meteorites.

Appraisal services are provided for tax, insurance, and estate needs.

Forrest & Barbara Cureton

P.O. BOX 5761, TUCSON, ARIZONA 85703 •TELEPHONE 602-743-7239

8th Edition Standard Mineralogical Catalogue

This useful price reference guide aids you in establishing values of specimens/collections and aids in intelligent buying, selling, trading. Over 32,000 prices, evaluation hints, special sections and more. Absolute necessity for collectors, beginner to advanced. Thousands sold. $6.00 plus 75¢ shipping. Mineralogical Studies, 1145 Foxfire Road, Kernersville, NC 27284.

MONTEREGIAN MINERALS
MICROMINERALS AND RARE SPECIES

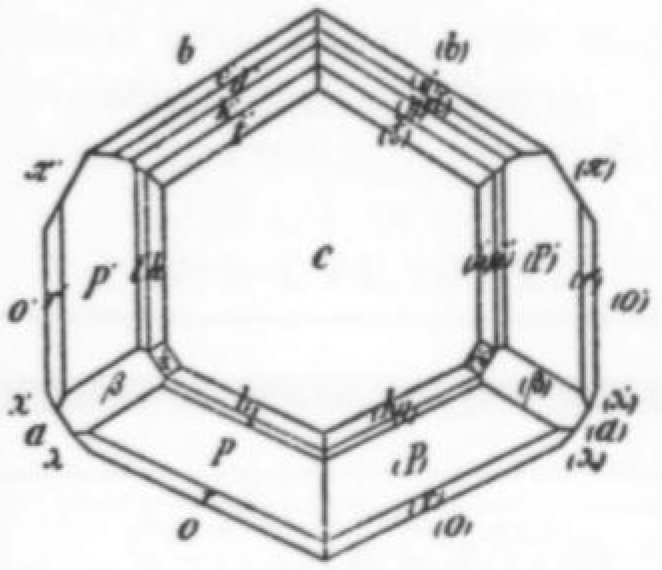
Specializing in Mt. St-Hilaire and other Canadian localities. List available.

P.O. Box 2096, Dorval, Quebec
H9S 3K7 CANADA

Fine
Mineral Specimens

H. Obodda
Box 51
Short Hills, N.J. 07078
(201) 467-0212

Rare Species?
Common
Minerals?



Our customers say: "Quality material, accurate labels, excellent wrapping." Find out why! $1 brings 20 pages of listings. $2 puts you on our mailing list for a year

Minerals Unlimited
P.O. BOX 877-MR
RIDGECREST, CALIF. 93555

G. Carlo
Fioravanti
mineralogist

Tetrahedrite *Carrara*

19/20 Via Pie di Marmo
Rome, Italy

Located between Piazza
Venezia and the Pantheon

Mon. 5-8 pm; Thurs. & Fri.,
11-1 pm, 5-8 pm; Sat. 11-1 pm

Phone: 06-6786067

BOOKS OUT—OF PRINT

Send $2.00 for latest catalog listing 100's on minerals, mining, geology, fossils, gems.

Tel.: 619-488-6904
PERI LITHON BOOKS
P.O. Box 9996
5372 Van Nuys Court
San Diego, Calif. 92109

NATURE'S WINDOW

- *Minerals*
- *Fossils*
- *Rare Species*
- *Micromounts*
- *Books*

Sept. 9-10, North Adams, MA
Oct. 8-9, Quarryville, PA
Nov. 19-20, Garden City, L.I., NY

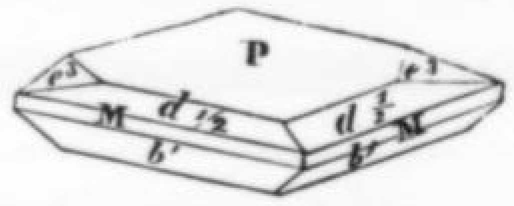
SHOW DEALERS • RON & EMILIE KENDIG
P.O. BOX 6049, WYOMISSING, PA 19610

Mineral List Available

WHOLE EARTH MINERALS
P.O. BOX 50008
RENO, NEVADA 89513

EMPEROR QUALITY GEMS
100% AUSTRALIAN OPALS
Mined, Valued, Sold Direct, Black, Crystal, White & Dark Based Opal, Rough & Cut.
INVESTMENT QUALITY
Phone Australia (08)265-5471 or (08)264-0062
BOX 65, GUMERACHA 5233, SO. AUSTRALIA

kristalldruse



Kristalldruse is the largest mineral shop in Munich.

