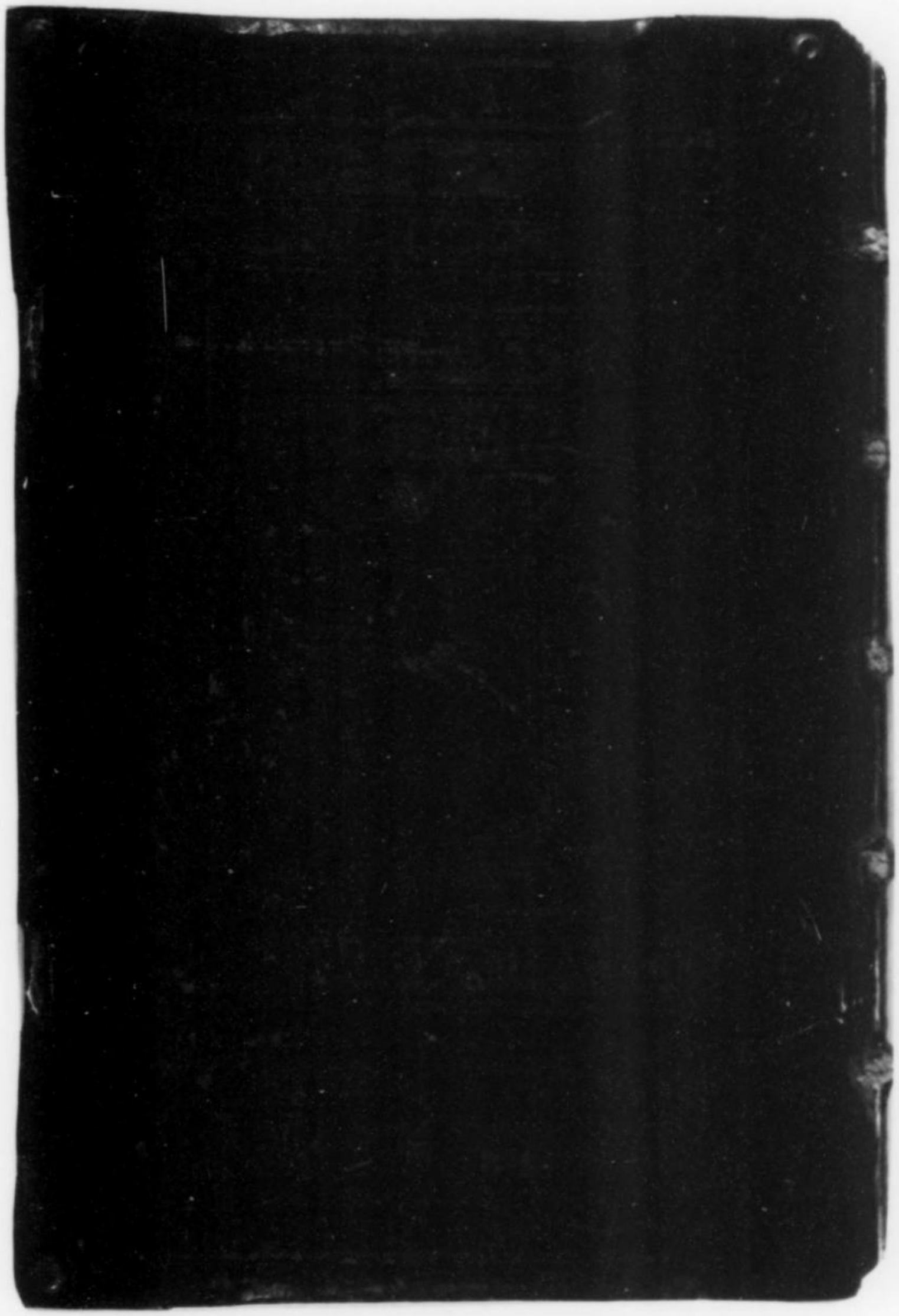
Mineral Books



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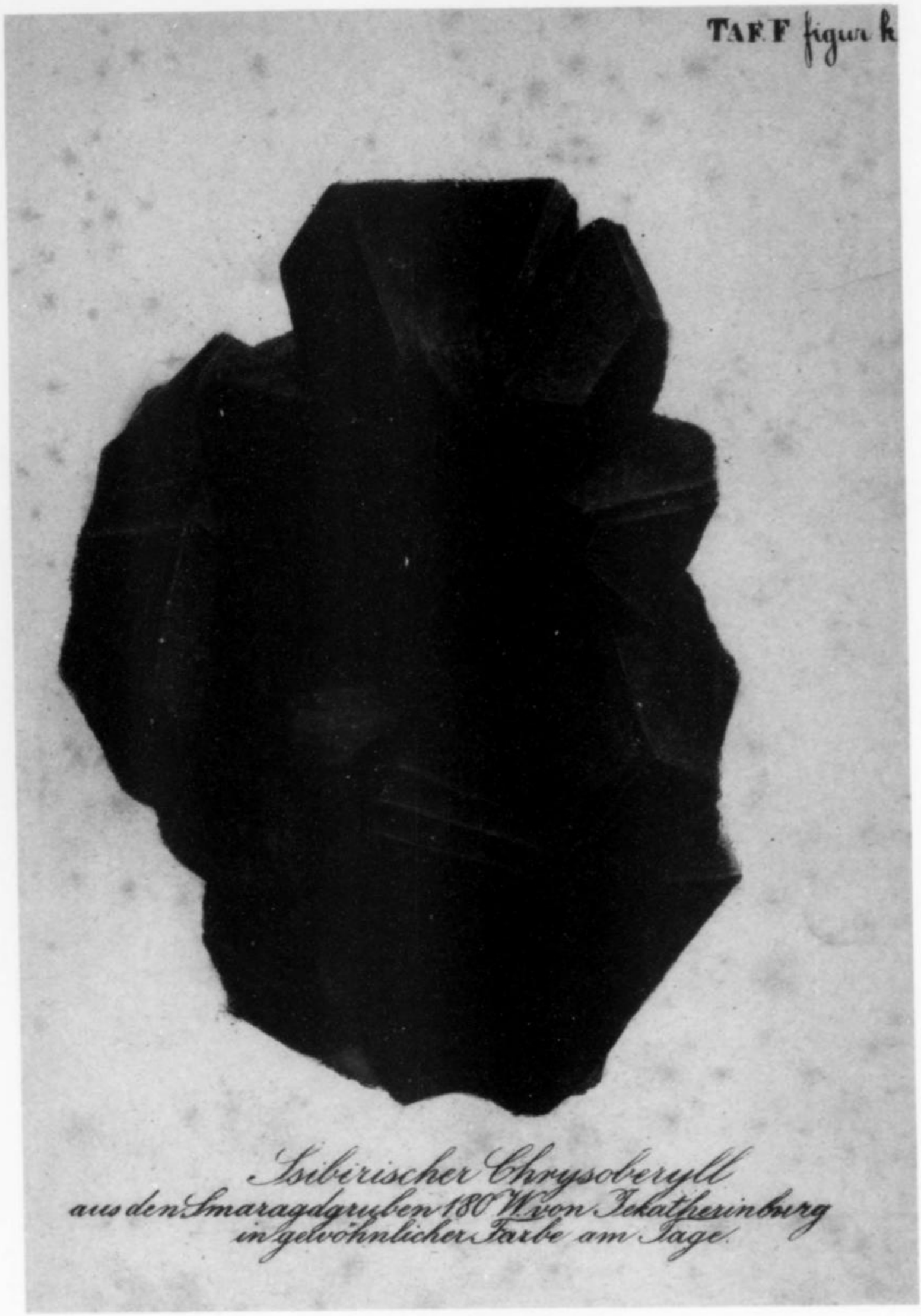
INERAL BOOKS



Isibirischer Chrysoberyll
aus den Smaragdgruben 180 W von Jekatherinburg
in gelwöhnlicher Farbe am Tage

Chrysoberyl (alexandrite) from the Takovaya emerald mine, Ural Mountains, Russia. From H. A. G. von Pott's (1842) Schriften der in St. Petersberg gestifteten Russisch-Kaiserlichen Gesellschaft für die gesammte Mineralogie von 1817 bis 1842.

MINERAL BOOKS

Five Centuries of Mineralogical Literature

Wendell E. Wilson

(Editor)

The Mineralogical Record

Tucson

MCMXCV

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Volume 26, number 4 • July–August 1995

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COVER: A treasure of book collecting: Georgius Agricola's famous *De re metallica* (1556). This copy was especially bound for the Elector of Saxony, and was later obtained from the elector's estate by Agricola's son, Valerius, who recorded the Agricola family chronicles on blank leaves until 1599. It was purchased at auction in 1981 by Herbert Obodda, and is now a centerpiece of the Obodda Library in Short Hills, New Jersey. (See also pages 14–15.)

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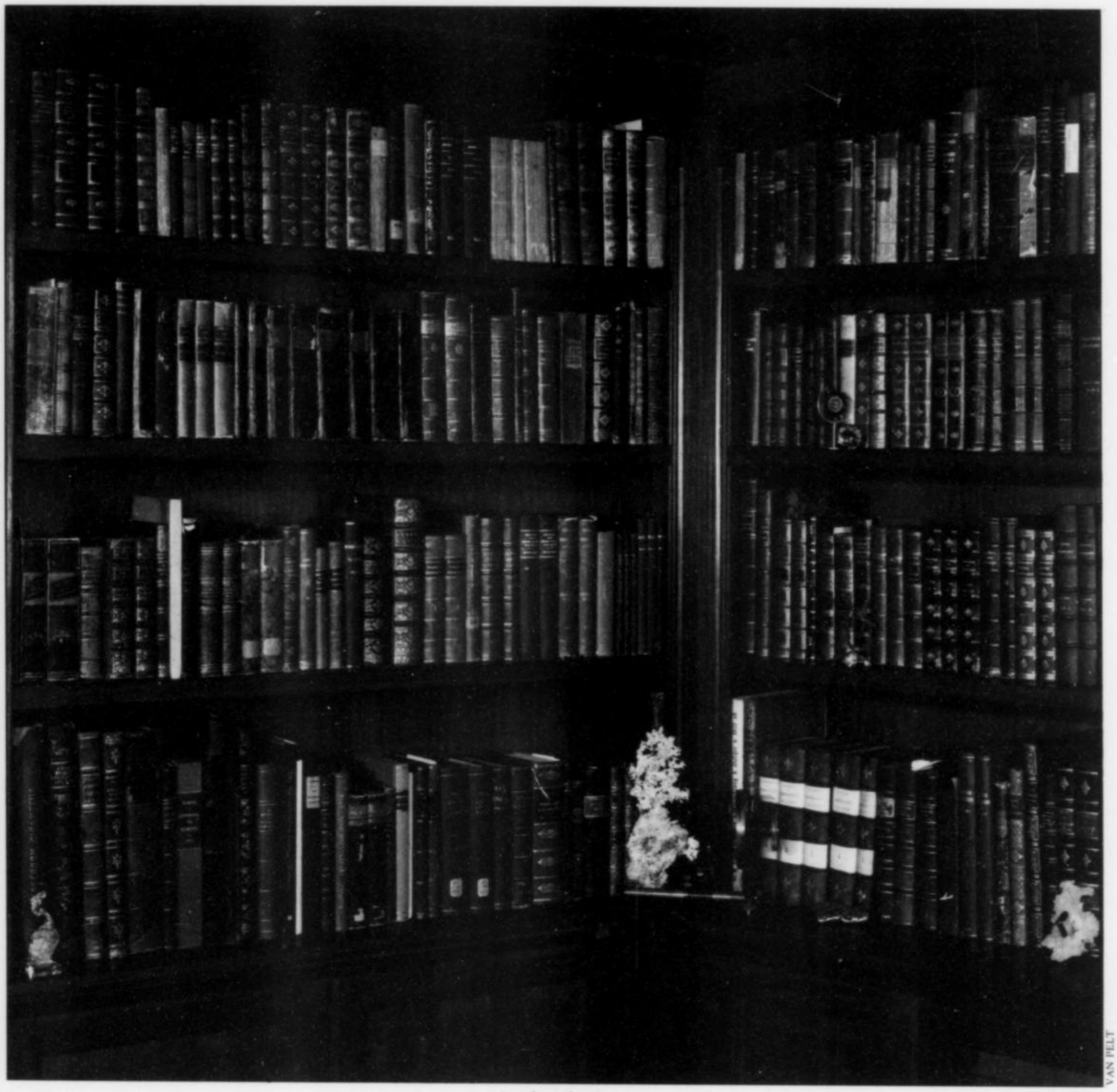


VAN PELT

Leicht Library

EDITOR'S PREFACE

This special issue on the appreciation and collecting of mineralogical literature is necessarily largely historical in nature, and therefore constitutes a companion volume to *The History of Mineral Collecting 1530–1799* (the November-December 1994 issue). The two works complement each other, and the serious reader of one will benefit by having the other at hand. Nevertheless, the current issue is more historically and financially egalitarian in that it deals with literature published right up to the present day (not all book collectors need to be "antiquaries"), much of which is quite inexpensive and accessible. We have tried to compose it as a useful reference and introductory guide for a range of interests.

Mineral book collecting, it turns out, has many parallels with the collecting of minerals. True, it is one step removed from the actual specimens which we love so much. But it is a step in the human direction, encompassing all that people have learned about minerals over thousands of years of investigation, how that knowledge has meshed with the cultures of the times, and the experiences people have had in the gathering of that knowledge.

In place of localities (for specimens) the book collector learns authors, and in place of species he learns the titles produced by those authors. There may be three or four times more titles known than species, but on the other hand there are far fewer authors to become familiar with than mineral localities worldwide. So the challenge in that sense is comparable.

As in mineral collecting, intrinsic value, condition, rarity and beauty are all important, with perhaps more special emphasis placed on historical significance. Every field of collecting has its "classics."

And, as with minerals, the book collector must learn the market, find dealers who are helpful and honest, develop a focus, husband the available financial resources, have proper bookplates (the counterpart of mineral specimen labels) prepared, provide for proper protection and storage of the collection, and give a thought some day to its eventual disposition or liquidation.

But is all this effort really worth it for the person who is already a dedicated collector of minerals? Why should he divide his time and money by taking on a *second* major field of collecting? I can only answer by pointing out that when we admire a new mineral specimen, the sensuous aesthetic pleasure and the intellectual stimulation we feel are simply the consequence of our eyes and hands taking in information about that mineral. But there is a limit to what we can take in on our own, with just ourselves and the specimen. We can break through that barrier with books, so as to be able to take in the vast amount of data gathered by others and thereby continue the pleasurable process. And in so doing we extend our horizon to include the *culture* of minerals, a step which humanizes the whole experience. Does this really constitute a *second* field, or just a lavish enrichment of the original?

Francis Bacon (1561–1626), the famous English philosopher, considered the combination of specimens and books to be essential. In his *Gesta Grayorum* (1594) he enumerated the recommended possessions of the learned gentleman:

> First, the collecting of a most perfect and general library, wherein whosoever the wit of man

hath heretofore committed to books of worth may be made contributory to your wisdom. [And second,] a goodly huge cabinet, wherein whatsoever Nature has wrought in things lacking life may be kept, sorted and included.

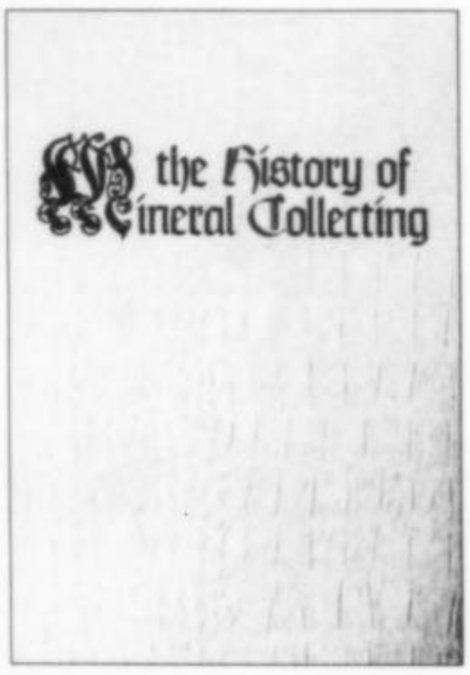
More recently (February 1995) Marilyn Vos Savant, the world record-holder for I.Q., answered in her newspaper column a question about why people should build a personal library even if they may not actually be able to read all of the books during their lifetime. She wrote:

> For the same reason that you buy a dictionary, an atlas and an encyclopedia—because you want the information at hand, even though you never intend to read them from cover to cover. And because you're curious, because you love learning and because you're intelligent. And because books are an essential component for a thoughtful life and because they're a link to the greatest minds of all times. And because filled bookcases look far better than wallpaper just about anywhere.

If you read and enjoy the *Mineralogical Record* you have already crossed the barrier between minerals and the literature of minerals. It is now only a question of how far you will go.

As in the case of previous special issues, I will take this opportunity to recap the articles on the same subject which have appeared in previous issues of the *Mineralogical Record*. Many of these are still in print and are available directly from the Circulation Manager.

Of all that has appeared in the past, the most important issue to obtain by far is the one listed first below. The others are given in chronological order of publication, with prices for those issues still available.



WILSON, W. E. (1994) The history of mineral collecting, 1530–1799. **25**, no. 6. [Softcover, $26 postpaid; hardcover, $51 postpaid]

SINKANKAS, J. (1970) First mineralogy [book] printed in the U.S.? **1**, no. 4, 135, 151 [out of print]

WILSON, W. E. (1978) The collector's library [recommended books]. **9**, no. 1, 5–13 [out of print]

SMITH, A. E. Jr., and COOK, D. R. (1979) The collector's library, Part II: Minerals of the United States. **10**, no. 1, 13–28 [$8 postpaid]

WILSON, W. E. (1979) The collector's library, Part III: Minerals of Mexico. **10**, no. 3, 169–171 [$8 postpaid]

CONKLIN, L. H. (1980) Reflections upon perusing a 1942 bookseller's catalog. **11**, no. 2, 127 [$8 postpaid]

SMITH, A. E. Jr. (1987) The collector's library: Minerals of the United States—update and additions. **18**, no. 3, 211–227 [$9 postpaid]

WILSON, W. E. (1989) Romé Delisle and his bibliography. **20**, no. 4, 259–263 [$11 postpaid]

WILSON, W. E. (1990) Bookbinding, *in* Notes from the editor. **21**, no. 2, 122–123 [$9 postpaid]

WILSON, W. E. (1990) Victor Goldschmidt and his atlas of crystal forms. **21**, no. 2, 125–126 [$9 postpaid]

WILSON, W. E. (1990) Hebenstreit's *Museum Richterianum*, 1743. **21**, no. 5, 399–403 [$13 postpaid]

WILSON, W. E. (1991) Nehemiah Grew's *Musaeum Regalis Societatis*, 1681. **22**, no. 5, 333–340 [$11 postpaid]

NOTICE!

The current issue is available in an attractive, bonded-leather **hardcover edition** (300 copies only). Bound into this hardcover edition is an ***extra 64-page reprint*** of most* of the above-listed articles on books from back issues going all the way back to volume 1, including also several reviews of books about books.

Also included is an unpublished **price tracking survey** covering over 300 of the most important antiquarian mineral books; this data, culled from many booksellers' catalogs published between 1979 and 1994, has been put together over the years by the Mineralogical Record Library for internal use in book valuation. Large accumulations of such data are almost always deemed proprietary by the compilers and are consequently not made available to the public. This is an invaluable opportunity to learn some concrete and useful, practical pricing information specifically about the antiquarian mineral book market.

For readers who want to have all of this book-collecting information easily at hand, in one place, this edition is the ideal choice. The price is $49 plus $1 postage *while the supply lasts.*

---

*Excludes the 264-page *History of Mineral Collecting,* which is available in its own hardcover edition, and The Collector's Library, Parts I and III, which are not of sufficient current reference value.

Collecting Mineral Books: An Introduction

Lawrence H. Conklin
2 West 46th Street
New York, New York 10036

The literature of mineralogy is a rich and varied field for the collector, with an almost unlimited abundance of possible specialties to choose from, discoveries to make and fascinating things to learn. Here is a primer to give the beginning collector an understanding of the basics.

Books about minerals and mineralogy have been, with a few exceptions, neglected as a focus for private collectors until the past decade or two. Indeed, the finest such library known to the writer (that of Herbert P. Obodda) has been in the serious stages of assembly only since 1979.

Recent years, however, have seen a strong interest among mineral collectors who are cultivating the collecting of mineralogical literature as an ancillary pursuit. The negative side to this newly awakened interest lies in the fact that some people now *invest* in such books; they have no intention of studying them and *will probably never read them*. This brings to mind the old adage about whether people who *do* not read their books are any better off than those who *can* not read them.

Of course, certain key works in mineralogy have long been collected by bibliophiles interested in the overall history of science—to name just two, Parker Cleaveland's *Elementary Treatise on Mineralogy and Geology* (Boston, 1816), the first substantive mineralogical work by a native-born American, and René Haüy's *Essai d'une Théorie sur la Structure des Cristaux* (Paris, 1784), a groundbreaking work on crystallography. Pioneering works in virtually all fields are collected generally.

There were a few early book-collectors in this field, notably historians of the earth sciences, some of whom built extraordinary private libraries. One of the most notable was Herbert C. Hoover (1874–1964), who, along with his wife, Lou Henry Hoover, collected books as a resource related to their work of translating, into English, Georgius Agricola's *De Re Metallica* (Basel, 1556). The Hoovers continued their book collecting for years after this *magnum opus* was published, nearly doubling the size of their library. Hoover's collection of 912 titles is preserved in the Honnold Library at Claremont College, near Los Angeles.

Frank Dawson Adams (1859–1942), author of the classic *Birth and Development of the Geological Sciences* (Baltimore, 1938), also had a significant library. Incidentally, I cannot recommend this work of Adams' too highly to collectors of mineral books, but alas, it has been long out-of-print. Even the poor quality, reduced-page-size paperback reprint has become scarce. So it is particularly fortunate for readers to have the chapter on medieval mineralogy reprinted here in this issue. Adams' books are now part of the Osler Library at McGill University in Montreal.