- European Classics
- Rare Species Worldwide

Send us your want list or visit us when you're in Munich.
Mon.-Fri. 9-6, Sat. 9-1 p.m.
Downtown Munich near the Stadtmuseum, 2 minutes from the Marienplatz in the Dultstrasse

OBERANGER 6, D-8000 MÜNCHEN 2
Tel. 089-260-4018

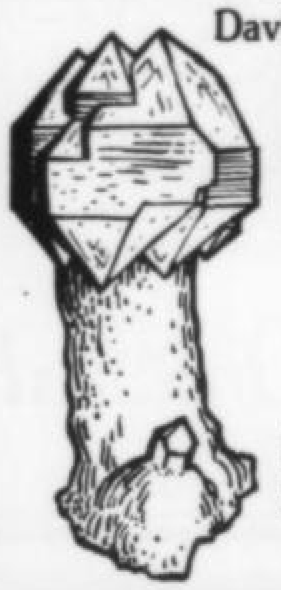
Tysons'
fine mineral specimens

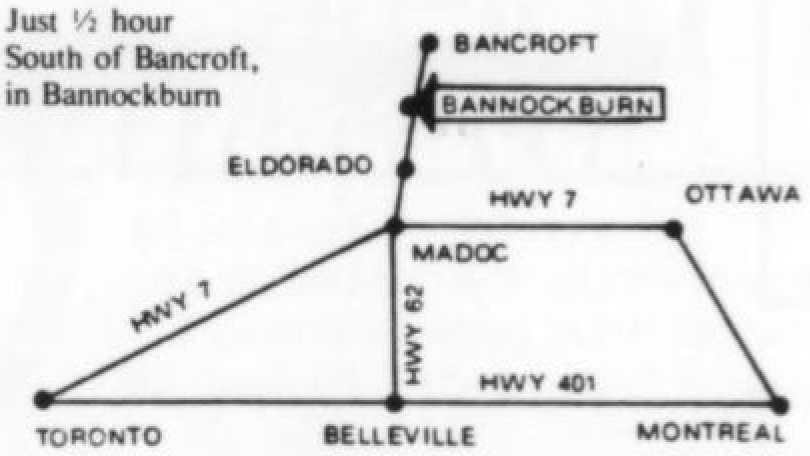
Rod & Helen Tyson
10549 133rd Street
Edmonton, Alberta
Canada T5N 2A4
(403) 452-5357

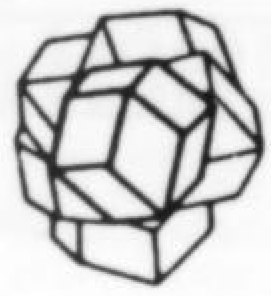
THE
ROCKSMITHS Inc.

Oct. 1-2	Franklin, NJ
Oct. 7-9	Detroit, MI
Oct.14-15	Gurnee, IL
Oct. 21-23	Portland, OR
Oct. 22-23	Tulsa, OK
Oct. 28-30	Tucson, AZ
Oct. 29-30	Warwick, RI
Nov. 11-13	Jacksonville, FL
Nov. 11-13	St. Louis, MO
Nov. 18-20	Marietta, GA
Nov. 1-20	Houston, TX (private)
Nov. 26-27	W. Palm Beach, FL

5th & Toughnut, Box 157, Tombstone, Arizona 85638




BANCROFT
BANNOCKBURN
ELDORADO
HWY 7
OTTAWA
MADOC
HWY 7
HWY 62
HWY 401
TORONTO
BELLEVILLE
MONTREAL



Dyck's Minerals

MEL & GRACE DYCK
1559 N. 18TH Street
LARAMIE, WY 82070

(307) 742-8719

fine mineral specimens

- visits by appointment
- mail-order lists
- shows

In FLORIDA
see the

Gallery of Gems

Fine gems & minerals

2291 N. Federal Hwy.
Boca Raton, FL 33431
(305) 392-3640

Colorado Gem and Mineral Company

Specializing in
Pegmatite Specimens
Jack Lowell
(602) 966-6626
Post Office Box 424,
Tempe, Arizona
85281

COMING "DOWN UNDER"?

PIERS & ROBYN FOA

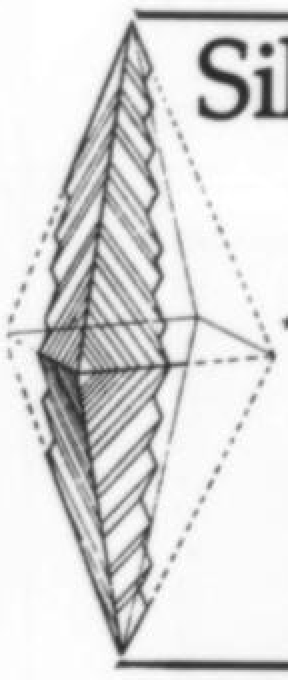
of

KOVAC'S GEMS & MINERALS

291-293 WATTLETREE ROAD
EAST MALVERN VIC. 3145

PHONE (03) 509 1611
TELEX 30625/ME1087

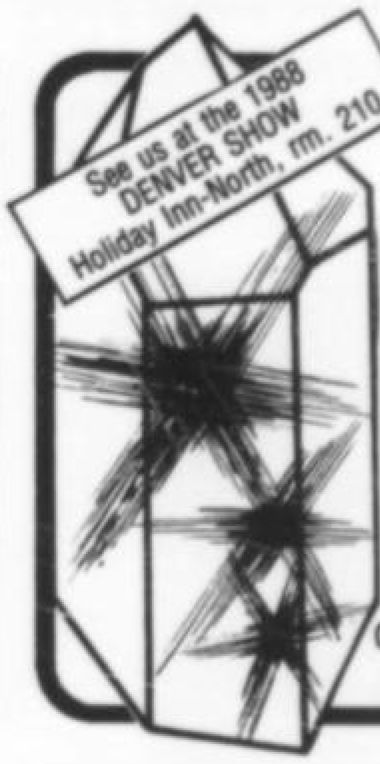
TRY AUSSIE SOUTHERN HOSPITALITY
WITH THE MIN. RECORD REPRESENTATIVES
IN THE *LAND OF THE BROKEN HILL!!!*



Silver Scepter *minerals*

◆

* WE BUY COLLECTIONS *
Fine Minerals
Oriental Carpets
Shown by Appointment
P.O. Box 1382
Richland, WA 99352
(509) 627-4163



See us at the 1988
DENVER SHOW
Holiday Inn-North, rm. 210

LUIZ
MENEZES

We have a large selection of Brazilian minerals, including superb RUTILATED QUARTZ crystals, blue phantom quartz, amethyst rosettes, pegmatite minerals, rare minerals from the Jacupiranga mine, and many others. Visit our showroom in São Paolo.

R. Eng. Agenor Machado 108
CEP 04710 - São Paolo, BRAZIL
Phone (011) 521-0538

* **VIDEO MINERALS** *

A New Concept

Now be able to view beautiful specimens in your own home.
Quality minerals $25–$1000.
Send for list and color videotape (Beta or VHS); $25 deposit required, refundable with return of tape or towards purchase.
ART GRAEBER • P.O. Box 252
Yucaipa, CA 92399 • 714-797-2591, eves.
(see review, vol. 18, no. 2, p. 115)

Donald A. Zowader
Write for list.

MOUNTAIN GEMS AND MINERALS

97 Lamington Rd.
Somerville, New Jersey 08876
201-526-1183

Schooler's
Minerals & Fossils

Quality Specimens
for the Collector
At Shows & By Appointment

P.O. BOX 1032, BLUE SPRINGS, MO 64015
(816) 931-1576

MICROMOUNTS, THUMBNAILS,
MINIATURES & CABINETS

Specializing in Arsenates,
Benitoite & Associated Minerals.
Micromount List, $2, refundable.