Mineralogists have typically collected mineralogical books as well, primarily as a professional resource but also as a hobby. The American mineralogist Parker Cleaveland (1780–1858) had a very fine library which survived intact until the 1950's when it was dispersed by a dealer; the extensive library of Freder-

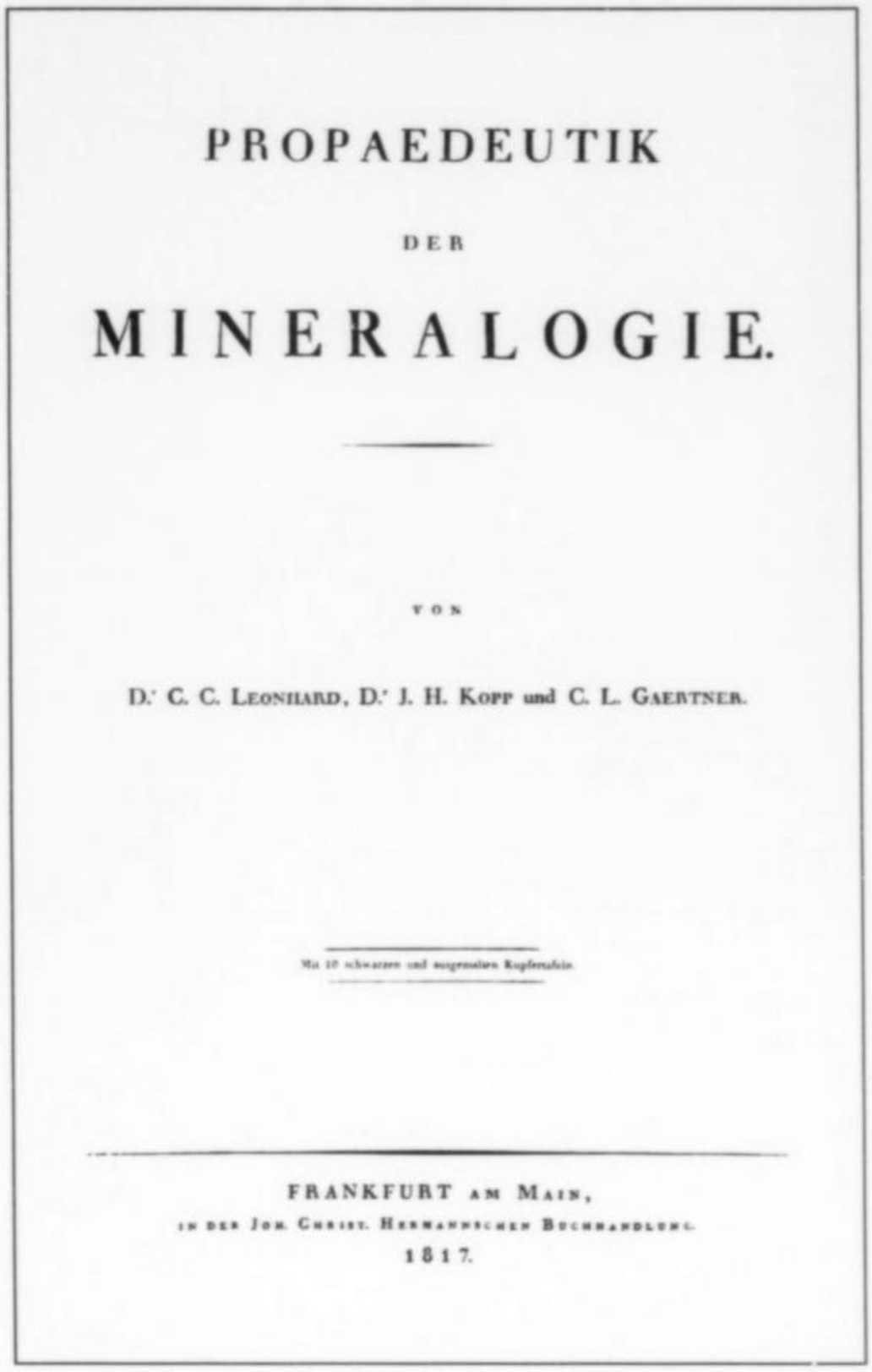
ick H. Pough, especially rich in color-plate books, was sold several years ago. George F. Kunz (1856–1932), who, with the clout of Tiffany and Company behind him, conducted one of the greatest mineral and gem businesses of all time, had an extensive library on gems and minerals, almost certainly the finest in his day. It survives today, possibly somewhat reduced in size from what it was originally, at the United States Geological Survey Library in Reston, Virginia. Kunz collected, in depth, everything in his field. His massive work *The Book of the Pearl* (New York, 1908) contains a *22-page* bibliography of pearl- and gem-related literature, along with the statement that "A large number of these works are in the library of George F. Kunz." Kunz was a long-time member of the famed Grolier Club of New York (a distinguished society of bibliophiles), from 1886 (only two years after the founding of the Club) until his death in 1932.

These days, it seems, there are just enough enthusiastic, knowledgeable and affluent collectors of works on mineralogy to compete eagerly for the few rare and valuable books that come on to the market each year and to keep prices quite elevated. There is no telling what will ultimately become of the fine libraries these persons are building, but it is safe to say that mineralogical book collecting is no longer limited to a few eccentric scholars and specialists.

BIBLIOGRAPHIC GUIDES

Bibliographies are excellent guides for book collectors. Not only do they inform us which books actually exist, but they often indicate which works the compiler found significant enough to add to the bibliography or to his own library. This writer has recently and fortunately become the recipient of a catalogue of the Obodda library and finds it extremely useful in a number of ways. If a book in question seems significant, and is not listed in the catalog, it is probably very rare.

While the mineral world still awaits the publication of a single, modern, definitive, scholarly bibliography (it is not enough merely to list author, title, date and place of publication. Accurate collations, at the very least by page, must be present, and bibliographers must be certain that the copy they examine and cite is, indeed, *complete as issued*), a lot of good information can be gathered, albeit piecemeal, from many specialized works already in print. An early, but extensive bibliography is Christoph Wilhelm Jakob Gatterer's *Allgemeines Repertorium des Mineralogischen und Salzwerkswissenschaftlichen Literatur* ["General Bibliography of Mineralogical and Salt-mining Literature"] (Giessen, 1798–1799) in two volumes. Gatterer's *Repertorium* is nicely organized into such categories as mineralogical glossaries, systematic mineralogies, geographical mineralogies, mineralogical journals, company and academic publications, collection catalogs, metals, volcanic minerals, and so on. Among the most complete for its time is the well-organized bibliography included by C. C. Leonard, J. H. Kopp



PROPAEDEUTIK

DER

MINERALOGIE.

VON

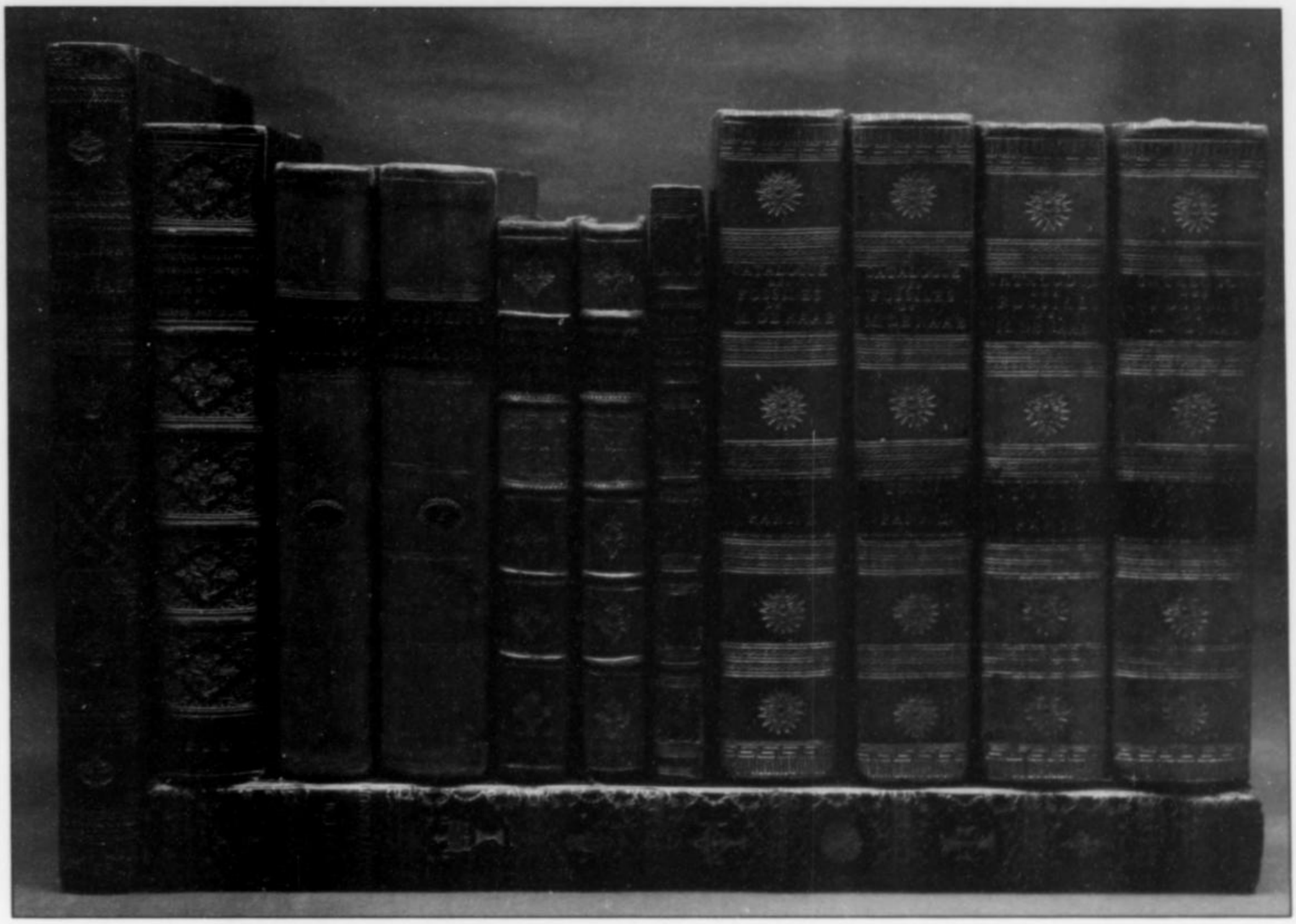
D.r C. C. LEONHARD, D.r J. H. KOPP und C. L. GAERTNER.

Mit 10 schwarzen und ausgemalten Kupfertafeln.

FRANKFURT AM MAIN,
IN DER JOH. CHRIST. HERMANNISCHEN BUCHHANDLUNG.
1817.

and C. L. Gaertner in their *Propaedeutik der Mineralogie* (Frankfurt, 1817). A 32-page list of authors, giving brief biographical notes, is cross-indexed to a 48-page, folio-sized, bibliography arranged by subject.

Some early mineralogical and crystallographical works also include significant bibliographies. Jean Romé de l'Isle's *Essai de Cristallographie* (Paris, 1772 and 1783) is one example. The famous series of editions of James Dwight Dana's *System of Mineralogy* also includes extensive bibliographies, the earliest of which appears in the first edition of 1837. Volume one of the seventh edition (New York, 1944) by Charles Palache, Harry Berman and Clifford Frondel includes a 20-page check-list bibliography of works which were "consulted in the preparation of this volume." A few people have had reasonably good success in attempting to collect this 1944 bibliography in its entirety, but they began their efforts in the 1960's and 1970's.



Today, in the current, more competitive market, it would be a daunting challenge indeed, and would surely require many decades, as well as a large sum of money, to gather a significant percentage of the works.

An even more challenging bibliography (a more in-depth and detailed compilation) to collect is the one listing the books in Herbert Hoover's collection, *Bibliotheca De Re Metallica: The Herbert Clark Hoover Collection of Mining & Metallurgy* (Claremont, 1980) by David Kuhner and Tania Rizzo. It includes many medieval works which today are particularly rare and costly. For collectors of early American mineralogies, there is no better work than Robert and Margaret Hazen's *American Geological Literature 1669–1850* (Stroudsburg, 1980), which lists more than 11,000 titles; alas, it is out-of-print and has become very scarce. Gem-book-collectors can always refer to the modern, but unfortunately, difficult-to-use, *Gill's Index To Journals, Articles And Books Relating To Gems And Jewelry,* by Joseph O. Gill (Santa Monica, 1978). It naturally includes many mineralogies but lists only works in English. There is also John Sinkankas's recently published work, *Gemology, an Annotated Bibliography* (1993) (see the review elsewhere in this issue).

Eventually the bibliographies or check-lists of some

THE

BIBLIOTHECA

HERBERT CLARK HOOVER

DE RE

COLLECTION OF

METALLICA

MINING & METALLURGY

ANNOTATED BY DAVID KUHNER

CATALOGUED BY TANIA RIZZO

INTRODUCTION BY CYRIL STANLEY SMITH

LIBRARIES OF THE CLAREMONT COLLEGES

CLAREMONT, CALIFORNIA

1980

modern collections will become generally available—already a few have been circulating in typescript form—and although they may not be written and composed with the high standards of, for instance, the Hoover Catalog, at least they may inform us of some previously unknown works. And in the case of the most massive of these compilations (as previously mentioned), the lack of a certain title may well be considered a sign of rarity.

Bibliographical data contained in the published catalogs of booksellers are also good references to have at hand, and these catalogs allow pricing trends (and, therefore, the relative rarity of a particular work) to be traced over the years; they sometimes include very interesting tidbits drawn from the vast knowledge of the cataloger. For instance, the bibliophile Carl Krotki, of New York City, presented the writer with more than 40 years of booksellers' catalog entries he had collected on James Sowerby's *British Mineralogy,* which showed, among other things, that incomplete sets (usually four of the five volumes) were offered for sale more frequently than completed sets. Occasionally booksellers' catalogs become reference works and collector's items themselves. One that springs immediately to mind is Bernard Quaritch's *Supplementa Sowerbiana; Or, A Catalogue Of Books And Manuscripts Written Or Illustrated By Members Of The Sowerby Family,* compiled by John Collins and issued as a supplement to their Catalog No. 894 (London, 1969). Some modern catalogs contain beautiful color prints and therefore automatically qualify as collectible in their own right. I am thinking especially of those of William Patrick Watson of London, whose Catalog Four, entitled *Science, Medicine And Natural History* (London, 1993), contains 36 full-page illustrations of which 12 are in *full color.* It offers 101 very rare and expensive books. Incidentally, it should be mentioned that most booksellers are willing to send their catalogs gratis to a prospective buyer for quite a long period of time in the hope of making a sale. The more venerable the bookseller, at least so it seems to this collector, the longer they are apt to keep a person on their mailing list provided they believe that:

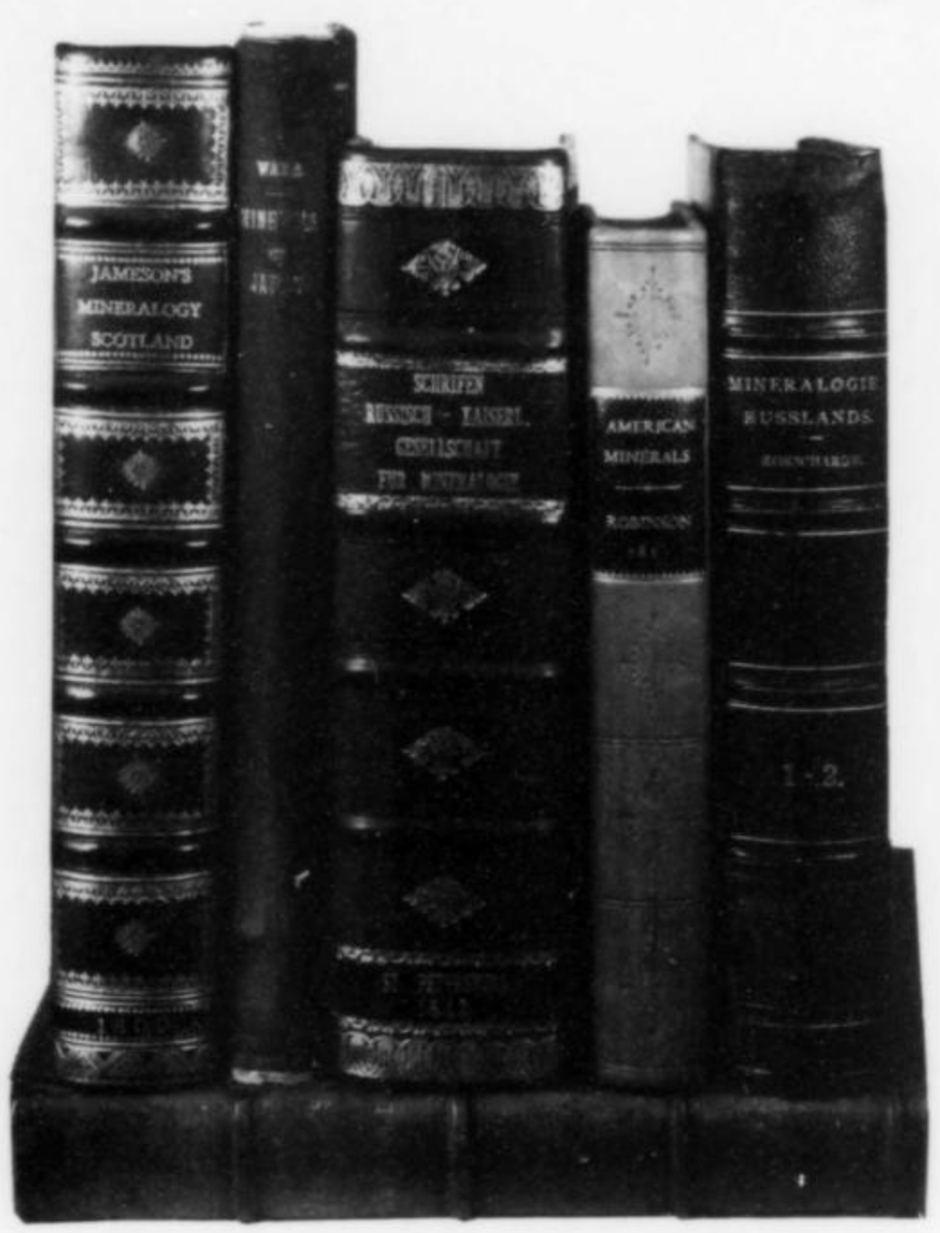
1. The potential customer's interest in what they sell still exists.
2. The person is financially capable of buying their wares.
3. The person is currently buying from their competitors.
4. There is nothing to indicate that a sale in the future is out of the question.

The above statements are especially true in the case of high-priced books.

SPECIALIZATIONS

The general field of mineral-related books is vast, too vast for most collectors. Consequently, people tend to specialize, and there are several possible directions that can be taken:

(1) **Regional mineralogies**—M. Forster Heddle's *Mineralogy of Scotland* (Edinburgh, 1901) or Samuel Gordon's *Mineralogy of Pennsylvania* (Philadelphia, 1922) are two good examples—comprise a very useful specialty for the mineral collector and curator. A great many such titles are available, and new ones are being published regularly. One might take the entire

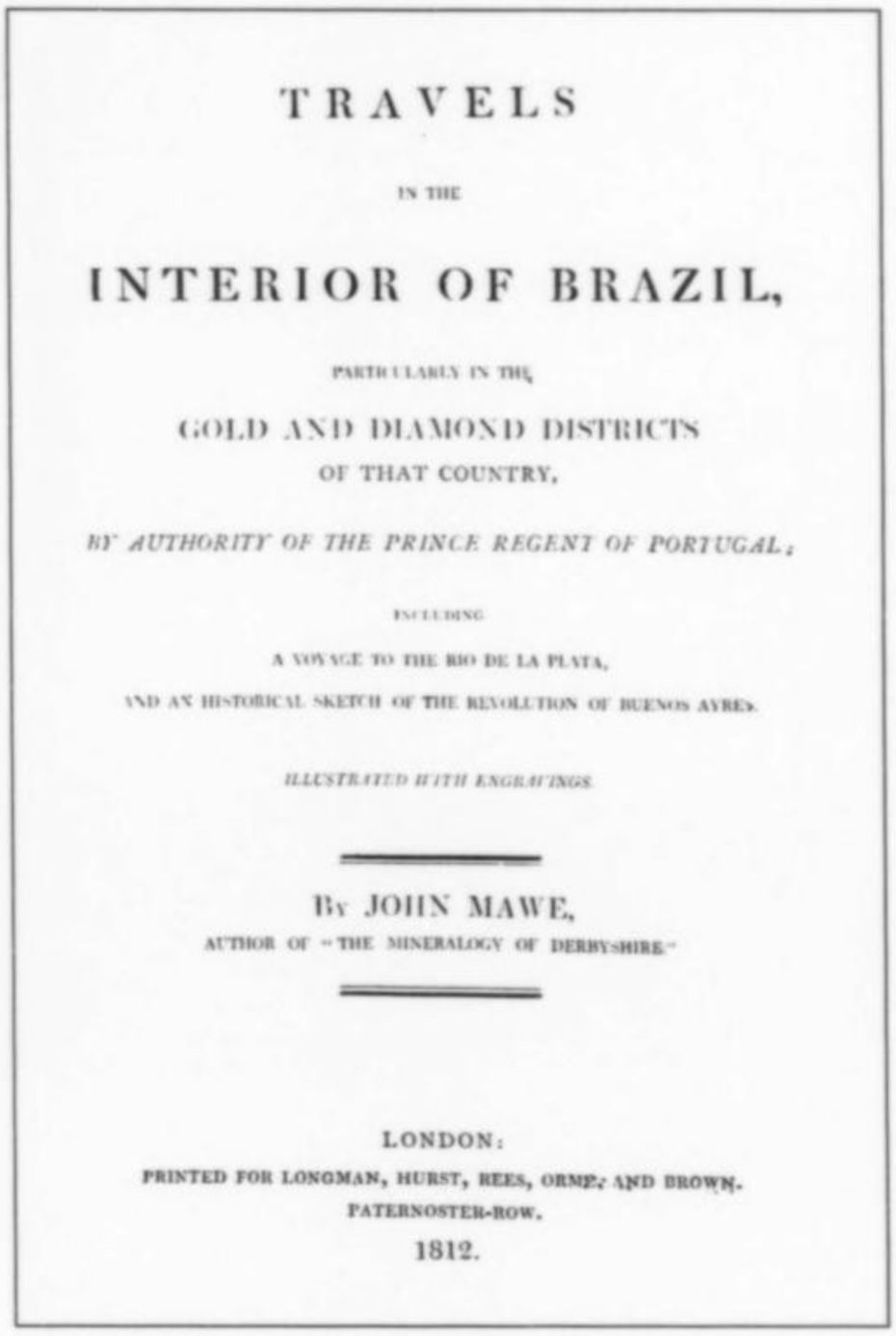


world as fair game, or restrict one's self to the mineralogical literature of a single country, state or region. Mineral bibliographies for states such as Arizona, or mineralized regions such as the Michigan copper country, are extensive. (For help see Smith's article, in this issue, on "Regional mineralogies of the world," the "Collector's Library" articles on mineralogies of the United States in **10**, 13–28 and **18**, 211–227, and also Spencer's 1948 "Catalogue of topographical mineralogies and regional mineralogies" published as a long article in *Mineralogical Magazine,* **28**, 303–332.)

(2) **Systematic mineralogies,** except for the most recent, are seldom used anymore as actual mineralogical reference works but are quaint and historically rich books that can prove surprisingly interesting and useful. For example, modern writers (Mitchell, Frondel, *et al.*) have stated that the mineral *columbite* was named for Columbia, an old name for America. But in Robert Jameson's *System of Mineralogy* (Edinburgh, 1804) we read that "Mr. Hatchett . . . gave the name Columbium [to the element] in honor of the *discoverer*

of America . . . [so] I have with Dr. Thomson denominated [the new mineral] Columbite." (See the essay by Jameson on the early history of systematic mineralogies in this issue.)

(3) **Mineralogical travels and narratives** are especially satisfying to collect because they can also be read for enjoyment. One such work is John Mawe's *Travels in the Interior of Brazil* (London, 1812), in which we can read of the author's frustration at not being able to find even one *doubly terminated* topaz crystal from among "at least a cart load" at Ouro Preto.



TRAVELS

IN THE

INTERIOR OF BRAZIL,

PARTICULARLY IN THE

GOLD AND DIAMOND DISTRICTS

OF THAT COUNTRY,

BY AUTHORITY OF THE PRINCE REGENT OF PORTUGAL;

INCLUDING

A VOYAGE TO THE RIO DE LA PLATA,

AND AN HISTORICAL SKETCH OF THE REVOLUTION OF BUENOS AYRES.