Bruce & Jo Runner

13526 South Ave., Delhi, CA 95315
Showroom by Appt. (209) 634-6470

713-862-5858

Collector's Choice

See us at
the 1987
Houston,
Detroit &
Dallas Shows!

Dalton & Consie Prince

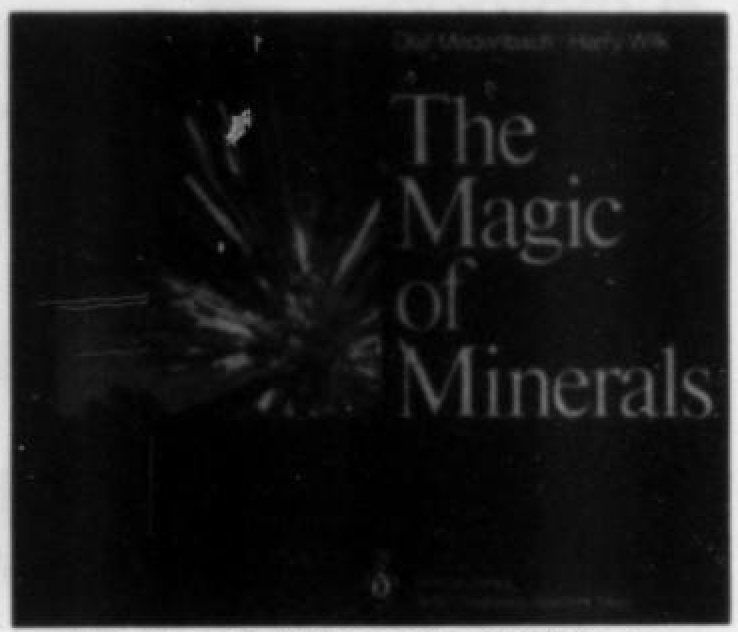
5021-A Augusta, Houston, Texas 77007

SIERRA CONTACT
MINERALS

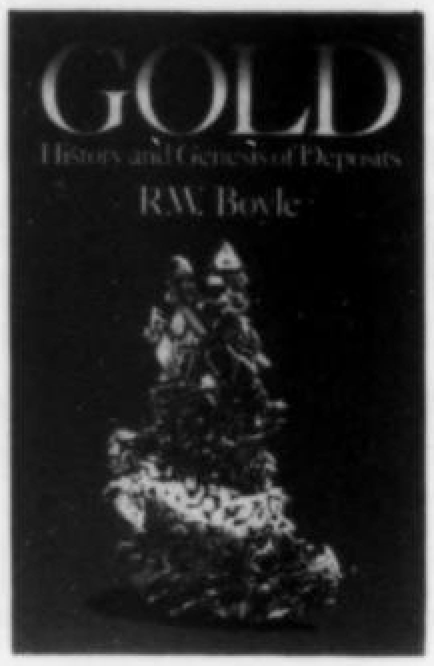
Fine mineral specimens from worldwide locations.
Thumbnails to Large Museum Pieces
Zuber Hydraulic Rock Splitters

Inquiries Invited
Collections Wanted

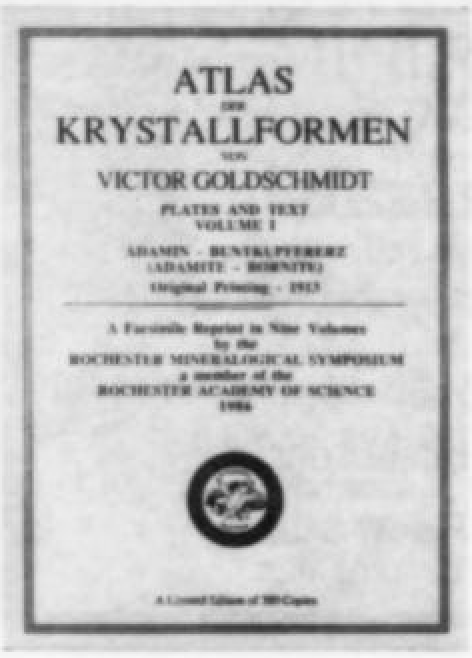
STEVE ROSE • HARVEY GORDON
1002 S. WELLS AVE., RENO, NEVADA 89502
TEL: 702-329-8765 (O); 702-329-4866 (H)