ILLUSTRATED WITH ENGRAVINGS.

By JOHN MAWE,

AUTHOR OF "THE MINERALOGY OF DERBYSHIRE."

LONDON:

PRINTED FOR LONGMAN, HURST, REES, ORME, AND BROWN,

PATERNOSTER-ROW.

1812.

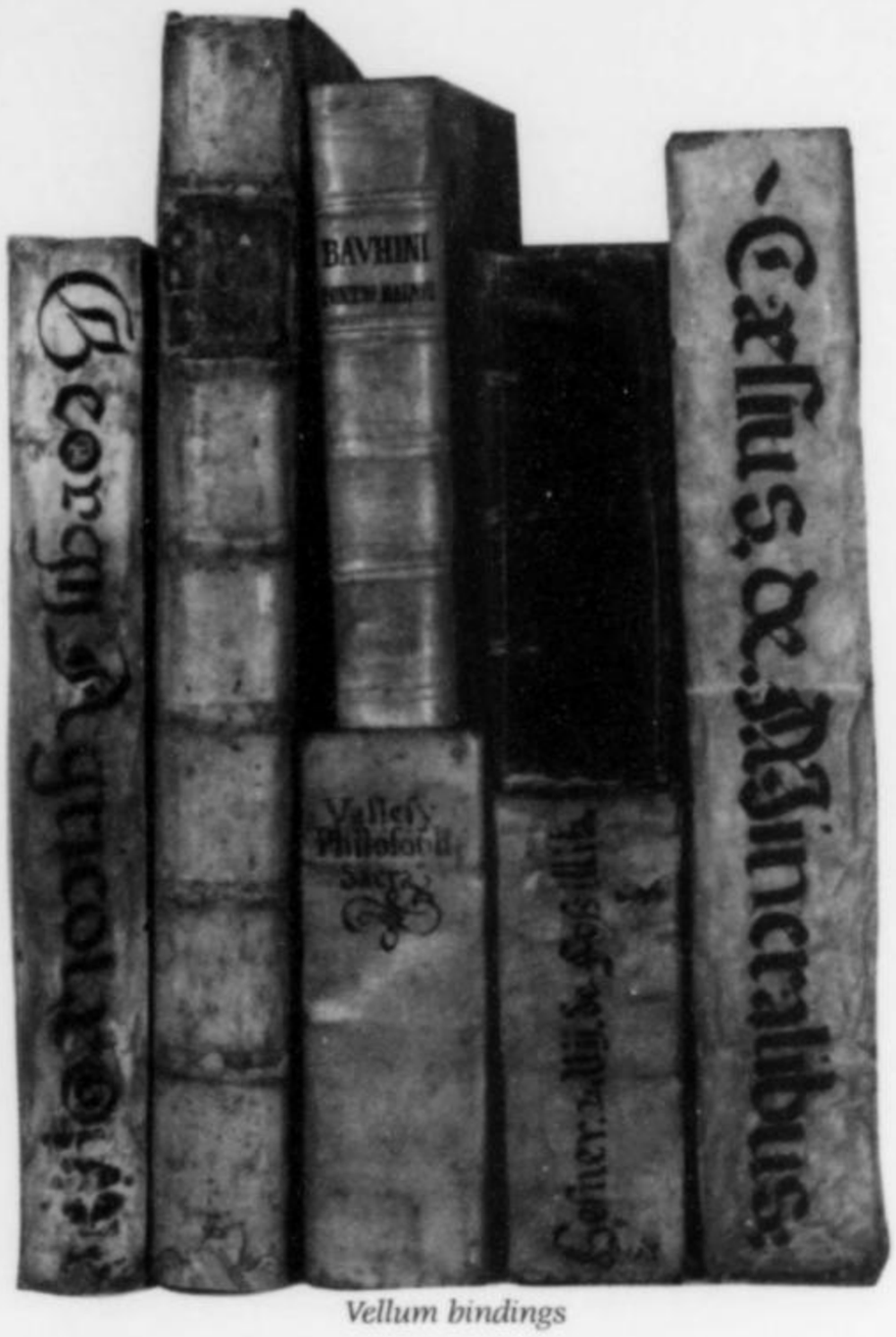
Another is Edward D. Clarke's *Travels in Various Countries of Europe, Asia and Africa* (London, 1816) wherein Clarke tells of collecting gold minerals (including faked specimens) in Transylvania. H. B. Saussure's *Voyages dans les Alpes* (Neufchatel, Geneva and Paris, 1779–1796) and Gustav Rose's *Reise nach dem Ural* (Berlin, 1837 and 1842) are equally interesting for collectors who can read French and German. Some foreign-language works have been translated into English; a good example of this type is John James Ferber's *Travels through Italy in the years 1771 and 1772. Described in a series of letters to Baron Born,* translated from the German by R. E. Raspe (London, 1776). There are many more, and I know of no specific bibliography to go by, except perhaps a very general work, Edward Cox's *A Reference Guide to the Literature of Travel.* This is then a fertile area for collectors to explore, discover, and perhaps compile a mineralogical-travel bibliography of their own.

(4) **Illustrated mineralogies** are a pleasure to collect for the pure joy of viewing the mineral plates. These can be divided into four basic categories: those with:

1. Uncolored illustrations
2. Handcolored illustrations
3. Illustrations with printed colors
4. Photographs

Johann Anton Scopoli's *Crystallographia Hungarica* (Prague, 1776), with its 232 engraved illustrations of specimens from Transylvania, is an example of the first type. James Sowerby's famous *British Mineralogy*

(London, 1804–1817) and *Exotic Mineralogy* (London, 1811–1817) together contain over 700 handcolored, copper-plate-engraved illustrations of specimens and represent the ultimate in the second category. Category three must be capped by Fabien Gautier d'Agoty's *Histoire Naturelle . . . Règne Minéral* (Paris, 1781). Copies contain between 40 and 70 color plates and, because this is a pioneering work in the history of color printing, the general book-collecting fraternity has bid its value to over $25,000! (Please see pricing comments about this work at the end of this article.) A good popular example, with 40 printed colored plates, might be Leonard J. Spencer's *The World's Minerals* (London, 1911). Photographic works, on the other hand, especially those that are known as "coffee-table books," (and are epitomized by Peter Bancroft's lovely productions) are surely the most beautiful, and are the least expensive of all.

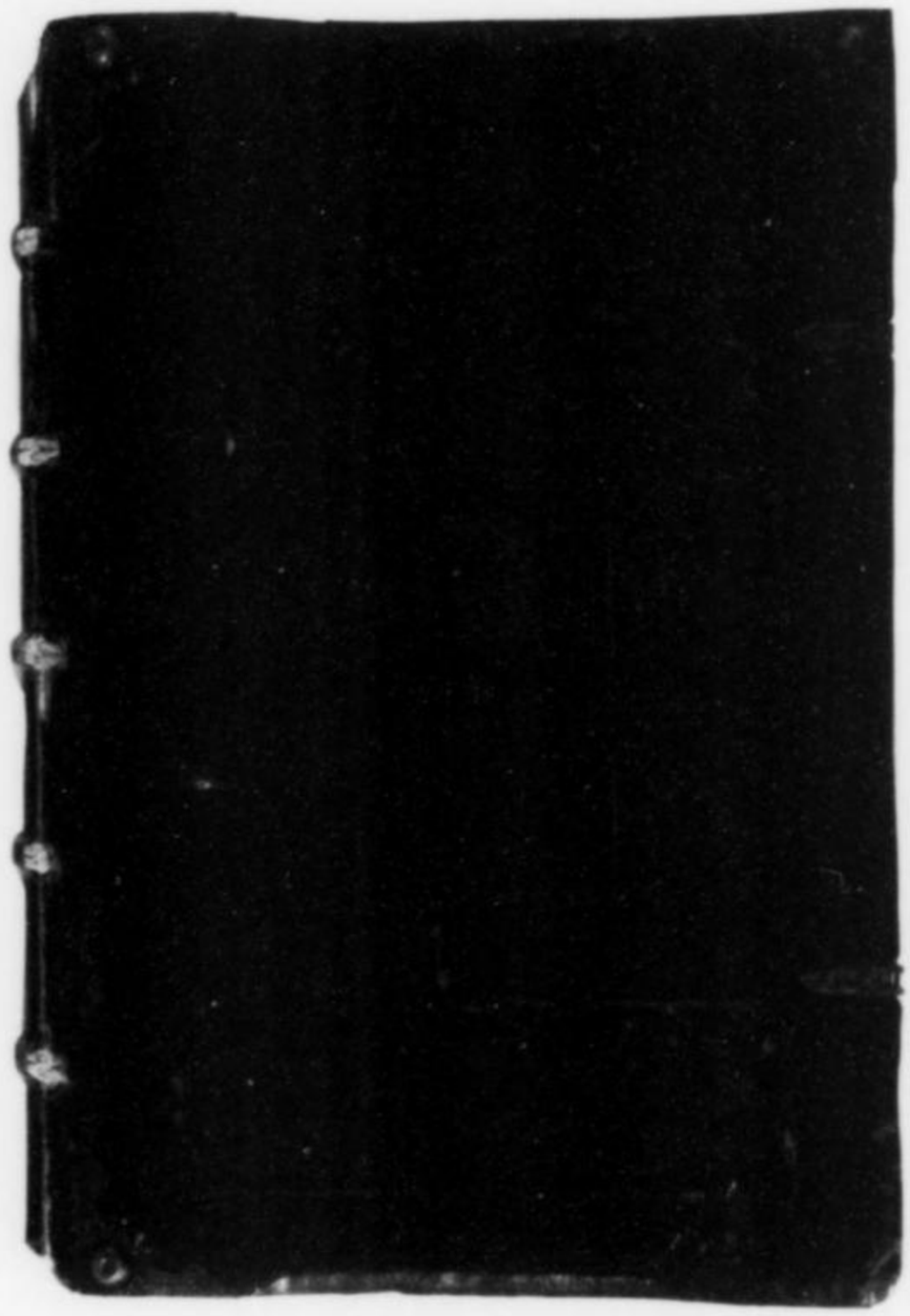


Vellum bindings

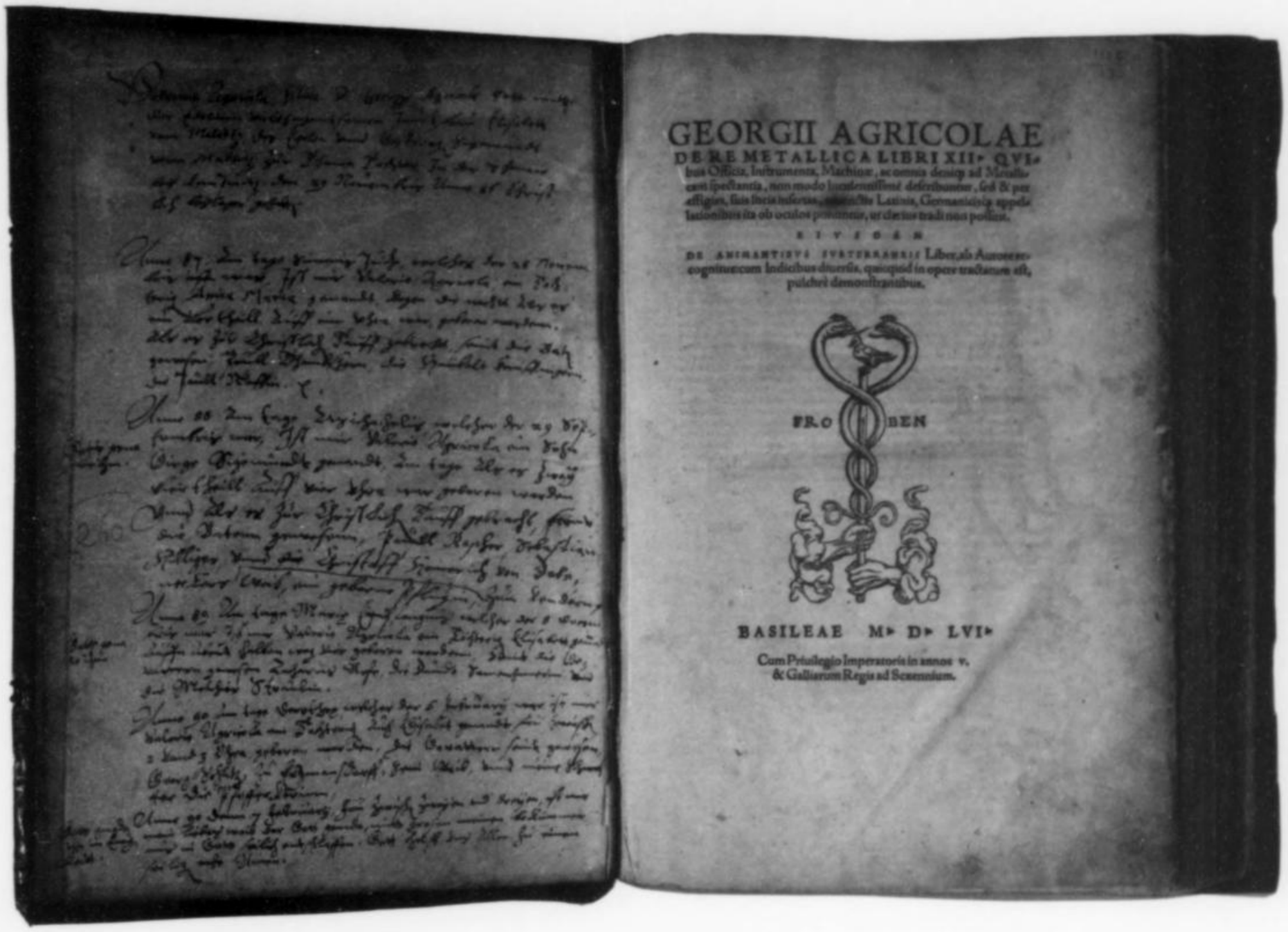
(5) **Medieval works** constitute an elegant, scholarly and always expensive specialty. They are of three general types: manuscripts, incunabula (books printed before the year 1500) and later printed books. Most of these are written in Latin, but despite their incomprehensibility to most people, they can still make a book collector's pulse quicken. Although the average collector can never hope to acquire a significant illuminated manuscript, a color facsimile reprint, done in 1880, of a thirteenth-century work, the *Lapidario* of Alfonso the Tenth, now in the Escorial Library in Madrid, is highly collectible. And just recently a magnificent full-color facsimile reprint of the 1556 *Schwazer Bergbuch,* an illustrated manuscript on mining, was produced in Austria. More available, and certainly more readable, are the recent English translations of the medieval writings of Lazarus Ercker, Georgius Agricola, Bernard Palissy, Albertus Magnus and others, not to mention the translations (some available in highly collectible and costly antique editions, some beautifully bound, for the advanced collector) of ancient authors such as Theophrastus, Dioscorides and Pliny. (See the reprinted essay by Adams in this issue, referred to above.)

(6) **Mining histories and mining books** are a specialty difficult to separate from mineralogy. The earliest examples could also fit equally well into bibliographies of systematic mineralogies or regional mineralogies. William Pryce's *Mineralogia Cornubiensis* (Cornubia being the Latin name for Cornwall), published in London in 1778, is a prime collectible dealing with Cornish mining and its ore minerals. An extensive bibliography of several thousands of entries relating to mining has recently been compiled by Arthur E. Smith of Houston, Texas, but alas, it remains unpublished. Although most works listed in it are relatively recent and easily obtained, others are now quite rare due to limited press runs, and their acquisition, therefore, is a challenge to the collector.

(7) **Historically significant copies** of books constitute an uncommon specialty that only a few particularly diligent and affluent collectors attempt. An example is the "association copy," so-called because of its association with a prominent or respected person who once owned the book and affixed his signature or bookplate, etc. It is most romantic, for example, to open a copy of René Haüy's *Tableau Comparatif* (Paris, 1809) and realize that Haüy held this very volume in his hands as he inscribed it to the American mineralogist Archibald Bruce in faraway New York City. Bruce only added to the romance by signing and dating it himself, apparently upon receipt, and as a final touch this exquisite volume, currently in the library of Robert Thomas Curran, Jr., also carries the book-label of Parker Cleaveland. (This book is discussed in some detail by its owner in *MATRIX. A Journal Of The History Of Minerals,* Volume 2, Number 6.) Such items are extremely rare and costly, and a collector cannot



The Obodda Agricola, originally bound for the Elector of Saxony (see following page).


GEORGII AGRICOLAE
DE RE METALLICA LIBRI XII. QVI-
bus Officia, Instrumenta, Machinæ, ac omnia denique ad Metalli-
cam spectantia, non modo luculentissime describuntur, sed & per
figuras, suis locis insertas, adiectis Latinis, Germanicisq; appel-
lationibus ita ob oculos ponuntur, vt de re tradi non possint.
EIVSDEM
DE ANIMANTIBVS SUBTERRANEIS Liber, ab Autore eo-
gnitus: cum Indicibus diuersis, quicquid in opere tractatum est,
pulchrè demonstrantibus.
FROBEN
BASILEAE M. D. LVI.
Cum Priuilegio Imperatoris in annos v.
& Galliarum Regis ad Sexennium.

Agricola family records written in the Obodda Agricola (1556). This copy was originally bound especially for the Elector of Saxony, but was later obtained from the Elector's estate by Agricola's son, Valerius, who inscribed family births and deaths up until 1599. It was purchased at auction in 1981 by Herbert Obodda. (See cover and p. 14.)

expect to acquire very many of them, regardless of what he may be able to spend on such books, even over a lifetime of searching. One old-time bookseller called them "precious copies."

Historically significant in a different sense are copies of books that have survived in their "original state." These are also called "unsophisticated copies," that is, copies that exist today precisely as they were originally issued. Many of them are bound or stitched in paper covers known as "wrappers," or cardboard covers called "boards." These covers were intended by the publisher to be merely temporary protection for the pages until the buyer's own bookbinder could place a custom-designed permanent cover on them. The pages in such copies are often found "uncut" (with rough and irregular edges) and sometimes "unopened" (the pages joined at the top and side by a fold which would normally be cut away during binding).

Some books, such as Casimir Christoph Schmiedel's *Erz Stuffen und Berg Arten* (Nürnberg, 1753) and the previously mentioned Sowerbys, were originally issued serially, in parts resembling periodicals, and were bound into volumes when the subscriber had accumulated a sufficient number of the parts. In such cases the unbound installments (in their original paper wrappers, if they were so issued) represent the minimum "sophistication" inflicted upon the work and, to many serious bibliophiles, the maximum desirability. Many serialized works were later issued by the original publishers complete in a binding, sometimes called "original cloth," and if presented with a choice between the two, many collectors opt to acquire this "first book edition," rather than the parts. This is especially true in the case of the first editions of literary works of authors such as Charles Dickens or William Thackeray.

"Contemporary bindings," that is, those which are approximately coeval with the printing and which were produced shortly after publication, are next best. Successive rebindings, restoration, washing, repair, and other forms of "sophistication" further diminish the level of desirability.

Even non-bibliophiles know that a "first edition" has some significance, although in mineral-book collecting the distinction is often of less importance. For

MINERALOGIA CORNUBIENSIS;

A

TREATISE

ON

MINERALS, MINES,

AND

MINING:

CONTAINING

THE THEORY AND NATURAL HISTORY OF

STRATA, FISSURES, AND LODES,

WITH THE METHODS OF

DISCOVERING AND WORKING OF TIN,

COPPER, AND LEAD MINES,

AND OF

CLEANSING AND METALIZING THEIR PRODUCTS;

SHEWING EACH PARTICULAR PROCESS FOR

DRESSING, ASSAYING, AND SMELTING OF ORES.

TO WHICH IS ADDED,

AN EXPLANATION OF THE TERMS AND

IDIOMS OF MINERS.

By W. PRYCE, of REDRUTH in CORNWALL.

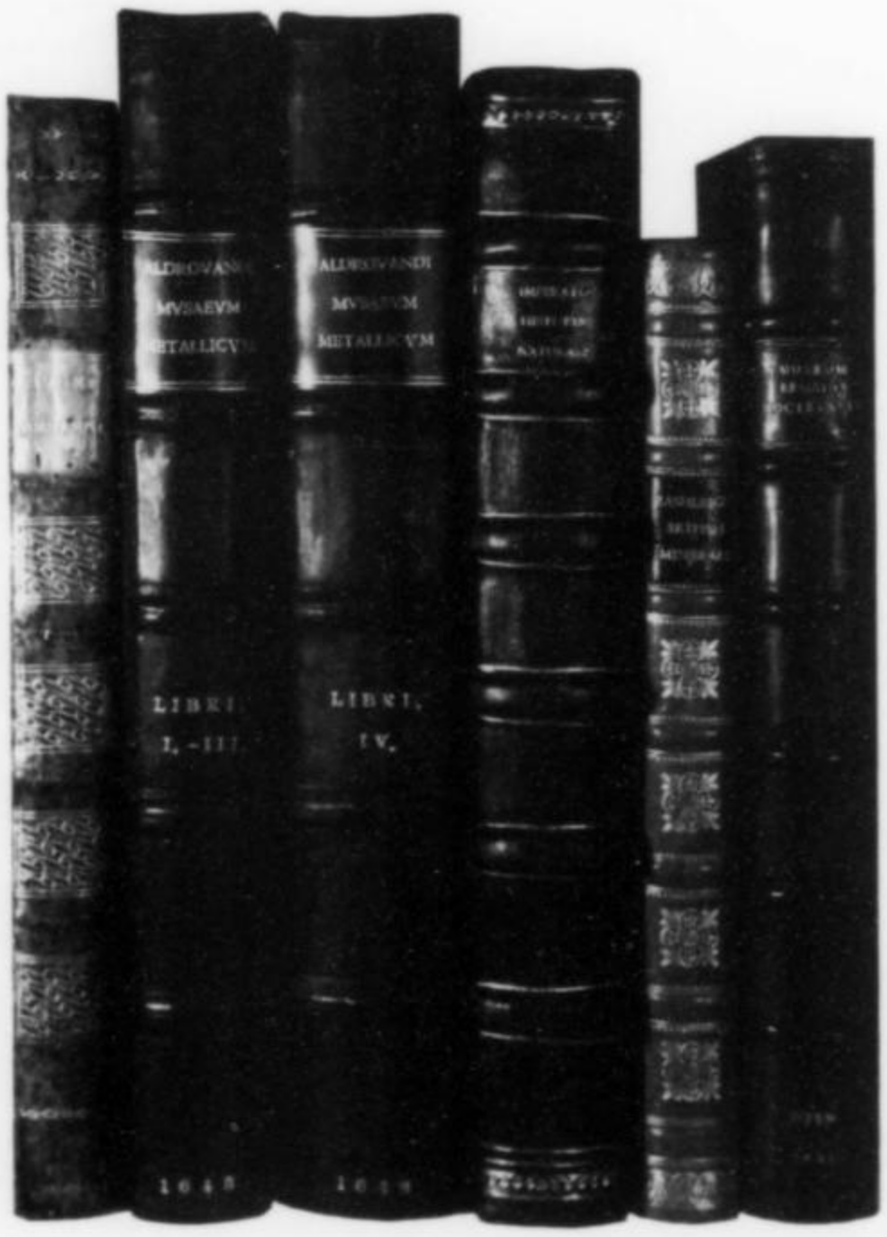
Illi ex Terrâ fanctâ, cujus Venas fequuti,
Efficiunt STANNUM, *&c.* DIOD. SICUL. Latin Tranflat.

LONDON:

PRINTED AND SOLD FOR THE AUTHOR,
BY JAMES PHILLIPS, GEORGE-YARD, LOMBARD-STREET.
SOLD ALSO BY B. WHITE, FLEET-STREET; AND J. ROBSON,
NEW BOND-STREET. MDCCLXXVIII.

example, of the seven editions of James Dwight Dana's *System of Mineralogy* (and most mineral book collectors of my acquaintance wish to own all seven), it is the second edition, privately published by the author in New York in 1844, which is the rarest and therefore the most difficult to acquire; but the first edition of 1837, in the general book market at least, where the cult of the *first edition* reigns, is still the most expensive. (Please see pricing comments about this work at the end of this article.) Mineralogists and students of mineralogical history will surely want to add the third edition of 1850 to their shelves because it was the first to employ the modern "Dana" system of mineral classification as opposed to the old Linnean system used in the first two editions, and therefore can be considered "historically significant" or even a "pioneering work" of modern mineralogy.

Other specialities are also possible. For example, a collector might focus on, to name just a few categories, books about determinative mineralogy, pegmatites or the California gold rush. However, in this last specialty, romantic and highly collected as it is, he will find much competition from general book-collectors. He could also, as this writer is doing, try to find all the contemporary English language editions and translations of the early mineralogies of authors such as Cronstedt, Werner, Henckel, etc. and mineralogical/geological travels such as Ferber, Lyell, etc.



One of the specialties of the Mineralogical Record library, to cite just one more example, is early mineral collection catalogs and auction catalogs. The possibilities are really endless.

SOME MARKET FUNDAMENTALS

What is it that a person really needs to know to successfully collect rare mineral books? One needs, first of all, to be comfortable with the jargon of the general booksellers and their catalogs. This is, at least in this writer's experience over the years, because it is from the generalists that he has acquired most of the mineral books in his library, and, surprisingly, not from the specialists. One reason for this is pricing. When books are found out-of-context, as it were, they are often (but not always) underpriced. And, for the time being at least, the general booksellers are much more knowledgeable in their descriptions and discussions. For instance, what really is (and what is not) a "first edition?" Then there are other questions: How important are dust jackets? What about bindings, condition, restoration, rarity and the effect of these factors on value? Rarity in books should certainly not be a difficult concept to nail down.

What is a rare book? According to one widely held opinion, any book printed on the continent of Europe before the year 1500, any book printed in England before 1600 and any book printed in America before 1700 is, *by definition,* a rare book. (This has been expanded a bit at the New York Public Library so that any American book printed before the year 1800 is now considered *rare.*) This approach is interesting, of course, but does not help us much with mineral books. We will often read in a book catalog such qualified descriptions as "rare in this condition," "rare with the half-title," "rare thus," and on and on.

Sowerby's *Exotic Mineralogy,* most will agree, is a difficult book to acquire (the writer has never owned a copy), it is quite expensive when it turns up, but is it rare? Probably not. Twenty-four complete copies are known to this writer so far (there are surely more) and four incomplete ones. One collector of my acquaintance owned, at one time, *five copies.*

Carl Krotki quotes a librarian at the Morgan Library who observed that the Gutenberg Bible is not really a rare book. She said that the Morgan owns two and one-half copies and there are six copies in New York City alone, so it should not be considered rare. Rare-in-the-marketplace, however, is something else again. One simply must develop one's own concept of the rarity, or availability, of mineral books (and the pricing connected thereto) through a long-term study of dealers' catalogs and price lists, and auction sales records.

Mineral-book collectors of today are generally not yet inclined to split hairs over the fine distinctions that fascinate and sometimes dominate the lives of those bibliophiles known lovingly as bibliomaniacs. Nevertheless, because the time may come when they will, and because those factors definitely can affect the price of a book (sometimes, shockingly), it is worthwhile to understand some of them. The definition of what constitutes a first edition, for example, may seem patently obvious. If a publisher plans to print a new book in an edition of, let us say, 1000 copies, then these 1000 copies will constitute the "first edition." If, however, he discovers an error half-way through the printing, and judges it serious enough to correct in the remainder of the run (but not serious enough to destroy the already-printed copies), he has created a "first issue" and a "second issue" of the first edition, and it will be this "first issue" and *only* this one that the serious collector will covet and pursue.

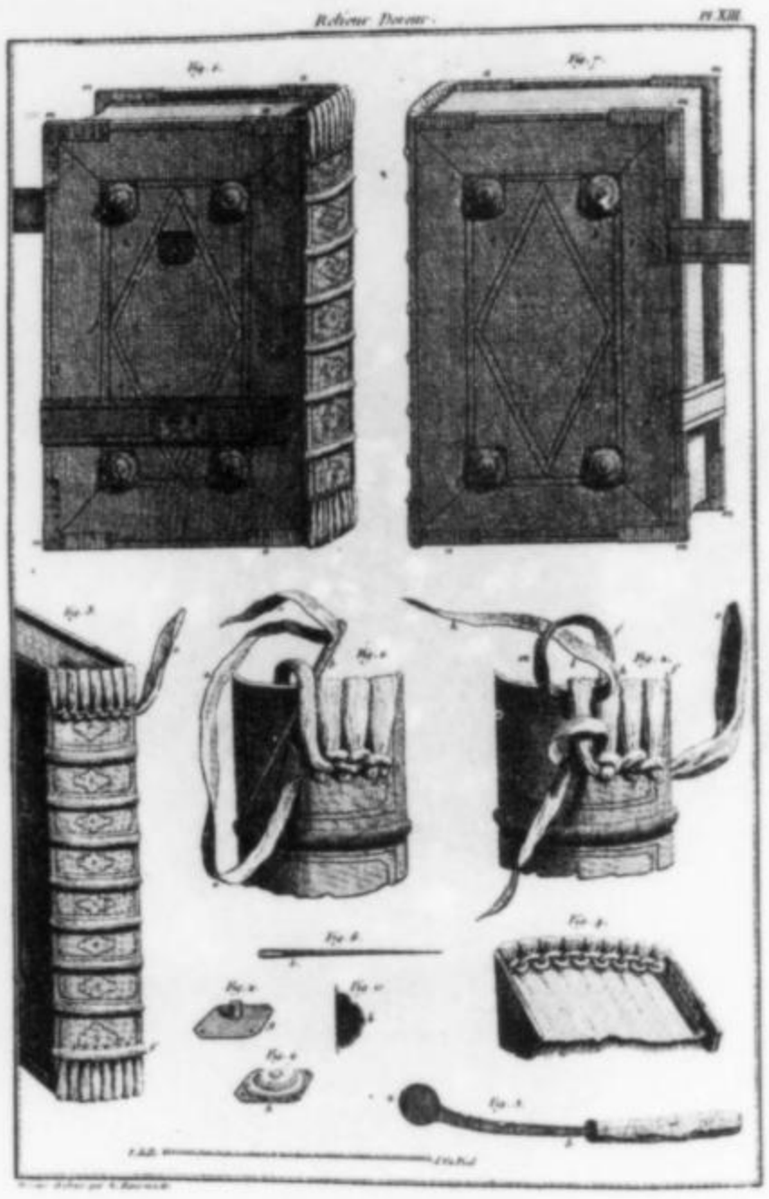
These minute differences taken so seriously in the general book world can be of extreme importance and can sometimes mean a difference in price of many thousands of dollars. A new issue might also be created by a change in paper stock, ink color or any similar noticeable change.

Should some of the metal type break down after some copies have been printed, and if this problem goes undetected and uncorrected, a "first (or early) state" and a "second (or later) state" would then exist. One could, in theory, have copies of the first edition, that are first issue, first state; first issue, second state; second issue, first state and second issue, second state, with the first edition, first issue, first state copy the *only one* the serious collector would be interested in owning! (This term "state" is sometimes used another way. Editions are sometimes published in which some of the copies have had their plates handcolored, and some copies have the same plates but without coloring; the work is then said to exist in a "colored state" and an "uncolored state.")

Little work has as yet been devoted to compiling serious mineralogical bibliographies in such fine detail so as to record different issues and states, but these differences or "points" as they are sometimes called, surely exist and may eventually be considered important. Deciding what constitutes an "edition" can sometimes be confusing enough. For example, William Babington's *A New System of Mineralogy* (London, 1799) has been called a second edition of his earlier *A Systematic Arrangement of Minerals* (London, 1796). However, a work that changes title, and increases from 26 to 279 pages surely deserves (sometimes to the contrary of the author's wishes) to be designated as a new work and to be called a first edition in its own right. Generally speaking, if a book (especially a mineralogy) does not state otherwise, it is probably a first edition. Exceptions, however, include purposeful deceptions. This may have been what led Romé de l'Isle to entitle his massive four-volume *Cristallographie* of 1783 the "second edition" of his slim one-volume *Essai de Cristallographie* (Paris, 1772). Edgar Allan Poe some 50 years later may have been similarly motivated when he instructed his printer to place the words "Second edition" on the title page of the *first* edition of his *Poems* (New York, 1831). These marketing ploys are taken, apparently, to make a work appear to have been already well received by the

public and popular enough to have required a second printing.

When it comes to bindings, mineral-book collectors are, for the most part, not as demanding (again, the disclaimer "as yet" must be added) as general bibliophiles. I have yet to hear of a mineral-book collector paying a significant premium for a book because it was in "original wrappers," and only rarely do I hear of a book in a contemporary binding bringing much more than a nicely rebound copy. Indeed, often the exact opposite is true in the general book world. Under certain circumstances, the former might command a price ten times higher than the latter. Curiously, things were not always so, and a wealthy



"gentleman collector" of a century ago would have had most, if not all, of the books in his library routinely rebound in sumptuously gold-tooled, richly colored morocco leathers, sometimes with contrasting leather inlays, onlays, jewels, etc. Today there is a school of bibliophiles who collect, and pay handsome sums for, the best of these "exhibition" bindings.

On the other hand, with paper covers being as fragile as they are, a book bound with old paper cannot safely be read and used for everyday reference purposes. Nor, for that matter, can a book which is "unopened" be easily consulted. Here is one of the principal paradoxes faced by the collector of rare books. How can he rationally prefer copies of books which he cannot permit himself to read and use? One's passion for the subject matter is not well served by standard bibliophilic priorities and proprieties, and each collector must decide what is most important to him. Some collectors will aspire to owning two copies of "delicate" works, one suitably bound for reference and one safely ensconced in a custom-made book box. Of course, if a reprint edition should be available, then the reference-copy problem is easily solved.

What of the difference between a contemporary binding (as old as the printing) and a more recent binding? In the general book world, contemporary bindings command prices that can be two to five times, or more, higher, but in the mineral-book world the difference, if any, is slight. This attitude seems to be changing a bit, and may alter drastically if mineral-book collectors evolve closer in philosophy to that of the wider community of bibliophiles.

The precise condition of a book, although easier to convey than that of a mineral specimen, can never be perfectly described in words. A book must be seen to be properly evaluated. Booksellers and auction houses, nevertheless, attempt verbal descriptions in their catalogs, and in general there has been a drift in the use of standard terminology to describe condition; a book called *good* 20 years ago would probably be called *fine* today. There have been many jibes at the details of descriptions typically offered by booksellers. A familiar one is: "Pages foxed, covers detached, titlepage missing, corners mashed, *else fine.*" (Italics added.) The term "else fine" is something of a joke among bibliophiles. Another self-contradictory description, this time from a mineral-book catalog issued about ten years ago: "Hinges cracked, spine coming loose, front endpaper torn, light foxing throughout, *otherwise fine.*" (Italics added.) What is important, though, is for the collector to study how his favorite booksellers describe their books and learn to interpret their descriptive terms concerning condition, rarity, etc.

MODERN BOOKS

Collecting modern mineral-related books can be as enjoyable and challenging as it is inexpensive. The late Paul Desautels, former curator of minerals at the United States National Museum of Natural History, told me that his classic "coffee table" book *The Mineral Kingdom* (New York, 1968) appeared in a first edition of 10,000 copies. Two years later a second printing was produced which differed only in the substitution of a photograph on page 224. Later there was a "Crown Edition" printing and then a softcover edition. There also was a London edition in which, without the author's knowledge or permission, the text on Michigan copper was removed and a new chapter on Cornwall added! In addition, there were French, German and Italian language editions. So, a discriminating collector can, if he wishes, have eight different copies of *The Mineral Kingdom* on his shelf, ideally, *each with its original dust-jacket preserved* (because dust jackets *should* be preserved), except, of course, in the case of the softcover edition.

"The Book Dealer
If you seek the treasure of wisdom,
make room for good books"

A FEW COMMENTS ON PRICES

The lack of sophistication in the attitudes of mineral-book collectors relative to that of general bibliophiles is accompanied by (and perhaps related to) extraordinarily lower pricing. The 1781 work by Fabien Gauthier d'Agoty, mentioned previously as an early example of color printing, is probably the single most valuable mineralogy book and is worth more than $25,000. Were it not for its significance as a pioneering work in color printing, it would certainly be less costly as a mineral book. The color plates, with one or two exceptions, are not especially attractive. As another example, Wendell E. Wilson (*Mineralogical Record,* Volume 21, page 399) remarked that one of the four known copies of J. E. Hebenstreit's *Museum Richterianum* (Leipzig, 1743) in the colored state, might have sold then (1990) for $5,000 to $10,000. I would guess somewhat higher, but even so it would still be insignificant compared with the prices being fetched by comparable books in other fields today. For example: In 1989 Sotheby's auction house in New York sold the library of the late H. Bradley Martin (1906–1988), generally recognized as one of the finest in the world. Martin's copy of *A Monograph of the Phasianidae or Family of Pheasants* (New York, 1872), two volumes containing 79 handcolored plates, sold for $93,500. *Oiseaux brillans du Brasil* ["Brilliant Birds of Brazil"] (Paris, 1834), with 59 of 60 handcolored plates (lacking one) and missing the title page, brought $121,000. *Birds of New South Wales* (Sydney, 1813), with 18 handcolored plates, one of 11 known copies, brought $396,000, and, *The Natural History of Carolina, Florida & the Bahamas* (London, 1729–1747), two volumes containing 220 handcolored plates, was hammered down at an impressive $407,000. Finally, it will perhaps be overkill, but it must be mentioned that Mr. Martin's copy of Audubon's *The Birds of America,* with 435 handcolored, double-elephant-folio sized engravings, brought the sum of $3,960,000!

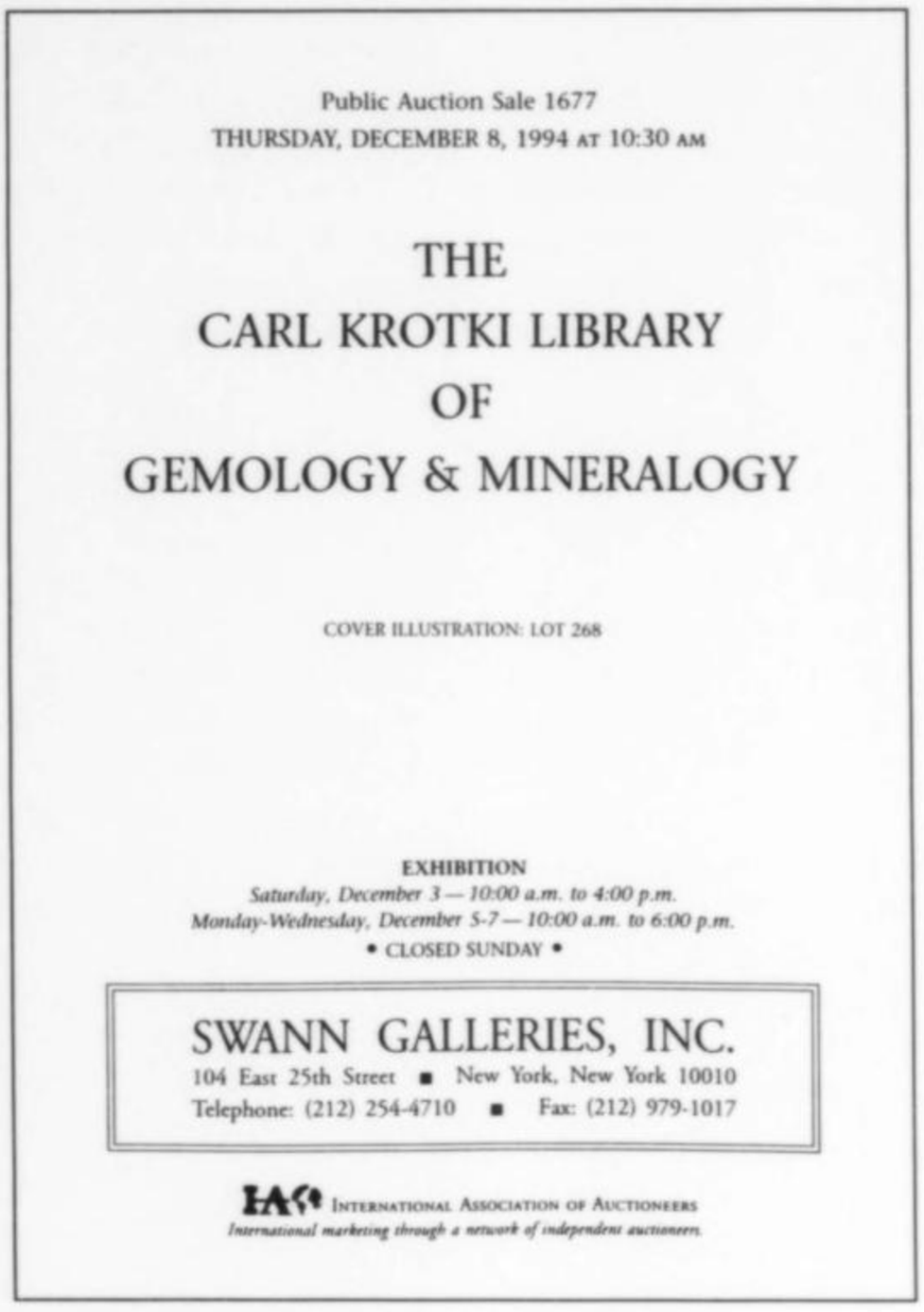
This disparity in prices is something which mineral-book collectors may point to with relief or despair (depending on whether they are buying or selling), but identifying the cause is a different matter and perhaps some honest soul-searching will provide an answer. Are the color-plates in the classic mineral books *really* beautiful? Are they of sufficiently dramatic coloring to be compared with, and collected by, the same persons who long for a copy of *Brilliant Birds of Brazil*? Probably the answer has to be no. If one looks carefully and objectively at a copy of the recent re-publication of Schmiedel's *Erz Stuffen und Berg Arten (and tries to forget the affection he has for the depicted objects)* he can then see the problem. The prints are exciting, quaint, fascinating to the cognoscenti, but they are not especially beautiful!

Another interesting case in point is Johann Christian Sepp's polyglot (five language) edition of *A Representation of Different Sorts of Marble* (Amsterdam, 1776). This work, depicting polished *rock* samples, of course, and not crystallized minerals, contains more than 500 hand-painted examples of the most beautiful, sensitive, superbly executed, and delicately colored plates imaginable. The three-dimensionality of the paintings is fascinating, and it puts to shame, in this writer's opinion, *any* handcolored mineral plate book in which the colorists were required merely to fill in the outlines of a printed image. The marble work, which shows up from time to time on the antiquarian market and in the auction rooms, and seems to be collected almost entirely *outside* of the mineral fraternity, is usually priced at retail at around $20,000. Incidentally, Mr. Martin owned no mineral *or marble* color-plate books.

IN CONCLUSION

The above caveats and pronouncements should not cause the reader to be discouraged about acquiring old mineral books. *Now* is the time to buy them, because they will never be cheaper, more plentiful, nor more easily obtainable. Indeed, in a recent issue of the *Mineralogical Record,* I counted no less than *six* advertisements offering books on gems and minerals. Over the last 20 or 30 years, books have been as good an investment as fine minerals. They are easier to describe, ship, store and preserve than minerals; they are less prone to tiny, but value-reducing damage and (perhaps most importantly) are easier to liquidate as assets; but in the last analysis, they represent the

distillation of the mineral knowledge of the centuries. In my article "Reflections upon perusing a 1942 bookseller's catalogue" (*Mineralogical Record,* March-April, 1980), I observed that—"Today, only the most vigorous and vigilant pursuits and pursuers are turning up any good old books on minerals and gems. The standard sources are drying up and prices are going wild." And we all know what has happened since 1980!



Public Auction Sale 1677
THURSDAY, DECEMBER 8, 1994 AT 10:30 AM

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CARL KROTKI LIBRARY
OF
GEMOLOGY & MINERALOGY

COVER ILLUSTRATION: LOT 268

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Saturday, December 3 — 10:00 a.m. to 4:00 p.m.
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A very interesting epilog to the pricing information in this article took place on December 8, 1994 at the Swann Galleries in New York City: the auction sale of the "Carl Krotki Library of Gemology & Mineralogy." To my knowledge it was the largest such auction sale ever held. It was not only the very high prices of most of the better books that were notable (dealers present at the sale watched in awe as books sold for prices that, in some instances, were more than *double* those of similar copies for sale in their inventories) it was the broad interest in bidding including much by mail (or as it is called in the auction house jargon "orders"). At the end of the spirited bidding on each lot it usually came down to a contest between only two bidders, but earlier in the competition action seemed to come from all corners of the room as well as over the telephone lines (six were open and they were often all in use simultaneously). A few highlights require comment. The d'Agoty (Jean-Fabien Gautier d'Agoty's *Histoire Naturelle . . . Regne Mineral,* Paris, 1781, first edition, second state, containing 60 of 70 colored plates and carrying a pre-sale estimate of $10,000–15,000, which evaluation this writer, at least, knew was well under reality) was the highlight of the sale, going to a New York mineral collector and bibliophile for $48,300! The room burst into applause at the conclusion of the bidding for that lot. The Louderback pamphlet on benitoite went back to California for $1,265 and Sowerby's *British Mineralogy* made $12,075. (At the conclusion of the bidding for that item Carl Krotki announced to the room that he had paid $90 for it.) The purchaser of the d'Agoty got a deserved bargain later in the sale when he bought, with virtually no competition, a copy of "Schmiedel" with 21 plates (pre-sale estimate $1,000–2,000) for a very low $825; a copy of my book *Letters to Kunz* (with an original letter) made a very respectable $1,035 and a first edition of Dana's *System of Mineralogy* sold for an amazing $5,060; but the mystery of this sale has to be the reason why the slim, unillustrated first edition of A. H. Chester's *A Catalogue of Minerals alphabetically arranged* (New York, 1886) made $3,910! (Remember, it took a minimum of *two* bidders to reach that sum.) The total for the 347 lots (including many multiple lots or "bunches") with the buyer's premium of 15% added came to an impressive $212,295.

Finally, I should like to leave you with this thought, a quotation, slightly edited for modern readers, from *Gossip About Book Collecting* (two volumes, New York, 1900). It was written by William Loring Andrews (1837–1920), gentleman, bibliophile, author, amateur publisher of books in limited editions and one of the founders of The Grolier Club. (It was one of his publications that was my first "rare book" purchase in the mid 1950's. Mr. Andrews is the subject of an extensive bio-bibliography now being written by me, and it was his style I tried to emulate in my book, *Letters to Kunz.*)

> Buy books cheaply if you can, dear if you must, but when an opportunity arises to secure a rare book, do not hesitate to pay the price demanded, even if it appears to you excessive. It may be *nunc aut nunquam* [now or never] and the book may *never* pass your way again, or if it should, the chances are ten to one that the demand on your wallet will be still more exacting. After years of patient and persistent collecting, if you have exercised good judgment as to the character and *condition* of the books you have bought, you will inevitably find that the cost of your acquisitions is less than they could be replaced for.