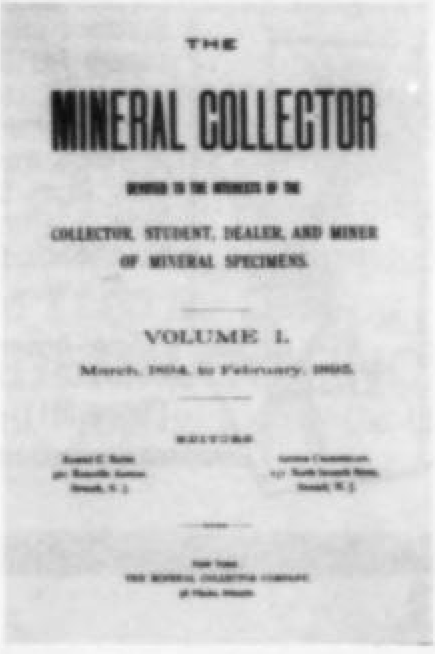
Magic of Minerals (1977) by Medenbach & Wilke [Hardcover]. One of our best sellers; an exquisitely beautiful "coffee-table" book of fine mineral photographs. 205 pages, 10¾ x 12¼ in. **$50 ppd.**



Gold: History and Genesis of Deposits (1987) by Boyle [Hardcover]. A thorough technical treatise, 676 pages. (No photos) **$55 ppd.**

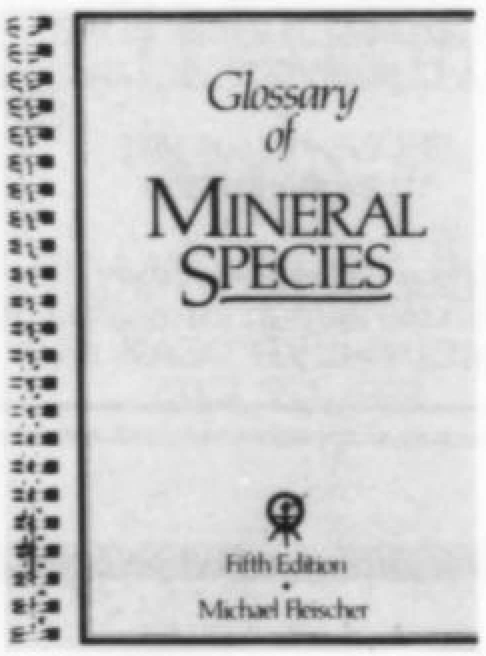


Atlas der Krystallformen by Goldschmidt. Massive 9-volume reprint of the classic compliation of crystal drawings. Supply limited! **$360 ppd. ($375 ppd. foreign)**



The Mineral Collector (1894–1899). Softcover reprint of the first five volumes of this early journal; more volumes to come. **$120 ppd. ($123 ppd. foreign)**

Mineral Museums of Europe (1986) by Burchard & Bode. Fascinating look at the histories and collections of 80 museums. Over 100 color mineral photos. **$53.50 ppd.**



Glossary of Mineral Species (1987) by Fleischer. Indispensable compendium of mineral names, formulas, etc. **Unbound** **$12 ppd.**

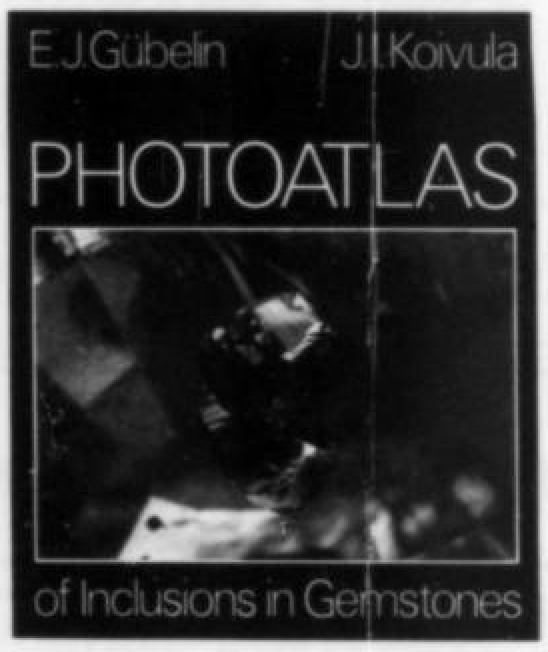


Photo Atlas of Inclusions in Gemstones (1987) by Gübelin and Koivula. Spectacular, beautifully illustrated study. 531 p., 1,400 color photos! **$201 ppd.** ($204 foreign)