GLOSSARY OF BOOK TERMS

BEST EDITION. Used in earnest (and of course, occasionally very subjectively) by some booksellers, but often read cynically by collectors to mean

that very edition currently in the dealer's stock, or the one in which he has the biggest markup, etc.

BIBLIOCLAST. A "book breaker" who disassembles books in order to sell their plates individually.

BIBLIOGRAPHER. A person skilled in compiling systematic lists of books relating to specific limited topics, often bringing significant knowledge to bear regarding book history, format, editions, collations, printing, etc.

BIBLIOPHILE. A book lover. (BIBLIOPHILY is the love of books.)

BINDING COPY. A book whose binding is so tattered that it must be rebound to be used might be called a "binding copy." The interior should be in acceptable condition and, of course, worth the cost of rebinding.

BOOK SIZES. Listed are some of the traditional terms, but they are not usually considered of critical importance today.

Folio. Undefined exactly, but a large size that can be 15 x 22 inches or more, sometimes consisting of a very large sheet folded once to form two page sheets.

Quarto. (Qto., 4to.) Roughly half the size of folio. Often a folio that has been folded once, yielding four page sheets.

Octavo. (Oct., 8vo.) Roughly half the size of quarto, sometimes a folio that has been folded twice, yielding eight page sheets.

Duodecimo. (twelvemo., 12mo.) Usually derived from a sheet folded so as to yield twelve page sheets.

Sextodecimo (sixteenmo., 16mo) Usually consisting of a folio folded three times to yield sixteen page sheets.

BOOKPLATE. A printed label (created as a plate) denoting ownership, usually applied to the inside of the front (sometimes called upper) cover. A bookplate of someone famous affixed to a book is a plus; an ordinary person's bookplate, if small and tasteful has no effect on value, but if it is of large size or garish, and cannot be removed without leaving ugly glue stains, it can definitely detract from a book's desirability *and value.* (See the article on bookplates elsewhere in this issue.)

BREAKER. A book that is usually, but not always, a defective copy, that is more valuable for its plates and is often destroyed to obtain them. The plates are sold individually for framing and the text is discarded. Fortunately (or is it?) this rarely happens to mineral color-plate books.

CALF. A smooth leather made from the skin of a calf. Calf is the type of leather most often found binding old mineralogies, especially American examples.

COLOPHON. From the Greek meaning *summit.* A page at the end of a book giving detailed information about the printing of the book. In very early books its use preceded that of the titlepage.

CONTEMPORARY. This term, when applied to book bindings, means that the binding of the book dates approximately to the time of the printing of the book. Sometimes used very loosely. In the world of books it is never used as a synonym of *modern.*

DEDICATION COPY. That particular copy of a book (and, *by definition,* there can be *only one* unless, of course, the book was dedicated to more than one person) that the author presented, usually with autograph inscription, to the person to whom he dedicated the book. Many years ago I informed a certain geoscience author of my acquaintance that I possessed the dedication copy of one of his books. His reply was that it wasn't significant because he could, with his pen, create any number of them. My answer, and correctly, was that all of those later copies would be *forgeries.*

FIRST EDITION. See discussion.

FIRST ENGLISH EDITION. The first edition of a book published in *England.* This term should never be used to denote the first edition of a book in the English language published in another place. Such a book can be referred to as *the first edition in English.*

FOXING. A quaint term for ugly, blotchy brown staining or discoloring that results from a chemical reaction within the paper of the book. It is usually brought on, or hastened, by exposure to dampness.

HALF-TITLE. The page before the titlepage, containing the title information, usually in abbreviated form. Many half-titles are discarded when books are bound, but they are important and should be recorded carefully in mineralogical bibliographies.

INCUNABULA (singular form: INCUNABULUM). From the Latin meaning, literally, "from the cradle," that is, books produced in the earliest days of book printing. The term applies to books printed in the year 1500 or before.

INSCRIBED COPY. A copy of a book bearing the author's signature only, and not specifying the name of the owner or recipient, if any. This can also can be called a signed copy.

INTERLEAVED. Occasionally mineralogies (and other books, too) are bound with blank leaves alternating with the printed ones, presumably to be used for handwritten notes. Such books are said to be interleaved.

KEY BOOK. Usually the earliest or, more likely, the most important or most desirable book in a field.

LARGE-PAPER COPY. Occasionally, especially in the past, a publisher might print some copies of an edition on sheets that were noticeably larger than his normal stock, resulting in very large margins *all around*; the paper used may *also* have been

thicker or heavier than normal. The result is what is called a "large-paper copy" and is different from a *tall copy* (which see).

MADE-UP COPY. A made-up copy is the result of the replacement of a single leaf, a plate, a titlepage, or more, from another, but also defective or incomplete, copy of the same edition. The term is seldom encountered in bookseller's catalogs because of a lack of recognition (or honesty?).

MINT. A term describing condition that means as-new, usually used in referring to stamps and coins; it should be *avoided* in book descriptions. I recently saw the following terms used in describing modern first editions—(M) = Mint; (NM) = Near Mint; (PM) = Pristine Mint, etc. All are inadvisable.

MOROCCO. Originally a grained leather made from the skin of Moroccan goats. Today the term is used much more loosely for any leather, even calf, that has been processed to look like goatskin.

OFFPRINT. A separate printing of a part of a larger work, especially articles from scientific journals, *using the same type as the original.*

OUT-OF-PRINT. When a *publisher's* supply of a particular book is exhausted, that book is said to be out-of-print.

PRESENTATION COPY. A copy of a book that was a gift from an author (or occasionally, an artist, an editor or a publisher) to the recipient, with presentation inscription. Also seen described as author's (etc.) presentation copy.

PRIVATELY PRINTED. A term generally used for a book which is not produced for commercial distribution, but usually by the author. This phenomenon is sometimes called *vanity publishing.* Such a book is usually distributed privately, and not by the standard commercial methods.

READING COPY. An apologetic term reserved for a copy of a book definitely not in good enough condition to satisfy the requirements of a discriminating book-collector.

REBACKING. Replacing a damaged spine while retaining the original front and back covers.

RECTO. The front of a leaf (two-page sheet). See Verso.

RE-HINGING. If a book's outer hinges have broken, a skillful binder can reapply the original spine *over* a new leather spine in a manner that is almost undetectable. This is called re-hinging and is different from (and preferred to) rebacking, when an entirely new spine is supplied. It is also a much more expensive operation if sympathetically accomplished.

SLIP-CASE. An open-front box slightly larger than its occupant volume, into which the book is "slipped." The spine of the book is then visible on the shelf. There are also more elaborate versions that completely encase the book, relying on a newly-made spine on the box to provide the book's title information. In special cases where the friction of sliding a book in and out must be avoided to prevent wear, a clam-shell slip-case can be prepared which opens flat for insertion of the book.

TALL COPY. A book whose pages have been only slightly trimmed by the binder, and whose resultant top, bottom and outer margins are larger than other copies of the same edition, may be called a "tall copy." If the edges have not been cut at all, the book is called "uncut." Not to be confused with a "large-paper-copy" (which see).

UNSOPHISTICATED COPY. A book, generally an early one, that retains its original condition and that has not been restored in any way.

VERSO. The back of a leaf (two-page sheet). See Recto.

SUGGESTED READING

For pleasant and sometimes exciting reading I can recommend a few of my favorite books-about-books, but please keep in mind that there are literally thousands of them, and that several booksellers exist who sell *only* this type of book.

CARTER, J. (with corrections and additions by Nicolas Barker) (1980) *ABC for Book Collectors.* London, Sixth edition. (In print.)

JACKSON, H. *The Anatomy of Bibliomania.* Various editions.

KRAUS, H. P. (1978) *A Rare Book Saga. The Autobiography of H. P. Kraus.* New York.

NEWTON, A. E. (1918) *The Amenities of Book-Collecting and Kindred Affections.* Boston.

REES-MOGG, W. (1985) *Christie's Collectors Guides: How to Buy Rare Books. A Practical Guide to the Antiquarian Book Market.* Oxford.

WOLF, E., and FLEMING, J. F. (1960) *Rosenbach. A Biography.* Cleveland. This volume is, in my opinion, the single best, and most exciting, book-about-books ever written, and it discusses mineral-collector Clarence S. Bement's book-collecting activities.

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MEDIEVAL MINERALOGY

Frank Dawson Adams
(1859–1942)
McGill University
Montreal, Quebec

Minerals have been the subjects of study, or at least of interest, since ancient times. The early authors did their best to puzzle out mineralogical relationships and the significance of real and legendary physical properties. The works they published during the centuries before the Renaissance and shortly thereafter are historically and culturally fascinating, and also constitute today some of the rarest and most desirable titles for the antiquarian book collector in the field of mineralogy.

INTRODUCTION

The following article* was originally published as part of Frank Dawson Adams' *Birth and Development of the Geological Sciences,* which is perhaps the most quoted reference on early mineralogical literature. The only alteration is the compilation of a reference list from Adams' footnotes, augmented by translations of various works published after 1938 and some new illustrations.

Adams was born in Montreal in 1859 and died there on December 26, 1942, at the age of 83, just four years after the publication of his book. He received his bachelor's degree from McGill University in Montreal in 1878, attended the Sheffield Scientific School at Yale and obtained his PhD (*summa cum laude*) in geology at the University of Heidelberg in 1892. He began lecturing in geology at McGill in 1889 and was made a full professor in 1893. He retired from teaching in 1924 and devoted himself to book collecting and research in the history of medicine and of geology. His extensive antiquarian library numbered about 1500 volumes at the time of his death and was willed to the Osler Library at McGill where the books may be seen today. He was held in high esteem particularly for his work with the petrographic microscope. The geology building at McGill is named in his honor. Ed.

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In medieval times no distinction was made between minerals, rocks and fossils as these words are now understood—all were brought together into one class and were known as "Fossils" from the Latin word *fossilis,* that is, a thing dug up out of the earth. With the advance of knowledge the distinction between these three classes came to be recognized and the three sciences of mineralogy, petrography and paleontology arose devoted to the study of these three groups respectively. Those "fossils" which are now known as minerals are the subject of this article.

SOURCES

Our information concerning medieval mineralogy is derived from several sources. First, and of least importance, are the medieval encyclopedias. These

works aim at setting forth the whole range of human knowledge at the time in which they were written and among other things treat, in a general way, of minerals. The information which they give is compiled from other and older writers whose works in many cases have now disappeared and are known only from the quotations given in the encyclopedias. A large part of the information, such as it is, has its origin in Pliny's *Natural History* or comes from Theophrastus. They also copy from one another as they appear in successive order (see Mieleitner, 1922). The earliest of these is that extraordinary collection of miscellaneous information which was the encyclopedia of the Dark Ages by St. Isidore of Seville, who was born in Cartagena in 570 and died in 636. He was for some thirty years Bishop of Seville. His descriptions of minerals are taken largely from Julius Solinus, and he devotes especial attention to the etymology or derivations of the names of minerals, as indicated by the title of his work. These are for the most part quite incorrect and in many cases ridiculous, as when he says that aurum (gold) is derived from aura (air) because it is through the air that the splendor of the metal is reflected to our eyes.

Another early encyclopedia is that of Rabanus Maurus who was born in 776 at Mainz. He was Abbot of Fulda and almost continuously from 804 to 842 was head of a celebrated cloister school in that center of learning. In the sixteenth chapter of his book, which is entitled *De Universo,* he treats of minerals but follows Isidore and adds little or nothing of his own. He tries to bring everything into relation with Holy Writ and his treatment is frequently very recondite, fanciful and mysterious.

Another writer who deserves special mention here is Alexander Neckam (1157–1227), who was one of the most remarkable English men of science of the twelfth century. In him we have a curious link between the history of science and ordinary secular history, for he was the foster-brother of King Richard the First of England (Coeur-de-Lion). In a chronicle formerly existing among the manuscripts of the Earl of Arundel it is recorded that "In the month of September 1157 there was born to the King at Windsor a sone named Richard and the same night was born Alexander Neckam at St. Albans, whose mother gave suck to Richard with her right breast and to Alexander with her left breast." He received his early education at the Abbey School of St. Albans and later studied at the University of Paris, where he became a professor in 1213. His relation to the King who was a lover of learning explains, in part at least, the brilliant position which Neckam achieved in later life. While still bound by a reverence for authority, he sought for something more satisfactory than the teaching of the schools and frequently shows a leaning toward experimental science. Neckam in his book has a long satirical discourse on the logical teaching of the schools of the University of Paris and especially on the quibbles and falsities into which, in the scholastic teaching, logic continually degenerated. Wright, who edits Neckam's book and supplies an interesting and valuable preface to the volume, remarks that Neckam gives a number of examples of this:

> He shows how, by the train of reasoning employed in the schools, a man—Sortes the man of straw employed in the language of the scholastic disputations—might be proved to be a stone, or a rose, or a lily, or any other object; how what Sortes or any other individual said was at the same time true and false; how Sortes at the same time knows something and knows nothing; and a number of other similar quibbles.

Neckam's book was intended to be a manual of the scientific knowledge of the time but has an additional interest from the introduction of many contemporary stories and anecdotes illustrating the conditions and manners of the age. He draws from almost every scientific fact which he mentions a moral or religious lesson or application, although these are often far fetched and their truth by no means very apparent. His book abounds in stories of animals and plants. He mentions the metals briefly and refers to a dozen minerals or stones but does not describe them. Concerning mercury he remarks:

> Quicksilver is necessary in gilding; at first the substance of the gold appears to be totally absorbed by the quicksilver, but afterward, by the agency of fire, the quicksilver is consumed and the colour of the gold comes out in all its brightness. So the mind is not gilt with the gold of wisdom without the agony of tribulation and sometimes the beauty of wisdom appears to have entirely disappeared in the tribulation

until it is submitted to the solace of the Holy Ghost, represented by fire, and then the strength of wisdom returns to its brightness.

Like most people in the Middle Ages, Neckam believed that gems and precious stones possessed extraordinary virtues. Thus in referring to agate he repeats the statement made by Marbodus to the effect that the agate (*achates*) carried on the person rendered the bearer amiable, eloquent and powerful, and he explains the story of Aeneas having a faithful companion named Achates by supposing that he carried with him an agate stone whereby he acquired the love of many people and was rescued from many dangers.

At a considerably later period in his life, Neckam wrote a poem called *De Laudibus Divinae Sapientiae,* which is a metrical paraphrase of the *De Naturis Rerum,* but in it many of the stories are omitted and in places very considerable additions of new material are made.

In the interval between the writing of the two works Neckam had evidently continued his studies and enlarged his knowledge of mineralogy for in the *De Laudibus* after naming the metals he mentions thirty seven minerals, most of them precious stones and refers to their distinctive virtues.

Another great Englishman among the ranks of the medieval encyclopedists is Bartholomaeus Anglicus, whose book *De Proprietatibus Rerum,* written about 1240, was widely read and had a great influence in its time. He treats a series of stones and metals arranged in alphabetical order closely following Isidore of Seville.

Another of the great encyclopedias is the *Speculum Mundi* by Vincent of Beauvais written between 1240 and 1264. In the general prologue he says that there are a multitude of books and time is short and furthermore man's mind cannot gather in and retain all that the books set forth, therefore he had determined to condense all knowledge into one great work. It is indeed a great compilation in which he quotes from 450 writers by name, some of whom are now known only by the "excerpts" which he gives from their writings. In the brief portion dealing with minerals and rocks he seems to have added nothing to the observations of former writers. The work went through many editions: that in the Osler Library, which is one of the earliest, was printed "not later than 1478." Among the writers whom he quotes most frequently is the almost unknown writer of a very early encyclopedia, Arnoldus Saxo (see Sarton, 1931, for references to the literature concerning this author), whose work *De Finibus Rerum Naturalium* was written between 1220 and 1230. In it the section on stones consists of an annotated list in alphabetical order of 81 names, and is in turn taken from Albertus Magnus, "Evax," Dioscorides and certain Arabic writers.

Another writer whose work is but little known is the Dominican Thomas Cantimpratensis, who was born at Brussels in 1201 and died between 1263 and 1280. He resided for many years at Cambrai, from which place he derives his name. His encyclopedic work entitled *De Natura Rerum,* was never printed, but several manuscripts of it exist, one of the most perfect being in the Staatsbiliothek in Munich. He describes about 70 minerals, the number varying somewhat in the different manuscripts, and enlarged on the occult properties of the precious stones, but adds nothing to the work of earlier authors from whom his information is derived. According to Valentine Rose (Mieleitner, 1922), a number of the trade names for certain stones, as for instance corneolus, granatus and rubinus, first appear in this book.

The encyclopedia attributed to Berengarius and entitled *Lumen Animae* may also be mentioned. A critical description of it is given by Thorndike (1929).

In addition to these encyclopedias there appeared in the Middle Ages a number of popular works on natural history, many of them compilations by men who cannot be ranked as scholars. Some of these works were very widely read, and foremost among them is a very celebrated work entitled the *Book of Nature* ("Buch der Natur") by Conrad of Megenberg. The author of this work was born in 1309 and died in 1374. His father was Constable of the castle of Megenberg near Schweinfurt. He studied at Paris and Vienna and was later appointed to the important position of Canon in the Cathedral of Regensburg. This is the first Natural History which appeared in the German language. It is a compilation drawn largely from the work by Thomas Cantimpratensis or Thomas of Cambrai, already mentioned, but much material has also been taken from Aristotle and Galen, coming through Arabian channels. There are four copies of fifteenth century editions of Conrad of Megenberg's book in the library of the British Museum, the oldest of which was published in Augsburg in 1475. On the title-page of each of these it is stated that the work was translated ("transferiert") out of Latin into German by Conrad von Megenberg. The Latin text referred to was evidently that of Thomas Cantimpratensis. In the portion dealing with gems, these are arranged alphabetically in order of their Latin names, and introduced with the words "In this 6th chapter of our book we will speak of gems, their color, the peculiar properties which characterize them and how we can increase their powers." 82 stones are mentioned, a number of these being quite fabulous as for instance the Terobolen, which are said to be the "Stones which come from the orient, some of them presenting the form of a man and others that of a beautiful young woman. If they are brought near to one another they send forth flames of fire." Also the Dyadochos, a stone which when cast into water causes certain spirits to appear who will answer

questions which are put to them. The book also contains many wonderful stories about animals and plants, which made it very attractive to the general reader, its popularity being enhanced by numerous illustrations, so that it passed through many editions. The book is worthy of study as presenting an admirable picture of the medieval conception of the world of nature. Megenberg himself, however, recognized that many statements in his book, even when drawn from what were considered to be sources of the highest authority were open to doubt, and in many places he does not hesitate to go so far as to state that he does not believe them.

The Herbals of the late Middle Ages and the Renaissance form another source from which some knowledge of the medieval mineralogy may be obtained. In 1484 Peter Schöffer of Mainz printed one of these in Latin which bore the simple title *Herbarius*.

Topazos.
From the Hortus Sanitatis *(1491)*

There was such a demand for this, that early in the following year he issued a similar but much larger book in German written by Johann von Cube the "Stadtarzt" of Frankfort, to which the author, in the preface, gives the name *Hortus Sanitatis* or, in German, *Garten der Gesundheit*. The book as the name indicates was intended to treat more particularly of the medicinal virtues of plants. In addition to the plants, however, a few animals and minerals, from which materials of therapeutic value were supposed to be obtained, are included. The work appeared in a great number of subsequent editions, some in German, others in Latin. It was also translated into Dutch, Italian and French. It appeared in a greater and in a smaller form known as the *Hortus Sanitatis Major* and the *Hortus Sanitatis Minor*. The smaller form is the older and was never printed in Latin but always in some other language. Most of the later editions are divided into three sections dealing with plants, animals and minerals respectively, completely illustrated and supplying information concerning the character and medicinal value of each and all. In the French edition of 1529 mention is made of 140 metals, stones and gems.

Who the author of the work was is really not known with certainty. By some it is believed to be Johann Wonnecke, his designation "von Cube" being derived from the fact that he came from Caub, a town on the Rhine between Bingen and Coblenz. Chouland (1858) thinks that the book is really a compilation from the works of a number of earlier writers. In any event it was the most popular illustrated book on natural history of the time.

A number of other herbals, based upon the *Hortus Sanitatis* and embracing minerals of supposed therapeutic value, appeared shortly after it. Among these may be mentioned that of Rösslin (1533) which passed through six editions in thirteen years. The second edition of this work mentions 80 metals and gems and is illustrated. Another on Lonicer, also illustrated, appeared in 1551 and treats of 85 metals, stones and gems.

MEDIEVAL LAPIDARIES

The most important source from which our knowledge of medieval mineralogy is obtained is the medieval lapidaries. They are treatises, usually quite short, which deal exclusively with metals, stones and gems, and in which as in the sources already referred to, nothing is said of the composition of the stones, and very little concerning their physical characters, but their medicinal, magical or mythical characters are set forth, these being, at the time when the lapidaries were written, properties which such stones were almost universally believed to possess, and which caused them to be looked upon with interest, if not with awe.

The lapidaries were very popular, not only among the educated classes of the community but also among the middle classes, as shown by the fact that there were many of them and they were in great demand, and when written in Italian were frequently translated into the vernacular languages of many of the leading European countries. Probably the goldsmiths and jewellers offered them for sale as setting forth the value of their wares, and the people bought the gems not only for purposes of adornment but for the magical powers which they were supposed to possess. How many of these lapidaries have survived is unknown. Some of them were never printed but are known to exist in the form of manuscripts only, in one or other of the great libraries of Europe.

Among the most important of these lapidaries the following may be mentioned (brief references to the other less well known lapidaries of Persian, Spanish and other origin are given by Sarton, 1931).

1. The Lapidary of Aristotle. It is now known that this book, although it bore the name of Aristotle down through the centuries, was not written by him but is of Persian origin from the pen of some unknown author [Ed. note: probably Avicenna] who lived about the middle of the ninth century. It describes 72 stones and is of especial value in that it affords an insight into the mineralogy of the Arabs, which had an important influence on the development of the science of mineralogy in Europe at a later date (see Ruska, 1912).

2. The Lapidary of Marbodus. This is in Latin hexameters and was written by Marbodus, also called Marbodacus or Marboeuf, Bishop of Rennes, between 1061 and 1081. It is by far the most important of the early medieval lapidaries.

DE
MINERALIBVS
ET REBVS METAL-
LICIS LIBRI QVINQVE.
AVCTORE
Alberto Magno ſummo
Philoſopho.
Solerti cura repurgati, & rerum natural. ſtudioſis publicati.
COLONIÆ
Apud Ioannem Birckmannum
& Theodorum Baumium.
An. M. D. LXIX.