Minerals of Cornwall & Devon (1987) by Embrey and Syms. Superb popular review of this famous mineralogical area; many color photos. **$32 ppd.**

World of Minerals through Postage Stamps (1987) by Autissier and Bariand. Survey of world postage stamps depicting minerals. Over 400 color photos of mineral stamps, 1175 philatelic references. **$26 ppd.**

ORDER FROM: *The Mineralogical Record Bookstore*
1601 Fairview Dr., Suite C, Carson City, Nevada 89701 (Tel: 702-883-2598)

Prepaid orders only, except by previous arrangement. Allow 4–6 weeks for delivery. Foreign orders add $1 per book.
Telephone orders accepted. VISA & MasterCard accepted. Add $1.25 for U.P.S.–No U.P.S. outside U.S.

History of Mining in Arizona (1988) by Canty & Greeley. Well illustrated, authoritatively written history of mining in Arizona. Essential for the Arizona collector. **$27 ppd.**

Mineral Museums of Europe (1986). Full-leatherbound edition, black calf with gold stamping. A collector's item.
$176 ppd. ($201 foreign)

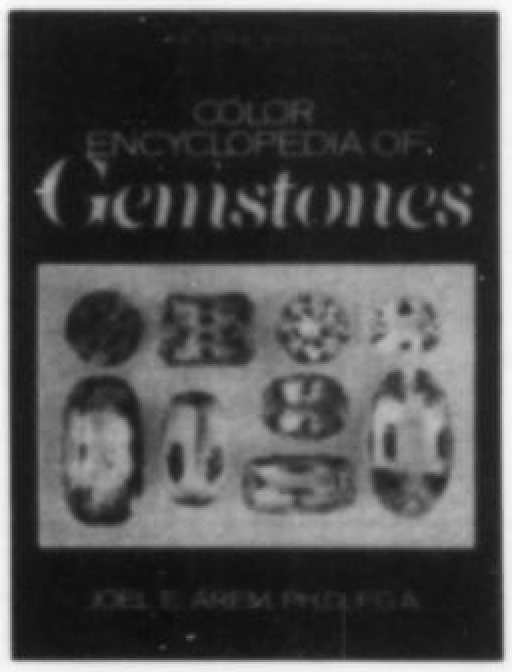
Sinkankas Books!

Field Collecting Gemstones and Minerals (1988) by Sinkankas. A thorough guide for field collectors on the necessary tools, techniques and background data. **$23 ppd.**

Gemstone and Mineral Databook (1972) by Sinkankas. Unique compilation of useful data in a wide range of categories—every collector should have it. **$21 ppd.**

Mineralogy (1966) Reprint of the classic *Mineralogy for Amateurs*. **$36 ppd.**

Glossary of the Minerals of the Lake District (1987) by Young. Meticulously detailed reference on the minerals and localities in this famous British district. **$33 ppd.**



Color Encyclopedia of Gemstones (1987). Full leatherbound edition, black calf with gold stamping. A collector's item, signed and numbered. **$80 ppd.** ($100 foreign)

Gill's Index to Gemological Literature (1978) Unique indexed bibliography giving access to many otherwise unindexed materials, e.g. *Lapidary Journal*. **$13 ppd.**

Nevada Literature

Mines of Eastern Nevada by Hill (1986) (reprint U.S.G.S. Bulletin 648)	$17 ppd.
Mines of Western Nevada by Hill (1986) Hill (reprint of U.S.G.S. Bulletin 549)	$17 ppd.
Mines of Northern Nevada by Emmons (1909, 1910) (reprint of U.S.G.S. Bulletins 408 and 414)	$17 ppd.
Mines of Southern Nevada by Ransome (1907) (reprint of U.S.G.S. Bulletin 303)	$17 ppd.
Mines of Southwestern Nevada by Ball (1907) (reprint of U.S.G.S. Bulletin 308)	$17 ppd.
Mines of Lander & Eureka Counties, Nevada by Vanderburg (1938, 1939) (reprint U.S.B.M. Inf. circ. 7022, 7043)	$17 ppd.
Mines of Humboldt and Pershing Counties, Nevada by Vanderburg (1936, 1938) (reprint U.S.B.M. Inf. circ. 6902 & 6995)	$17 ppd.