Wayne Leicht Library

3. Albertus Magnus: De Mineralibus. One of the best and most comprehensive of the western medieval lapidaries, it was written about 1260. There are several works, dealing in whole or in part with minerals, which are attributed to Albertus. Of these, that entitled *De Mineralibus* is the most important and is at the same time undoubtedly a genuine work of his. The first edition was printed at Padua in 1476. Other editions have somewhat different titles: one printed at Oppenheim in 1518 bears the title *Liber Mineralium Domini Alberti Magni,* another in which the text is identical was printed at Cologne in 1569 with the title *De Mineralibus et Rebus Metallicis Libri Quinque.* It is a compilation from earlier writers with the addition of some facts derived from the author's own observations. While Albertus preserves the medieval attitude of mind, he shows unmistakable signs of a belief in the value of research and personal observation. He tells us that he has wandered far to visit places rich in mines that he might test the natures of metals. Seventy stones are mentioned arranged alphabetically, and Albertus says that gems differ from other stones in that in them the watery element preponderates over the earthy constituent and he attempts to classify them by color. He, however, while saying little of the medicinal value of gems, enlarges at length on their mystical and wonder-working powers and virtues. There is scarcely an ill that flesh is heir to, for which he does not indicate some stone that will act as a protector. He also shares the general opinion of the time that when these gems or stones have certain signs or figures engraved upon them, such "sigils" greatly enhance the power of the stone (Evans, 1922). He states furthermore that in many cases at least, the sigils were not carved in the stone by any human agency, for the gems on which they are found are too hard to be worked by any tool; they are of celestial origin, having been impressed upon the growing stone by the mighty agency of the stars which is also displayed in those gigantic starry pictures which are seen in the heavens and are called constellations.

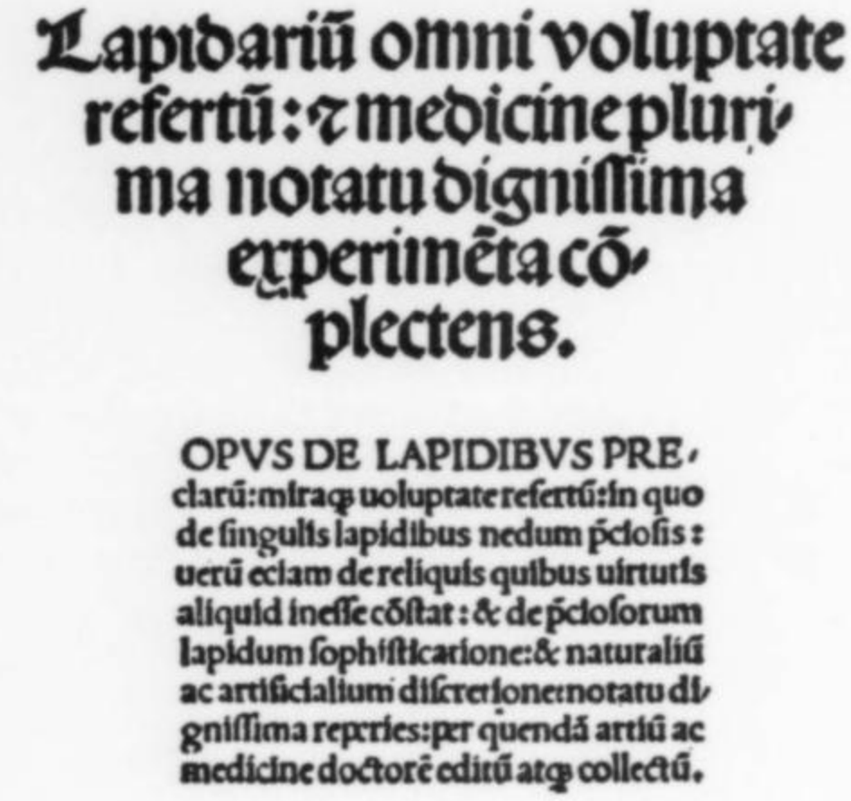
4. The Lapidary of Alphonso X. This is a beautifully illustrated lapidary, the only recorded manuscript of which is in the Escurial library. It is said to be a Chaldean lapidary of unknown date, which was translated into Arabic by Abolays and from Arabic into Spanish by Garci-Perez. This latter translation was finished in 1278. Evans, who gives an extended review of the work, states that it deals with 360 "stones" among which are included substances such as sulphur, soda and even sponges. Myerhoff and Foster (1936) say that it describes 280 "stones,"

with brief references to some of their physical properties, uses and medicinal values.

The basis of classification is color "Cast into the 12 signs of the Zodiac."

The treatment of the virtues and powers of the stones as influenced by the stars and changing according to the position of the planets indicates the complexity of the connection made by Arabic science between minerals and the celestial forces. The court of Alfonso the Learned of Castile (1223–1284) was as typical a court of the Arab Renaissance of the thirteenth century as that of Lorenzo de Medici was of classical learning in the fifteenth century. Jews, Mohammedans and Christians there met on equal terms; his court was the Academy where an epitome of the science of the Mediterranean world of the thirteenth century was to be found.

5. Volmar: Das Steinbuch. An old German lapidary written about 1250 which mentions some 38 stones.


Lapidariũ omni voluptate refertũ: ⁊ medicine plurima notatu dignissima experimẽta cõplectens.

OPVS DE LAPIDIBVS PRE-
clarũ: miraq; uoluptate refertũ: in quo de singulis lapidibus nedum pciosis: uerũ etiam de reliquis quibus uirtutis aliquid ineſſe cõstat: & de pcioſorum lapidum ſophiſticatione: & naturaliũ ac artificialium diſcretione: notatu dignissima reperries: per quendã artiũ ac medicine doctorẽ editũ atq; collectũ.

Title page of Steinpreis: Lapidarium omni Voluptate refertum.

6. Steinpreis: Lapidarium omni Voluptate refertum. This is an interesting lapidary of which very few copies are known to exist. Dolch-Langer knows only three copies, those in the Glasgow Hunterian Museums, the British Museum and the Munich Staatsbibliothek. There is a fourth copy in the Adams collection at McGill University. It is a small quarto volume of 28 unnumbered leaves, is believed to have been written by Steinpreis and was printed shortly after the year 1500, probably about 1510. In the opening paragraph the author states that he has two objects in writing the book, first to give such information concerning the various minerals we will enable them to be recognized, and second, to set forth their origin, virtues and properties.

The book is divided into two parts. The first consists of twelve short chapters setting forth and establishing the fact that the precious stones have peculiar virtues and properties, how these manifest themselves, how they may be strengthened and how they should be venerated. He inveighs against those ignorant and foolish persons who, although quite unfitted to express any opinion on the subject, are wont, in their bestial stupidity, to blaspheme God by stating that these gems possess no such virtues. These opinions he proceeds to confute in the true medieval manner. Let such men listen to the words of Aristotle, the head and chief of all philosophers, let them hear what the divine Bonaventura says upon this subject, and what the divine Plato asserts. The words and the authority of these great men establish and definitely prove that these stone have the mystic virtues which they are asserted to possess.

The second part treats of 117 different stones in alphabetical order. This portion consists largely of quotations from Albertus, Serapion, Pliny, "Dyast," Evax and Avicenna. Indeed a large portion of it is a direct and verbatim copy from Albertus Magnus.

ERASMI STELLAE
LIBONOTHANI
INTERPRAE-
TAMENTI
GEMMA-
RVM LI-
BELLVS
VNI-
CVS.

Sola ſalus ſeruire deo,
Sunt cœtera fraudes,

Title page of Erasmus Stella: lapidary. *Nuremberg, 1517.*

7. Erasmus Stella: Interpraetamenti Gemmarum Libellus. This lapidary was written in 1517 by Dr. Erasmus Stueler. He was born about 1450 and studied at Leipzig and Bologna. In 1501 he was appointed

town physician and later became burgomeister of Zwickau in Saxony, which was at that time an important mining centre. It is a book of quarto size and comprises 21 unnumbered leaves. It shows a distinct advance upon the older lapidaries in that the alphabetical arrangement of the minerals is abandoned and they are grouped into four classes according to their color: white, green, red, and blue or black. Thirty-three minerals are described and a number of others are mentioned by name. The descriptions given of the minerals are longer and more complete than in most of the older lapidaries, and more attention is devoted to the varieties of the several minerals and to the localities where they are found. Furthermore he has little belief in the magical properties attributed to gems by the older writers and in the chapter having the title *In Universum de Gemmis* he says that while no one in his sound mind denies that gems have medicinal and curative properties he would find it very difficult to concede that they possessed any of those powers attributed to them by superstitious persons, such as those of bringing to their wearer joy, sorrow, tranquility or security. He merely mentions such powers in describing the several gems in order that the reader might know that they had been attributed to the respective stones by the ancient writers, but not because he himself shared such opinions, which were ridiculous if not indeed actually irreligious.

In the chapter on rings (in which gems were mounted) he refers to the custom of wearing the ring on the third finger of the left hand, which he says was derived from the Egyptians who believed that a vein passes from this finger directly to the heart.

8. Camillus Leonardus: Speculum Lapidum. The last of the medieval lapidaries to be mentioned is that of Leonardus.

It is a significant fact that in all the lapidaries which appeared prior to the sixteenth century the minerals, when any definite system of classification was adopted, were arranged and listed in alphabetical order. This was owing to the fact that their authors knew practically nothing of the composition of the minerals and little or nothing of their actual physical characters—with the exception of color. They knew scarcely anything concerning the form of minerals, or of their hardness, specific gravity, cleavage, lustre or fusibility and nothing of their optical characters, on which knowledge alone a proper classification could be based.

The number of species enumerated differs largely in different lapidaries. Marbodus mentions 60, Albertus Magnus 93, the Steinpreis *Lapidary* 117, Leonardus, who gives a longer list than any other writer, catalogues 279 separate names. The list given by Leonardus includes almost all those given by the other writers. Steinpreis differs most widely from him in enumerating 38 names not mentioned by Leonardus, while omitting a much larger number of those found in the lapidary of that author.

MARBO:
DEI GALLI POETAS VE
tuſtiſſimi de lapidibus preaoſis
Enchiridion, cũ ſcholijs
Pictorij Villin-
genſis:
EIVSDEM PICTORII DE
lapide molari carmen;
PARISIIS
Excudebat Chriſtianus Wechelus, ſub ſcuto
Baſilęenſi, in vico Iacobæo, anno
1 5 3 1.

Leicht Library

MARBODUS

It may be of interest here, in order to present an adequate idea of the character and contents of these medieval lapidaries, all of which cover essentially the same ground although some of them do so more thoroughly than others, to select two, those of Marbodus and Leonardus, and describe them in some detail. The work of Marbodus is the earliest lapidary of the Middle Ages, and also the one which is quoted most widely. As has already been stated, Marbodus was Bishop of Rennes and wrote his lapidary, in 734 Latin hexameters describing sixty stones, between the years 1061 and 1081. More than 100 manuscripts of this lapidary are known, and it was translated into French, Provençal, Danish, Hebrew and Spanish. After the invention of printing, 14 editions (see Riddle, 1977; Beckmann, 1799) appeared between 1511 and 1740 and still others at later dates.

To a student of the present time it seems strange that a treatise on minerals should be written in verse. Janus Cornarius, who includes the lapidary of Marbodus in his edition of the *Macer Floridus* herbal (1540), says that this was done in order that the contents of the book might be more easily remembered.

Since there are certain differences in different

MARBODAEI
GALLI CAENOMANENSIS DE
gemmarum lapidumq; pretioſorum formis, natu
ris, atq; uiribus cruditū cū primis opuſculū, ſane q̄tile, cum
ad rei medicæ, tu ſcripturæ ſacræ cognitionē: nūc primū nō
mō cētū ferme uerſib. locupletatū pariter & accuratius emē-
datū, ſed & ſcholijs q̄q illuſtratū p Alardū AEmſtelredamū
Cuius ſtudio
additę ſunt & præci
puæ gemmarū lapi
dūq; p̄tioſarū expli-
cationes, ex ueruſtiſſ.
qbusq; autorib⁹ co-
actæ. Cū ſcholijs Pi
ctorij Villingeñ.
Εμ μαργάριτον τί
μιον. Ἀποδοὺς
ἅπαντα λάμβανε.
En margaritū no-
bile, Eme ſi cupis
diteſcere.
Rationale. Exodi.
28. & 39. Leui. 8.
Doctrina
& Veritas
3 Smaragdus Leui	4 Carbūcul⁹ Juda	5 Saphirus Zabulon
2 Topazius Simeon	9 amethyſtus Aſer	6 Iaſpis Iſſachar
1 Sardius Ruben	10 chryſolitus Nephthalim	7 Lincurius Dan
12 Beryllus Beniamin	11 Onychinus Ioſeph	8 Achates Gad
Coloniæ excudebat Herm. Alopecius. Anno. 1539

G.I.A. Library

texts, it may be stated that those which are used in the present notes are the first printed edition published at Vienna in 1511 and the third edition which was printed at Freiburg in 1531.

The poem commences with the following lines:

Evax, king of the Arabs is said to have written to
Nero,
Who after Augustus ruled next in the city,
How many species of stones, what name and
what colours,
From what regions they came and how great the
power of each one.

A reference to Evax, king of the Arabs, in almost the same words occurs in the Hellenistic lapidary attributed to Damigeron, which is one of the principal sources on which Marbodus has drawn. This Evax is also referred to by Pliny in the twenty-fifth book of his *Natural History* in the following words, "Evax a king of the Arabians, wrote a book as touching the virtues and operations of Simples, which he sent unto the Emperor Nero." Nothing further, however, is known of this person so frequently mentioned in the medieval lapidaries.

The sixty stones of which Marbodus treats are, in the first edition of his work, presented without any definite order, but in the third edition they are arranged alphabetically. A critical examination of the list shows that they may be classified in the following groups:

1st group:

Alabandina—staunches a flow of blood
Androdamas—dispels anger
Apistos—a heavy black rock with red lines—when heated retains the heat for seven days
Calcophonus—preserves and strengthens the voice
Chalazias—cannot be heated, cold by nature
Chrysopasius—shines brightly at night and is dark during daylight
Diadochus—when thrown into water causes spirits to appear who may be interrogated
Dionysias—prevents intoxication
Galactites—cannot be heated
Gagatromeus—secures victory in conflict, a stone for soldiers
Hephestites—thrown into boiling water will freeze it, calms sedition
Hexacontalithos—small stones showing 60 different colours. Found in Libya in the land of the Troglodites
Hieracites—similar properties to Galactites
Lipares—gives success in hunting, the hunter can secure any animal
Medus—gives sight to the blind
Molochites—prevents accidents
Ophthalmius—cures blindness
Orites—cures wounds, gives protection against the pestilence
Pantherus—variegated in color and hence has the virtues of many other stones
Peanites—a female stone which at certain seasons brings forth young, assists women in childbirth
Sagda—originates at the bottom of the Chaldean Sea and rising through the water, attaches itself to the bottom of a ship which, through its influence, is quickly and safely brought to port. It is however impossible to detach the stone from the bottom of the ship except by cutting away the wood to which it affixes itself.

These 26 stones, making up approximately one-third of the whole, are mythical—or at least the description of them, when any is given, is so trivial that it is impossible to connect the name with any particular mineral.

2nd group (This comprises six "stones"):

Alectorius	Dragonites
Calcedonius	Hyaenia
Chelonites	Lyncurius

These all come, or are supposed to come, from the body of some animal.

3rd group:

Cerauneus—falls from the Heavens, protects from lightning
Corallus—coral; preserves from tempest, gives abundant harvests, drives away demons
Aetites—aids childbirth
Unio—pearl, possesses many virtues, cures fever and epilepsy

The four members of this group are really not minerals.

4th group:

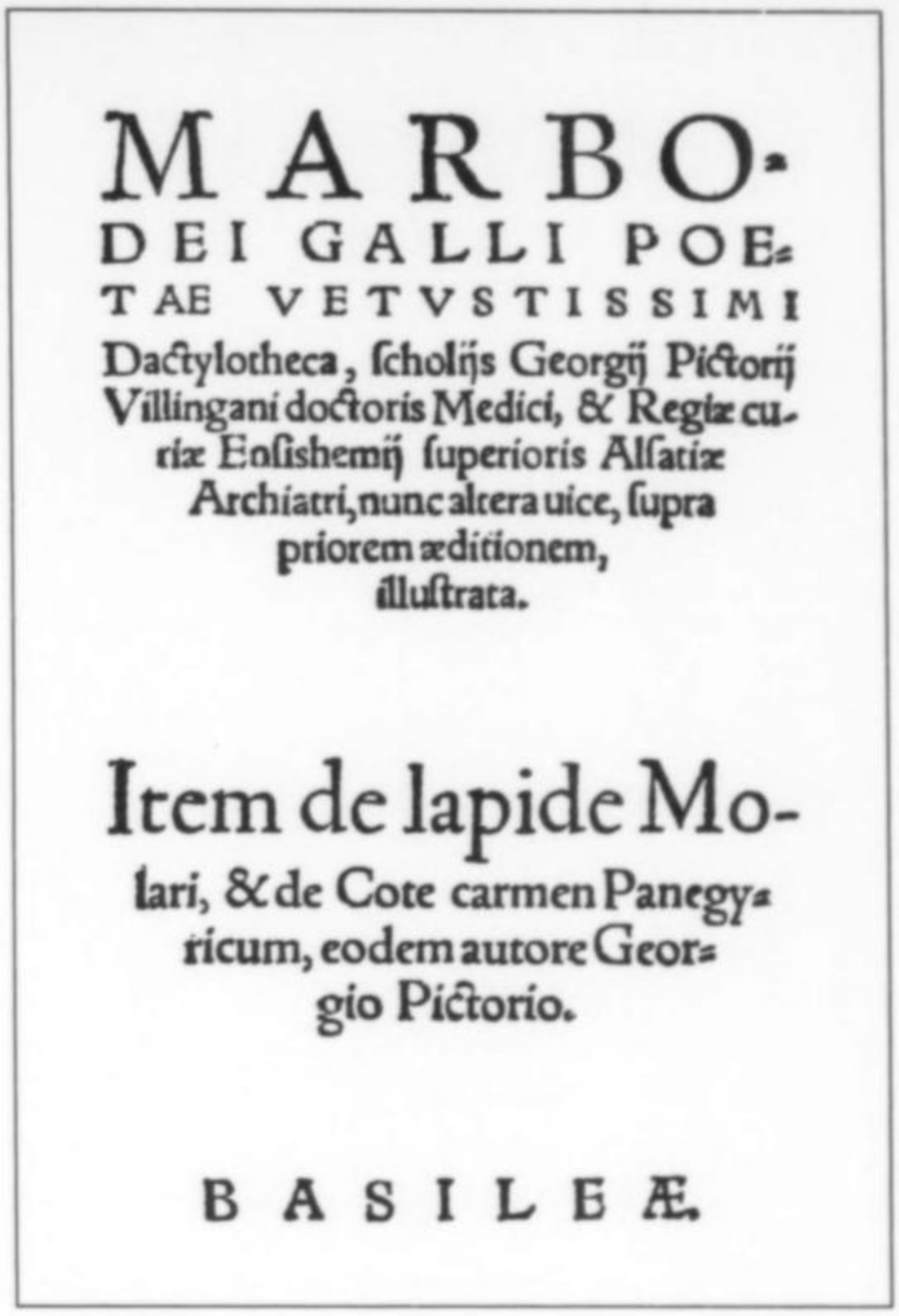
Achates—protects from serpents, makes men strong, handsome and eloquent
Amethystus—preserves from intoxication
Calcedonius—gives success in all undertakings
Chrysoprasus—may have virtues but if so these are unknown
Corneolus—cools anger, staunches blood
Crystallus—valuable for nurses
Enhydros—(see below)
Heliotropia—guards the body from poison and the soul from error. This stone was by others stated to make its wearer invisible. Dante in his *Inferno* sees the damned running about under a hail of fire, "No hope of hiding hole or Heliotrope."

The story in Boccaccio's *Decameron* told by Madame Eliza on the Eighth Day centers around the adventures of certain persons who "travelled to the Plaine of Mugnone to find the precious stone called Heliotropium, the vertue whereof is so admirable: as whosoever beareth it about him, so long as he keepeth it, it is impossible for any eye to discern him, because he walketh meerely invisible."

Iris—when the sun shines on it, it gives forth the colours of the rainbow
Jasper—seventeen varieties, each of which possesses its own properties.
Onyx—produces hate, evil visions, strife and bloodshed. The evil effects of the onyx are counteracted if one wears a sardonyx at the same time.
Prasius—has no special virtues.

These fourteen stones are all varieties of quartz—some coarsely crystalline and others cryptocrystalline and distinguished from one another chiefly by difference in color. They attracted attention probably because most of them were comparatively common minerals and because of their distinct and striking colors.

Achates—Marbodus, interpreting Virgil's "Fidus Achates" literally, ascribes, as already mentioned, the


MARBO-
DEI GALLI POE-
TAE VETVSTISSIMI
Dactylotheca, ſcholijs Georgij Pictorij
Villingani doctoris Medici, & Regiæ cu-
riæ Enſishemij ſuperioris Alſatiæ
Archiatri, nunc altera uice, ſupra
priorem æditionem,
illuſtrata.

Item de lapide Mo-
lari, & de Cote carmen Panegy-
ricum, eodem autore Geor-
gio Pictorio.

BASILEÆ.

Leicht Library

escape of Aeneas from his many perils to his having always carried an agate with him.

Enhydros—consists of quartz or of calcedonic or opaline silica which is deposited from heated waters and in which there are cavities partially filled with water, so that the inclusions of water can be seen within the substance of the transparent quartz or calcedony. This remarkable stone attracted widespread attention among the ancients. Marbodus says: "Enhydros perpetually sheds tears which drop as from an overflowing spring. It is," he observes, "extremely difficult to see how this comes about, for if the substance (water) is derived from the stone itself why does not the stone become smaller and turn completely into water. But if on the other hand the water finds its way in from the outside and flows out again, how is it that the external water is not prevented from entering by the water which is in the act of coming out?"

5th group:

Adamas—dispels evil dreams and saves its wearer from the influence of poison
Asbestos—(see below)
Beryllus—preserves and develops conjugal love and has other remarkable virtues
Carbunculus—shines in the dark (see below)
Chryselectrus—golden in color, resembling amber. The devouring flame is said to be its

substance. For, held near a fire, it quickly kindles.

Chrysolitus—drives away evil spirits

Gagates—cures certain diseases, overcomes demons and magic arts

Haematites—cures various diseases of the blood and has other valuable properties

Hyacinthus—red, yellow or blue in color. (Some specimens were probably varieties of amethyst and others corundum.) Confers safety on the traveller and secures to him his just requests.