ORDER FROM: *The Mineralogical Record Bookstore*
1601 Fairview Dr., Suite C, Carson City, Nevada 89701 (Tel: 702-883-2598)
Prepaid orders only, except by previous arrangement. Allow 4–6 weeks for delivery. Foreign orders add $1 per book.
Telephone orders accepted. VISA & MasterCard accepted. Add $1.25 for U.P.S.—No U.P.S. outside U.S.

UK Journal of Mines and Minerals

Rock Bottom

Forward Subscriptions: 3 ISSUES — U.S. Dollars $22.50
Payable to **'ROCKBOTTOM'**, stating commencing issue number.

Issues 1, 2 and 3 — Sold Out

U.S. Subscribers Remit To:
Mrs. J. Schmitt
812 Imperial Court
Hartland
Wisconsin 53029

Foreign Subscribers:
Mrs. J. Spence
3 Oak Tree Road
Bawtry, Doncaster,
DN10 6LD. England.

WILLIS' EARTH TREASURES
Fine Mineral Specimens
Wholesale & Retail
Rock Trimmers & Hardwood
Thumbnail Cabinets
Send want list or by appointment
Prospect St., Box 393, Stewartsville, N.J. 08886
201-859-0643

N
NORTHERN CRYSTALS
Beautiful, Interesting and Unique Minerals
from Canada and Selected Countries
Yukon Phosphates, Mont St-Hilaire
rarities, Bancroft Area minerals,
British Columbia ferrierite,
British minerals.
386 Park Ave., Newmarket, Ontario
CANADA L3Y 1V5 Tel: (416) 853-4434

Fine Australian &
Overseas Specimens -
Micro to Cabinet Sizes and
Rare Species

AUSROX

Robert Sielecki
exploration geologist
Janine Rea
mine geologist
42 Hex St., Tottenham
Melbourne, Victoria 2012
Australia (phone (03)314-9612)

See You At
the
Travelodge
Room 248
Jan. 29-
Feb. 16

Come to the

TUCSON GEM &
MINERAL SHOW

The Crown Jewel of Mineral Shows

TUCSON GEM & MINERAL SOCIETY

**Mineral, Gem, Lapidary,
Jewelry, Fossil and
Manufacturing Dealers.
Expanded wholesale room.
Enlarged area for Mineral,
Earth Sciences, Mining and
Natural History Literature
(new & used), Maps and
related items.
Magazine Publishers.
1988 Show Poster Sales.**

February 9, 10, 11, 12 • 1989

Tucson Convention Center

Presented by

The Tucson Gem & Mineral Society

Tucson Gem & Mineral Show Committee P.O. Box 42543/Tucson, Arizona 85733

EXTREMELY RARE CUMBERLANDITE is one of the oldest and rarest rocks on Earth. So little is left, it is now considered an endangered species. The one source in the world measures only a few 100 sq. ft. **A must for collectors.** Unique gift for anyone or for one of your own prized possessions. For your genuine piece of Cumberlandite, History and Registered Certificate of Authenticity, send check or M.O. to:
**THE RHODOSE MINE CO.
50 TITUS STREET
CUMBERLAND, R.I. 02864**
Sm. Rock — $19.95
U.S. ORDERS POSTPAID
Med. Rock — $24.95
GUARANTEED, FAST SERVICE!!
Foreign Orders add Shp. Chg.
for 1 lb. (U.S. Funds Only.)

Mineralogical Record Inc.
Board of Directors
Richard W. Thomssen
Executive Director
Wendell E. Wilson
Asst. Executive Director
Mary Lynn Michela
Secretary-Treasurer
Ronald Bentley
Patricia A. Carlon
Richard C. Erd
Anthony R. Kampf
George Robinson
Arthur Roe
Abraham Rosenzweig

Advertising Information
All advertising in the Mineralogical Record must be paid in advance of the closing date. Telephone orders not accepted. Write to the editor for rates.

Closing dates:

Jan.-Feb. issue	Oct. 15
March-April issue	Dec. 15
May-June issue	Feb. 15
July-Aug. issue	April 15
Sept.-Oct. issue	June 15
Nov.-Dec. issue	Aug. 15

An additional 20 days past the closing date are allowed in which advertisers may make changes (excluding size changes) in ads already paid for.

Design
Wendell E. Wilson

Graphic Production
Capitol Communications
Crofton, MD

Printing
Waverly Press, Easton, MD

Color Separations
Hollis Phototechnics
Tucson, AZ

Circulation
P.O. Box 35565
Tucson, AZ 85740
602-297-6709

Bookstore & Promotions
1601 Fairview Dr., Suite C
Carson City, NV 89701
702-883-2598

Editing, advertising
4631 Paseo Tubutama
Tucson, AZ 85715
602-299-5274

Foreign Payments
Remittance may be made in local currency, at *prevailing exchange rates,* without surcharge, to the following people:

Arab Countries
Abdulla Mohammed Al-Khulaifi
P.O. Box 3454
13035 Safat, Kuwait

Australia
Piers Foa, Kovac's Gems & Minerals
291-293 Wattletree Rd.
East Malvern, Victoria 3145

Belgium
Paul Van Hee
Marialei 43
B-2120 Schoten

Canada
Mrs. J. W. Peat
36 Deepwood Crescent
Don Mills, Ontario M3C 1N8

France
ADIDOM
32, rue Servan
75011 - Paris

Great Britain
Ian Medcalf
C.I. International
14 Ullswater Close
Kempston, Bedford MK42 8JX

Italy
Renato Pagano
Via S. Anna 1/B
I-34074 Monfalcone

Japan
Tsukasa Kikuchi
P.O. Box 18, Hongo
Tokyo 113-91

Netherlands
W. J. R. Kwak
Kabeljauwallee 23
6865 BL Doorwerth (Gld)

Scandinavia
Claus Hedegaard
Storgade 71
DK-8882 Faarvang, Denmark

South Africa
Horst Windisch
30 Van Wouw Street
Groenkloof, Pretoria

Spain & Portugal
Bailey Minerals
Paseo de la Castellana, 171
28046 Madrid, Spain

West Germany
Christian Weise Verlag
Oberanger 6
D-8000 München 2

Affiliated with the Friends of Mineralogy, an independent, non-profit organization devoted to furthering amateur and professional interests in mineralogy. For membership information contact Don Zowader, 97 Leamington Rd., Somerville, NJ 08876.

Searching the world . . .

. . . to bring you the finest in mineral specimens at competitive prices

- *Fine Display-quality Specimens and Rare Species:*
  Send for our bimonthly *mineral lists* of thumbnail, miniature, and cabinet specimens. First quality mineral specimens for collection and display, plus rare species for systematic collection, reference, and research. Send large SASE for lists. Non-USA, send two International Reply Coupons.
- *Micromount and Specimen Boxes of All Kinds:*
  Boxes: A separate listing is available detailing prices and sizes of micromount. Perky Boxes, plastic magnifier boxes, white cotton-lined specimen boxes, display stands, etc. Send large SASE for lists. Non-USA, send two International Reply Coupons.
- *Microscopes and Optical Goods:*
  Send for our separate price list with information covering *stereo microscopes* and accessories for gem and mineral use. Send large SASE for lists. Non-USA, send two International Reply Coupons.
- *Back Issues of the Mineralogical Record:*
  Ask for our listing of out-of-print issues currently in stock.

Mineralogical Research Co.

Eugene & Sharon Cisneros
15840 E. Alta Vista Way, San Jose, California 95127
Tel: 408-923-6800
Look for our booth at major Western U.S. Shows
A Division of the Nazca Corporation

Advertisers Index