Magnes—(see below)

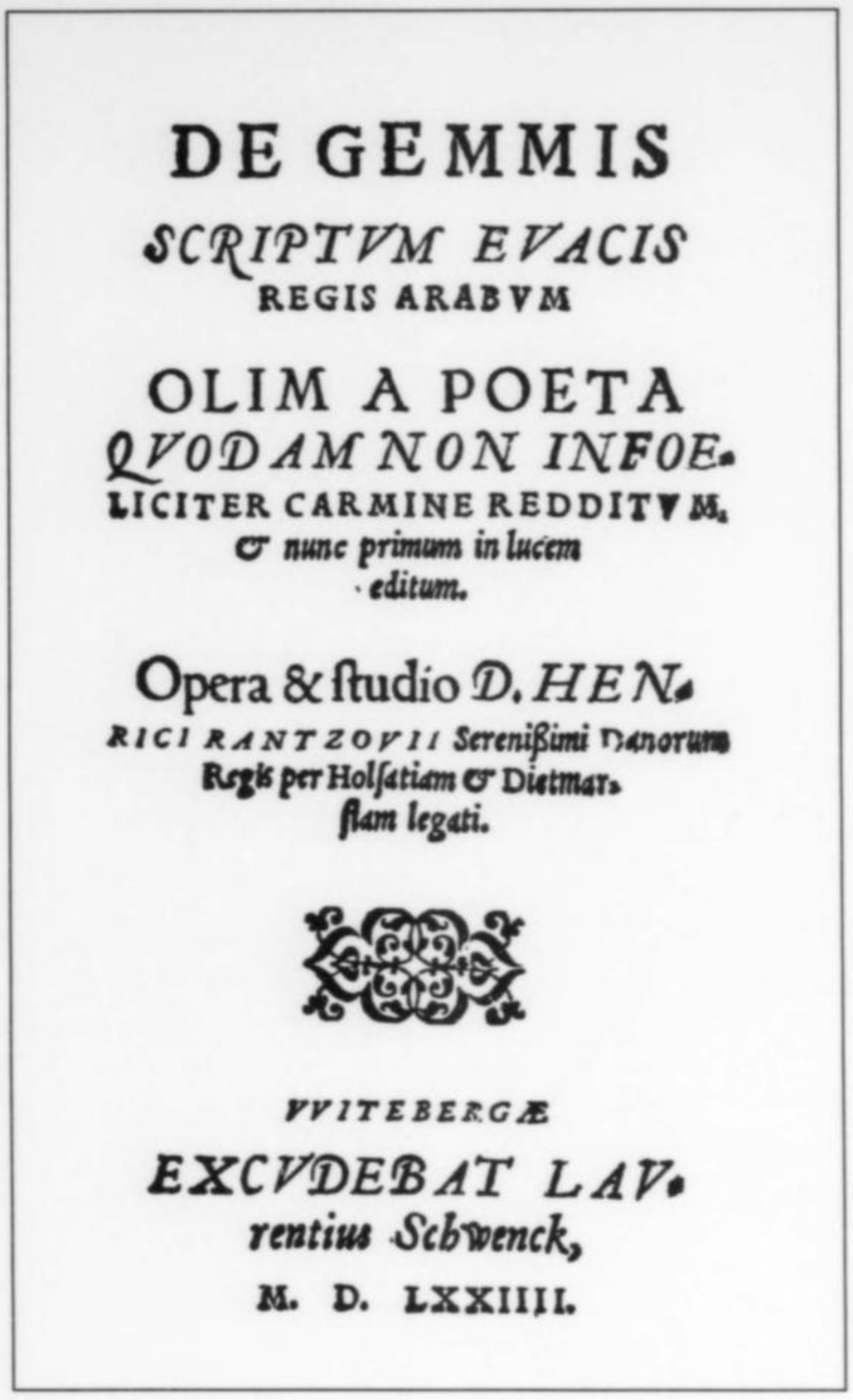
Pyrites—fire stone, burns the hand that roughly presses it

Saphirus—(see below)

Selenites—shows an image of the waxing and waning moon. Cures diseases of the chest

Smaragdus—includes emerald, malachite and probably other green stones. Enriches its wearer and makes him eloquent, wards off epilepsy and has many other virtues.

Topazius—staunches a flow of blood, if thrown into boiling water causes it to become cold.


DE GEMMIS
SCRIPTVM EVACIS
REGIS ARABVM
OLIM A POETA
QVODAM NON INFOE-
LICITER CARMINE REDDITVM,
& nunc primum in lucem
editum.
Opera & studio D. HEN-
RICI RANTZOVII Serenißimi Danorum
Regis per Holsatiam & Dietmar-
siam legati.
VVITEBERGÆ
EXCVDEBAT LAV-
rentius Schwenck,
M. D. LXXIIII.

G.I.A. Library

The fifteen minerals of this group, with the exception of the fifth, bear the names of well-known mineral species. The designation *Adamas* is given by Marbodus to the diamond, which derives its name from its *unconquerable* virtue. Marbodus mentions four countries in which it is found: India, Arabia, Cyprus and Philippi in Greece. The specimens from these four countries differ from one another in character. The Indian Adamas is a diamond. The others were in all probability varieties of quartz. Marbodus repeats the statement of Pliny that if the stone is placed upon an anvil and struck with a hammer with all possible violence, the stone will remain unharmed but the anvil and hammer will fly to pieces. He also reiterates the story that if a diamond is placed in the warm blood of a stag, it will break to pieces. Asbestos is stated to have the color of fire and to be found in Arcadia. When once lighted, like the fires of hell it burns forever, hence its name. No magical or medicinal properties are assigned to it by Marbodus. He states that there are twelve varieties of Carbunculus. Under this name were included ruby, Balas ruby (spinel), brilliant red garnets and probably other stones resembling these in color. He says that the stone gives out light, shining in the darkness like a glowing coal, and that it comes from the country of the Troglodites. The statement that it shines by night is repeated by Lonicerus and also by Rösslin, who says that it turns night into day. Marbodus says that Saphirus is the "Gem of gems," possessing vast powers, medicinal, magical and spiritual. Heavenly blue in color, it is endowed with transcendent celestial powers. Not only does it preserve its wearer in health of body and mind but shields him from all error and breaks the chains of prisoners and sets them free. But Marbodus goes much farther and claims that it turns aside the anger of God and secures from Him a favorable answer to prayer. This statement, which represents, as it were, a shocking climax to the long series of talismanic powers which are assigned to the various gems in this interesting little book, aroused the disapproval and even the indignation of many churchmen, who endeavored to throw doubts upon the authorship of the work as being from the pen of a Bishop of the Christian church. But, as Thorndike observes, practically everyone at that time believed that marvelous powers had been divinely implanted in gems, and such being the case, why should not God be more easily reached through the medium of gems, since He had endowed them with their marvelous virtues?

In the third edition of the Lapidary of Marbodus, which was published in 1531, there are glosses appended to each chapter, also some introductory and concluding verses by Georg Pictorius. At the end of the book there is a short poem by the latter addressed to the millstone. Being evidently somewhat weary of the continued enumeration of the magical and mystical powers attributed to the precious stones in the

work of Marbodus and probably harboring some secret doubts as to the reality of the powers in question, Pictorius turns as it were for relief to the common millstone, and addresses a concluding poem to it as a stone, which is indisputably full of virtue for mankind, and which renders inestimable services to the human race.

Speculum Lapidum Clariſſimi Artium Et Medicine Doctoris Camilli Leonardi Piſaurenſis.

Valerii Superchii Piſaureuſis Phyſici Epigramma.

Quicquid in humanos gemmarum parturit uſus
Terra parens: uaſti quicquid & unda maris.
Quãlibet exiguo claudis Leonarde libello
Mirandum/& ſeræ poſteritatis opus.
Quod poſitis Cæſar interdum perlegat armis:
Seruariq; ſuas imperet inter opes
Et tibi pro meritis æquos decernat honores:
Conſulat & famæ tempus in omne tuæ.

Leonardus (1502)

LEONARDUS

While the Lapidary of Marbodus was written at the very beginning of the Middle Ages, in fact a few years before the date which we have taken as marking the commencement of medieval times, the second lapidary which has been selected for more detailed consideration appeared when the Middle Ages were passing into the Renaissance. This is the *Speculum Lapidum* of Camillus Leonardus. The first edition was published at Venice in the year 1502 and this was followed by others printed at Venice in 1516, at Augsburg in 1533, at Paris in 1610 and at Hamburg in 1717. All these were in the Latin language, but an English translation (omitting Book III) was published in London as late as 1750. The book also figured in one of the most shameless cases of piracy in the whole history of letters, a well-known author, Lodovico Dolce, having made a literal translation of it into Italian, which he published at Venice as his own work, without making the slightest reference to the fact that Leonardus was the author of the book; in fact on page 3 he refers to it as *mia fatica* ["my work"].

Leonardus was physician to Caesar Borgia, to whom also he dedicates his book, so that as King (1867) observes, he "ought to know something about poisons."

His lapidary is divided into three books. The first treats of the nature and origin of stones, their beauties, colors and virtues. In the second there is a formal description of 279 minerals arranged in alphabetical order. As has been already mentioned, Leonardus includes in his lapidary almost every mineral mentioned by any previous writer, which gives to his book a special interest and value. Many of the minerals are, however, as is the case in all the medieval lapidaries, merely names to the modern student, and cannot be recognized as designating any mineral now known to be a true mineral species. Some are merely varieties of the same species, others are certainly altogether fabulous. In the third book the author treats of the figures engraved upon gems and other stones by the ancients, of the particular virtues of the engraved stones, how they absorbed the influence of the planets and constellations and why a stone engraved with any of the twelve signs of the zodiac is supposed to take its virtue from that sign, and what this peculiar virtue is. He mentions that the Israelites in the wilderness were the first who distinguished themselves in this art of engraving gems and that the Romans were the greatest masters of it.

In his lapidary Leonardus follows Albertus Magnus in adopting the Aristotelian theory of the origin of stones through the influences of the heavenly bodies. Gimma (1730), however, states that owing to the inclusion in it of certain ideas and certain statements drawn largely from Arabian sources, the book fell under the condemnation of the Church and was entered in the *Index Expurgtorius*.

The fear that the book might exercise a dangerous influence upon some of its readers also called forth the following warning on the part of the English translator:

> But tho' what I have said, in regard to the Use and Excellence of this little Treatise, is incontestibly the Truth; yet I must give the Reader a Caution in the Perusal of it, which is this: That the Author living in an Age when Superstition universally prevail'd, and when the Study of Astrology, Palmistry, Charms, Spells, Sigils, &c. was greatly in Vogue, but which, in our Days, is entirely out of Use, at least is laid aside by the Learned: I say, the Author, falling in with the Maxims of the Age wherein he lived, has assigned such Virtues to particular Stones as will not be allowed by the Moderns; as that such or such a Stone shall give the Possessor of it, Courage, procure him Victory over his Enemies, make him successful in Love, in Litigations at Law, and other Undertakings, with other Fancies

THE
MIRROR
OF
STONES:
IN WHICH

The Nature, Generation, Properties, Virtues and various Species of more than 200 different Jewels, precious and rare Stones, are distinctly described.

Also certain and infallible Rules to know the Good from the Bad, how to prove their Genuineness, and to distinguish the Real from Counterfeits.

Extracted from the Works of *Aristotle*, *Pliny*, *Isodorus*, *Dionysius Alexandrinus*, *Albertus Magnus*, &c.

By *Camillus Leonardus*, M. D.

A Treatise of infinite Use, not only to Jewellers, Lapidaries, and Merchants who trade in them, but to the Nobility and Gentry, who purchase them either for Curiosity, Use, or Ornament.

Dedicated by the Author to CÆSAR BORGIA.

Now first Translated into *English*.

LONDON:
Printed for *J. Freeman* in *Fleet-street*, 1750.

of the same Kind, which have long since been exploded. He, however, gives us this Caution, that in his Description of the Virtues and Properties of Stones, he has inserted nothing but what he has collected from the Writings of the most learned Men that have treated of the Subject; so that he exhibits nothing, or but very Little, as his own Opinion, nay, sometimes he banters and ridicules the extravagant Fancies of those whose Sentiments he quotes: So that when the ENGLISH READER meets with these odd Whimsies, he is to look on them in their proper Light, and to give a due Attention to the more weighty and important Design, and Use of the Book.

While Leonardus, as he himself states, garnered his material from a succession of older writers, he shows some indications of having come under the influence of the newer methods of study which were about to be advocated by Agricola and his followers, in that he treats of certain physical properties of minerals, such as "Perspicuity and Opacity, Hardness or Softness, Gravity and Lightness, Density and Porosity," and of the importance of these for the recognition of various stones. In fact the *Speculum* of Leonardus, which was one of the most widely read lapidaries of the time, in its successive editions bridged over the transitional period between the old and the new mineralogy, since the first edition appeared in 1502, or forty-four years before the publication of Agricola's *De Natura Fossilium,* while the last or English edition coming from the press in 1750, brings us nearly to the time of Werner. When Boyle wrote his *Skeptical Chymist* in 1677, the belief in the four elements of Aristotle was already seriously shaken. Boyle considered them as worthy of his trenchant criticism, so that about the time that the last edition of the *Speculum Lapidum* of Leonardus issued from the press, the belief in the Aristotelian theory of the origin of minerals and stones through the action of the celestial bodies flickered out. In fact, the third book of the *Speculum* was omitted in the English translation, since, as the translator remarks, "We judged it wholly impertinent to trouble our readers with speculations not agreeable to right reason nor indeed consistent with our religion."

That Leonardus did not repose implicit reliance on all the traditional stories concerning the virtues of stones, may be gathered from what he says concerning the stone Lippares:

> Lippares, or Liparia, is a stone to which all Kinds of Animals come of their own Accord, as it were by a natural Instinct. Some say, that he who has this Stone, needs no other Invention to catch wild Beasts; it is frequently found in Lybia. Others say, that it has a wonderful Virtue in defending Animals. For when a Beast is pursued by Dogs and the Hunters, he hastens to find out this Stone, to which he flies as to his Protector and Defender. For so long as the Animal looks upon the said Stone, neither the Dogs nor the Huntsman can see him, which if it be so, is indeed very strange; yet it is affirmed by the Learned; and as to this, I believe the saying of Pliny is very true, That there is no Lie so impudent which is not vouch'd for by Authority.

Little or nothing is known of the life of this interesting author beyond what he himself tells us in the letter in which he dedicates his work to the "Most Illustrious and most glorious Prince Caesar Borgia." In it he states that he was a citizen of Pesaro and that he was busily engaged in the "Practice of Physic and Speculation." He goes on to say that:

> Being governed by the desire to promote the Benefit and Utility of Mankind we have composed this little Treatise on the Nature of such Stones as contribute to the Health or Usefulness of Men, tho' at the expense of late hours, much

labor and diligent enquiries, and tho' the materials of it were dispersed thro' many volumes by various authors. We have, however, with the utmost care, labor and attention, collected such things as have been handled in the writings of the most famous men into this small Tract, which we have entitled *The Mirror of Stones*: in which, as in a Looking-Glass we may behold their Nature, Powers and Sculptures and attain to the knowledge of many things.

The book was evidently highly prized by those interested in minerals and gems even at so late a date as 1750, and the translator's preface to the English version throws an interesting light not only on the scarcity of the work at the time the translation was made, but also on the high esteem in which it was held, as well as the difficulties in the path of a book collector in that age:

> If the value of a book is to be rated by the scarcity of it, I am apt to think that there is not a Librarian in Europe can shew one of equal bulk that has a better title to the choice of the curious than this *Mirror of Stones*. For though the number of its Pages are but 244 in a small Octavo and printed in large Letters yet there is wrote on the cover of that which by a peculiar Favor I am possessed of, "This is a scarce book and has been valued at 100 Pistoles."

This is equivalent to eighty pounds. He goes on to say:

> A certain Nobleman who is pleased to honor me with his Friendship sought for it in vain in the most noted Libraries in England; but being determined to have it if there was one in Europe, sent a gentleman to France, where he was to make the best Enquiry he was able among the Booksellers, and to search every Library where there was any probability of its being lodged: and if his Enquiries should prove unsuccessful there, he was to proceed to Italy, and so on to other countries till he should find it. After a long and expensive search he at last was so happy as to light upon two of them, which he purchased, tho' at an exhorbitant Price and brought them to his noble Master, who was so pleased with the purchase that he not only paid him generously for his time and expenses, but over and above as a Gratuity and Reward for his Diligence presented him with a Bank Note for £30.

It will be noted that these medieval lapidaries, although they are the most important source from which information concerning the mineralogy of the Middle Ages is derived, really supply relatively little knowledge concerning the actual character of the minerals of which they treat. The names used to designate certain minerals in the Middle Ages, in many cases at least, refer to other minerals than those which now bear the same names. Thus the term carbuncle in medieval times was used to designate a bright red, hard, transparent mineral, it might be a ruby, pleonast (or Balas ruby), an almandine, pyrope or allied variety of garnet or some other mineral resembling them. Smaragdus included not only emerald but malachite, green feldspar or other minerals which had a bright green color. The name sapphire was used also for lapis lazuli and probably also for a number of other blue minerals.

The lapidaries are essentially handbooks of magic and medicine. It was on account of their supposed magical and medicinal properties that minerals were prized, and it is thus interesting to note that the science of mineralogy arose from the study of magic and medicine, although it made no real advance toward the status of a true science until the rise and widespread development of the mining industry in Europe. All the old writers followed authority blindly and it was observation alone that could break this pernicious succession.

Many writers who treated of the magical powers of stones regarded these powers as having their origin in the substance of the stone itself. Others considered them to have been developed under favorable conditions in the mineral or stone by the action of one or more of the Aristotelian elements or by the influence of the planets or of the fixed stars. Others again state that in gems having these supernatural qualities a certain symbol (or sigil) engraved upon the gem will greatly intensify its power. This belief goes back to the most remote antiquity.

Albertus Magnus in his *De mineralibus et rebus metallicis* points out that it is important that sigils should be engraved on gems at a time when the constellations influencing the operation of the celestial influences are favorably situated in the heavens. Owing to the fact that the rays from the planets fall directly upon the equatorial regions and only obliquely upon the more temperate zones, the gems found in India and the East were believed to possess greater power and virtue than those found in more northerly or more southerly latitudes.

Lists and descriptions of such sigils are given by many of the ancient writers. Leonardus in the third book of his *Speculum Lapidum* reproduces those attributed to Rhagael, Chael, Hermes, Tethel and Solomon. Tethel was a Jewish astrologer presumably identical with Sahl ibn Bishr (first half of the ninth century) (Sarton, 1931).

Conrad von Megenberg in Book VI of his *Buch der Natur,* which appeared some one hundred and fifty years earlier than the work of Leonardus, treats of these engraved stones at some length and gives a German translation of a Latin edition of Tethel's book. This book, he says, "Written by a great Jewish man of learning named Tethel, claims to have been compiled

by the Children of Israel during the time when they were journeying through the desert on their way to the Holy Land." The author of the Latin edition of Tethel is quoted as saying that in his opinion the book is not to be implicitly trusted and that the engraved figures were intended more for purposes of adornment than for any expectation that they possessed occult powers, since men should look to God alone for such mercies. "I am," continues von Megenberg, "of the same opinion, although the author states that the figures which are seen on these stones have been engraved solely by the art of man and never result from the powers of Nature. Herein he is in error, for many figures are to be seen in stones while they are still growing in the earth's crust." This same opinion is expressed by Albertus Magnus, who states that these sigils must for the most part at least have had their origin in the influence of the stars, since no material occurs in nature which is sufficiently hard to be used in engraving gems. Megenberg's book (quoting from Tethel) presents a long enumeration of gems and their sigils with the occult powers which they respectively possess. A few sentences will give an adequate picture of the contents of Tethel's treatise:

> If one finds the stone called Jasper with the form of a man with a shield hanging from his neck or carried in one hand while he holds a spear in his other, with a snake at his feet, this is a protection from all enemies: A chrysolite with the figure of a woman holding a bird in one hand and a fish in the other has the power of furthering the wearer in all undertakings. A turtledove with an olive branch awakens love for all mankind. A white stone having a figure upon it which is half woman and half fish, holding a mirror in one hand and an olive branch in the other, makes its wearer invisible. A cross on a green jasper will prevent its wearer from drowning.

LATER LAPIDARIES (1550–1650)

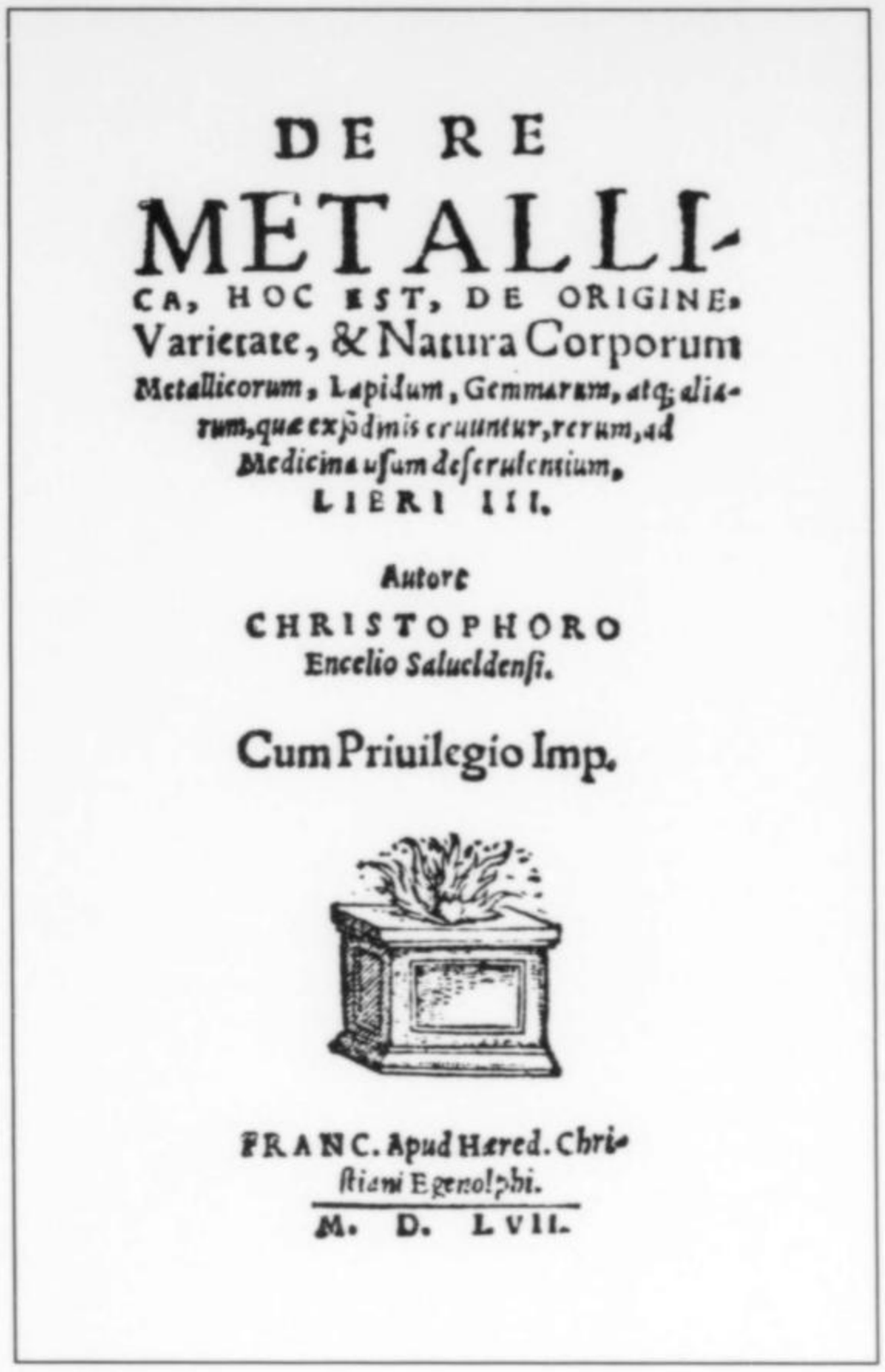
Other well-known lapidaries, all of which followed the same traditional treatment of the subject, appeared during the sixteenth and seventeenth centuries and may here be mentioned in the order of their succession.

Christophorus Encelius: *De Re Metallica* (1551). The author was a physician in Thuringia, a pupil of Luther and a friend of Agricola and Mathesius. The book is prefaced by a letter from Melanchthon.

Andrea Cesalpino—*De Metallicis* (1583).

Andrea Baccio—*De Gemmis et Lapidibus* (1603).

Anselm De Boodt—*Gemmarum et Lapidum Historia* (1609). This book, which appeared in the same year as that in which Kepler discovered the laws of planetary motion, is in many respects the most important lapidary of the seventeenth century and exerted a widespread influence. After De Boodt's death two


DE RE
METALLI-
CA, HOC EST, DE ORIGINE,
Varietate, & Natura Corporum
Metallicorum, Lapidum, Gemmarum, atq; aliorum, quæ ex ꝺ̃minis eruuntur, rerum, ad
Medicinæ usum deseruientium,
LIBRI III.

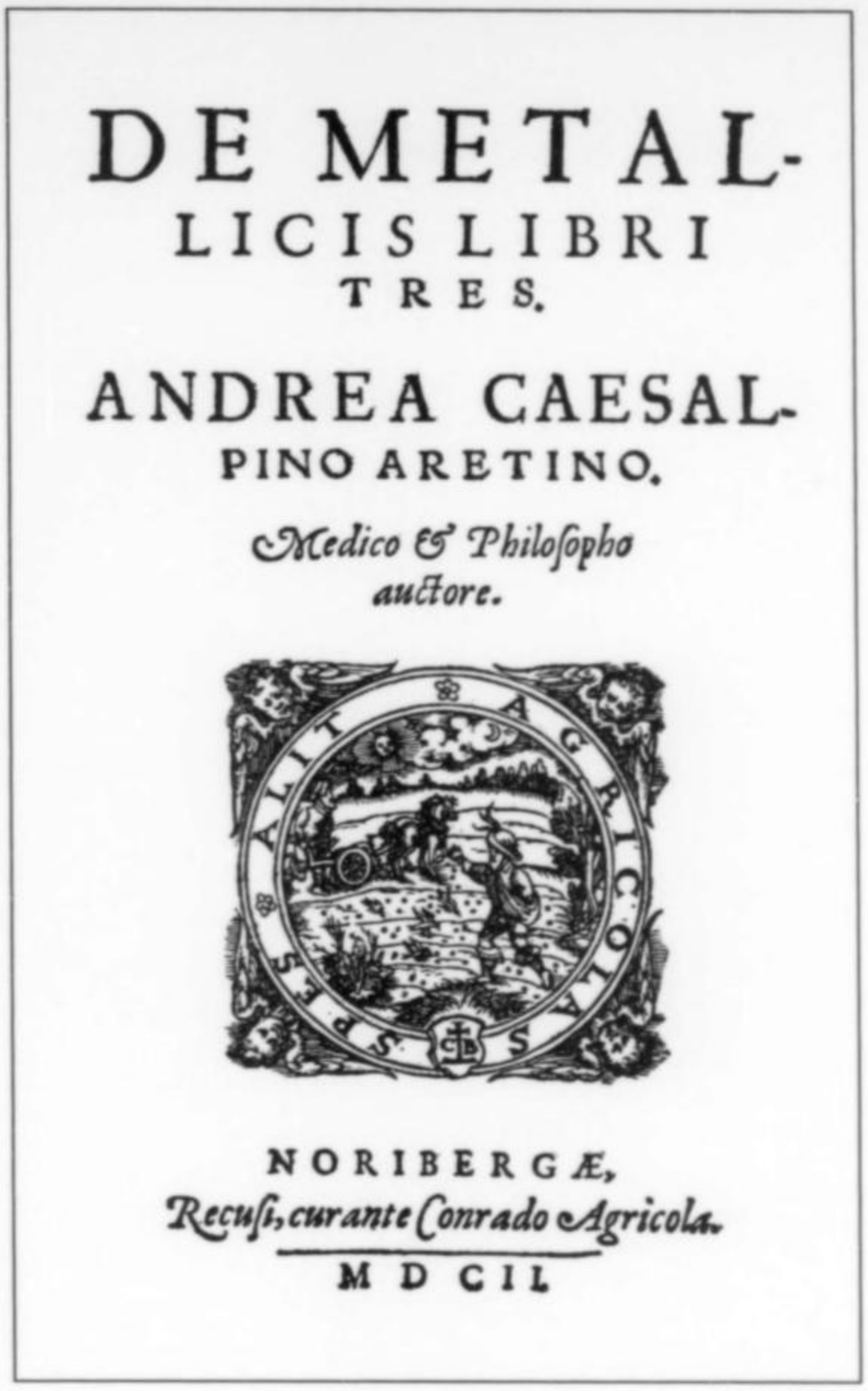
Autore
CHRISTOPHORO
Encelio Saluelꝺenſi.

Cum Priuilegio Imp.

FRANC. Apud Hæred. Christiani Egenolphi.
M. D. LVII.

further editions in Latin and two in French, edited with annotations by Andreas Toll, were published.

De Boodt was a citizen of Bruges and a man who occupied a high social position, being physician to the Emperor Rudolph II in Prague, and who also acted as his advisor in all matters relating to gems and precious stones, a subject in which the emperor was much interested. He was moreover not only a mineralogist but a philosopher and a theologian. In his views concerning the nature and origin of gems and other stones De Boodt follows the stream of medieval teaching but in several respects his work shows the influence of the newer age in which he lived. While refuting the assertions of those who deny that gems possess peculiar virtues, calling forth our wonder and admiration, he says that these gems, being themselves produced by nature, cannot in and of themselves produce supernatural effects. Such powers as they possess are not exerted by them but through them, the stones being merely the media or instruments through which the powers of good or evil act. These powers may come directly from God Himself or from Him through some good or evil spirit used by Him as an instrument, the former acting at His will and the latter by His permission. He however con-


DE METALLICIS LIBRI TRES.

ANDREA CAESALPINO ARETINO.

Medico & Philosopho auctore.

NORIBERGÆ,
Recusi, curante Conrado Agricola.
M D CII.

GEMMARUM
ET
LAPIDUM
HISTORIA.

QUAM

Olim edidit ANSELMUS BOETIUS de BOOT, Brugensis, RUDOLPHI II. Imperatoris Medicus.

POSTEA

ADRIANUS TOLLIUS, *Lugd.-Bat., M. D., recensuit; figuris melioribus, & Commentariis pluribus illustravit, & Indice auxit multo locupletiore.*

Tertia Editio longe purgatissima. Cui accedunt IOANNIS de LAET, Antverpiani, De Gemmis & Lapidibus libri II. Et THEOPHRASTI liber De Lapidibus, Gr. & Lat. cum brevibus notis.

LUGDUNI BATAVORUM,
Ex Officina IOANNIS MAIRE.
cIↃ IↃ C XLVII.

G.I.A. Library

temptuously dismisses the usual stories concerning the magical and medicinal properties of gems put forward by those who sell and trade in these stones.

He was evidently impressed with the necessity for the introduction of some adequate method of classifying minerals, and the recognition of this fact is in itself evidence that he was moving to break new ground for an advance in the science of geology.

The system of classification which he suggests and follows is, however, quite worthless, but one which might present itself to a person who like De Boodt was interested in the study of a class of objects of whose real composition, character structure and origin he was ignorant. He presents a scheme in which minerals are first divided into two classes, "Gems" and "Stones," according to their size, that is to say, according to whether they are minerals that are found in small individuals as for instance diamonds, or in larger individuals as in amethyst, agate or basalt. Each of these classes is again divided and sub-divided according to "rarity," "hardness," "beauty" and "transparity," with the result that minerals of the most diverse and unrelated kinds are thrown together in one and the same group. For those who do not approve of this classification he presents another which while somewhat different embodies many of the same features as the first and is open to similar objections. The book, however, marks a forward step in the development of the science. It is subdivided into chapters each treating of a division of the subject or of a mineral or group of minerals and is also illustrated by a number of woodcuts.

Two other important lapidaries which were written under the influence of De Boodt appeared shortly after the publication of his work. The first was by Joannes de Laet of Antwerp. De Laet, in his introduction, refers to De Boodt's book but expresses it as his opinion that much still remains to be said which is not to be found in the works of De Boodt and other authors and these deficiencies he hopes to supply in his own volume. It is a much smaller book than that of De Boodt and contains first an annotated translation of the work of Theophrastus "On Stones" from the original Greek into Latin and then passes on to describe the more important "fossils."

The second lapidary is that by Thomas Nicols, "Sometimes of Jesus College Cambridge," the son of Thomas Nicols, M.D., a Cambridge physician. A certain amount of confusion has arisen concerning this book owing to the fact that three issues of it

A

LAPIDARY:

OR,

THE HISTORY

OF

PRETIOUS STONES:

With cautions for the undeceiving of all thoſe that deal with *Pretious Stones.*

By THOMAS NICOLS,
ſometimes of *Jeſus-Colledge* in *CAMBRIDGE.*

Ineſt ſua gratia parvis.

CAMBRIDGE:
Printed by THOMAS BUCK, Printer to the Univerſitie. 1652

A 2

appeared during Nicol's lifetime, each bearing a separate title. These are as follows:

1. *A Lapidary, or the history of the precious stones* by Thomas Nicols, Cambridge, 1652.
2. *Arcula Gemmea, or a cabinet of jewels* by Thomas Nicols, London, 1653.
3. *Gemmarius Fidelis, or the Faithful Lapidary* by Thomas Nicols of Jesus College in Cambridge, London, 1659.

All three are identical with the exception of the title pages.

Nicols follows De Boodt closely and quotes him frequently. He adopts his classification of gems and his views concerning the occult powers which certain of them possess, as derived from the divine Being, acting through good or evil spirits, the stones being intermediaries, and thus they are "Oft times the habitacles of *daemones* and intelligences which Johannes Langius in his epistle calleth *syderum & orbium motores.*" The introduction to his chapter entitled *Of the Emerauld or Smaragde* is an interesting example of the quaint phraseology of the time:

> The Emerauld is a precious gemme or stone of so excellent a viridity, or springcolour, as that if a man shall look upon the Emerauld by a pleasant green meadow, it will be more amiable than the meadow, and overcome the meadows glorie, by the glory of that spring of viriditie which it hath in itself: The largeness of the meadow it will overcome with the amplitude of its glory, wherewith farre above its greatnesse it doth feed the eie: and the virescencie of the meadow it will overcome with the brightnesse of its glory, which in it self seemeth to embrace the glorious viridity of many springs. This stone is known by its apparent coldness in the mouth, by its gravity being weighed; and in this, that being cast into a fire, it will not burn, nor send forth any flame, and that in the brightnesse of the Sunne, it will keep its excellent viridity and greenness.

And in referring to pearls he puts forward a quaint and charming theory of their origin, which however did not originate with him:

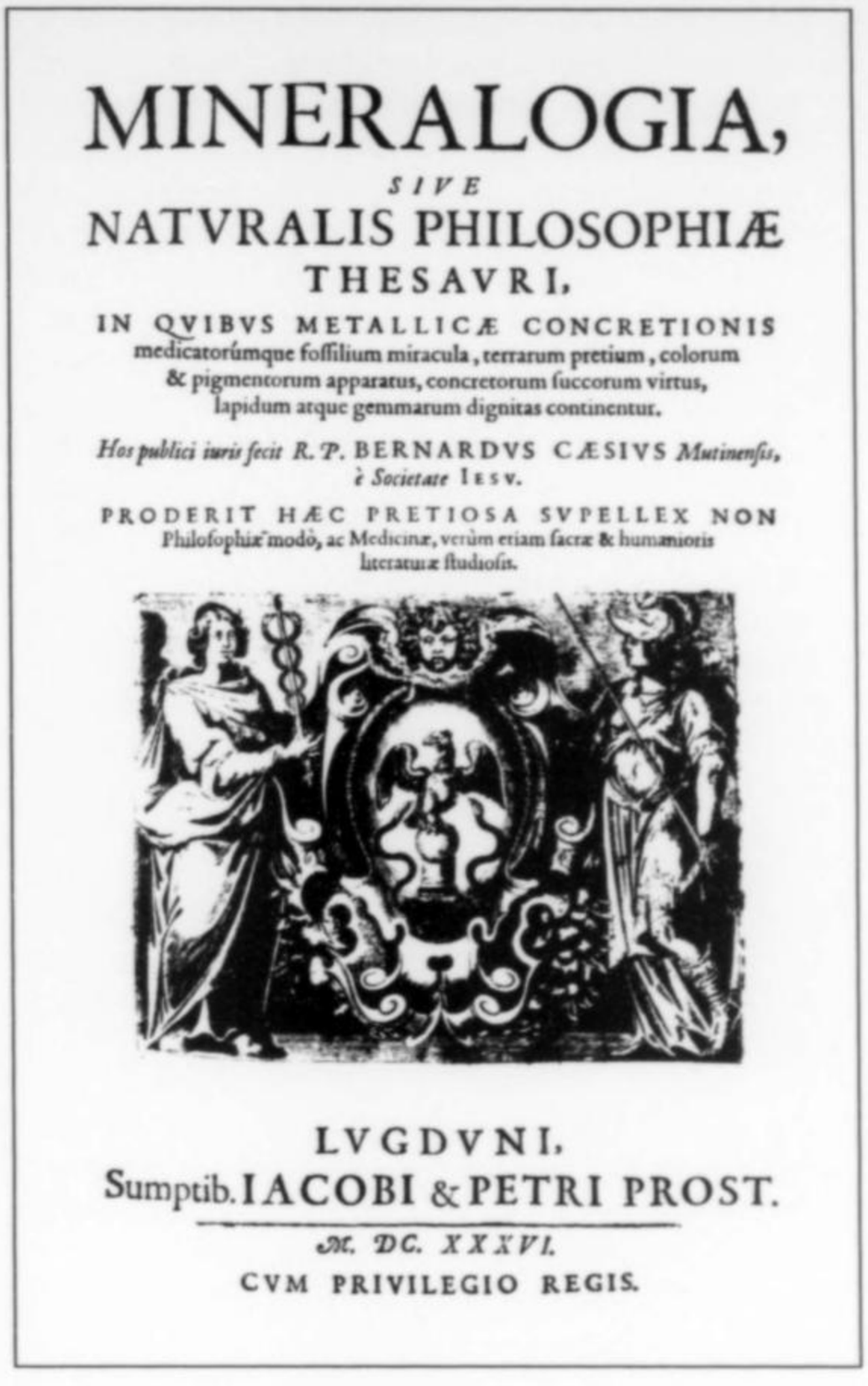
> The Margarites and Unions differ in the manner of their generation, from the generating of other Gemms or pretious stones, for these are generated of the pearly drops of chrystall morning dew, drunk in by the shell fish called Scallops and Cheripo . . . and are increased by the new addition of fresh draughts of purest chrystall dew, even by fresh supplies of that purest restorative liquor taken in as morning draughts to serene and chearfull days.

LARGER WORKS

Finally, in bringing this chapter to a close, two other books should be mentioned, those by Caesius of Modena and by Aldrovandus of Bologna. These differ in many ways from the lapidaries which have just been considered and of which they are the successors. The lapidaries are all small volumes; these are great folio tomes. Appearing toward the middle of the seventeenth century after the lapidaries had had their day and when the "New Learning" had already won its way in Europe, these encyclopedic works aim at presenting in its entirety the whole body of knowledge (or opinion) concerning the mineral kingdom which had been accumulated in times preceding their publication.

With regard to the work of Caesius, the estimate of it given by Webster in his usual blunt though forceful manner presents it in its true character:

> The Jesuite Bernardus Caesius writ a voluminous Piece of Mineralogie, or Natural Philosophy; wherein, though he expatiated too far to fetch in all things that might seem any way of kinred to that kind of knowledge; and that it was but a meer Collection and heap stoln from other Authors, and hardly any thing except notions; yet is there something in it (especially concerning the signs of discovering Mines and Ores)


MINERALOGIA,
SIVE
NATVRALIS PHILOSOPHIÆ
THESAVRI,
IN QVIBVS METALLICÆ CONCRETIONIS
medicatorúmque foſſilium miracula, terrarum pretium, colorum
& pigmentorum apparatus, concretorum ſuccorum virtus,
lapidum atque gemmarum dignitas continentur.
Hos publici iuris fecit R. P. BERNARDVS CÆSIVS Mutinenſis,
è Societate IESV.
PRODERIT HÆC PRETIOSA SVPELLEX NON
Philoſophiæ modò, ac Medicinæ, verùm etiam ſacræ & humanioris
literaturæ ſtudioſis.
LVGDVNI,
Sumptib. IACOBI & PETRI PROST.
M. DC. XXXVI.
CVM PRIVILEGIO REGIS.

that may advantage such a Reader, as hath the skill, or will take the pains to sever the tares from the wheat, and separate the gold from the dross.

The book is printed in double columns of rather small type but is excellently indexed so that while, as Webster says, it contains but little that is new, such detailed references are given to the original works from which its statements are derived that it is of great value as a guide to those who desire to explore the jungle of the earlier literature and find their way to the sources of the "notions" to which Webster refers.

Aldrovandus was one of the most renowned naturalists of the sixteenth century and occupied the chair of Natural History in the University of Bologna. He was a man of very wide learning who had travelled extensively and prosecuted his studies with great diligence. Being suspected at one time of coming under the influence of the teachings of Luther, "A heresy," his biographer Fantuzzi says, "whose poison was then permeating ever more widely through Italy," he was arrested by the Inquisition and imprisoned at Rome, but was subsequently liberated. He was the author of a number of great volumes on insects, fishes, birds and quadrupeds respectively, as well as one on serpents and dragons and left on his decease a large collection of unpublished papers. He refers to these in his will, which is reproduced in Fantuzzi's book and in which it is stated that one volume or package of these papers is labelled *Geologia ovvero de Fossilibus.*

It may be of interest to mention here that this is the first instance in which the word *Geologia* or *Geology* appears in literature when used approximately in its present sense. So far as is known at the present time, Lovell's work, *Pammineralogicon or an Universal History of Minerals,* etc. published in 1661, is the first work in the English language in which the word "geologia" appears.

The work of Escholt, written in the Danish language but published at Christiania in 1657, is the first printed work in which the word occurs.

But Aldrovandus employed the word, in some manuscript notes and in his will, essentially in the modern sense, at least as early as 1605, the year in which he died.

The word "geologia" was used at a much earlier time, but in an entirely different sense, by Richard de Bury, Bishop of Durham, in his interesting and entertaining little book, entitled *Philobiblon, or the Love of Books.* In this work, first printed at Cologne in 1473, and which was first translated into English by J. B. Inglis (London) in 1832 and by E. C. Thomas in 1888 (an issue of this translation was subsequently published by the De la Mare Press of London in 1903), the word "geologia," it is believed, made its first appearance in literature. It was apparently invented, if this term may be used, by de Bury, who used it in an entirely different sense from that in which it subsequently came to be employed. By it, he designated the study of *Law,* which faculty, he says, "We may call by a special term *Geologia* or the earthly science," in antithesis to the sciences which aid in the understanding of divine things, comprehensively speaking, *Theologia.*

Aldrovandus himself published nothing about "Geologia," but some forty years after his death, Bartholomeus Ambrosinus compiled from the material left by Aldrovandus the great folio volume bearing the title: *Ulyssis Aldrovandi Patricii Bononiensis Musaeum Metallicum in Libros IIII distributum Bartholomaeus Ambrosinus . . . Labore et Studio composuit.* This was published at Bologna in 1648. While the materials used in its preparation were in all probability those mentioned in the will of Aldrovandus under the title "Geologia Ovvero de Fossilibus," the word "Geologia" does not appear in the volume itself. The four books referred to in the title of the work are comprised in a single volume. Each book is divided into a number of chapters, each chapter dealing with the consideration of a separate "fossil" or with some special topic. In a paper by Lodovico Foresti (1887), this author gives the modern names and discusses the

recent opinions concerning the identity of the various organic "fossils" described in this work. The four books treat respectively of metals, earths, succi concreti and stones. Under this latter designation are included what are now known as minerals, rocks and fossils. Within each book there is no definite order in which the subjects are treated. The work, however, is provided with a good index. In each chapter the object or subject is treated of under a regular series of headings. Some of these, as for instance *Synonyms, Definition, Origin, Nature and Properties, Varieties, Mode and Place of Occurrence, Uses, Historical References,* are such as might be found in a modern textbook. Others, however, as for instance, *Sympathia et Antipathia, Mystica, Miracula, Moralia, Mythologica, Somnia, Symbola* and *Lapidati* remind us that the book was written in an age far removed from the present.

As instances of sympathy and antipathy he gives the following: The diamond is said to have an antipathy to the lodestone or magnet, since when it is present iron is no longer attracted by the magnet, and if a piece of iron has already been drawn to itself by a magnet, a diamond brought near it will cause the magnet to repel the iron. Such was the opinion of Pliny, Marbodus and many other authors. Sympathy and antipathy are also seen among metals. Thus lead is wooed by gold and silver, for these when fused together unite readily; on the other hand bronze shrinks away from lead, as also does tin from gold and silver.

Under the head of *Mystica* he refers to various mystical references to stones in the Bible.

Under the heading of *Somnia* many portents indicated by stones or falls of meteorites seen in dreams are mentioned, drawn from the works of various ancient authors.

Under *symbola* he mentions symbolic teachings set forth in the rocks, as for instance in that great stone mentioned and figured by Costalius, which so long as it remained intact floated freely on the waters of the sea, but when broken at once sank to the bottom, symbolizing the importance of harmony and concord among peoples, acting for their protection when maintained but when broken leading to their ruin. Other examples of mystical and moral lessons drawn from amber will be found in Chapter XIII.

An outstanding feature of the great work of Aldrovandus is that it is copiously illustrated by hundreds of woodcuts. These are rather roughly executed but are full of interest, many of them occupying the whole folio page; most of them, however, are smaller. They represent all the varied objects which are referred to in the text. Since specimens of rocks and those of many minerals do not lend themselves easily to pictorial representation, some of these cuts can scarcely be said to illustrate the text, they rather require the text to explain them. The fossil shells, however, are much more clearly reproduced. Interspersed with these are drawings of imitative forms of plants and of all manner of animals, also of various members of the human body, hands, feet and the internal organs, whose spontaneous growth in the form of stones suggests the action of some hidden and mysterious force in nature. Also strange pictures (undoubtedly much elaborated by the imagination of the artist) representing various ecclesiastical subjects as well as the saints and even the Savior himself revealed on breaking open blocks of marble. Belemnites, teeth of mammoths, bezoar stones, the "Precious Jewel" which the toad bears in its head, gems engraved with mystical devices the Tartars with their sheep and camels all turned to stone, as well as many implements, weapons, domestic vessels, and idols of barbaric peoples (some of them of Neolithic age) but to him equally mysterious in origin are also depicted.

In reading Aldrovandus, however, one gathers the impression that he was writing at the opening of a new age and that the authority of the past did not exert the same binding influence upon him as it had done upon the writers of the old lapidaries. He sets forth nevertheless the medicinal properties of various rocks, minerals and gems of which he treats, when taken internally or applied externally, but in almost all cases cites certain ancient writers as responsible for the statements which he makes. He says very little concerning the occult properties of these bodies, and their value when used as amulets and charms, and unhesitatingly rejects (with Pliny) the power assigned by Marbodus and most of the medieval writers to the gem Heliotrope of rendering its wearer invisible. He, however, still retains a belief in the efficacy of certain gems as amulets, as in the case of the golden topaz which, when attached to the left arm or suspended from the neck so that it is in contact with the skin, will strengthen the vital powers and ward off bad dreams and melancholy, and also the stone jasper which, when carved into the figure of a dragon, may be used *ad dolorem stomachi* ["for stomach ache"].

CONCLUSION

Looking back, then, it will be seen that medieval mineralogy had its origin in classical sources and especially in Pliny, who in his turn gathered his material from earlier Greek writers, whose works, except those of Theophrastus, have been lost long since, as well as from a body of local gossip and tradition, which in its turn was probably derived from still more ancient and occult sources in Chaldea and elsewhere in the far east.

The minerals, gems and stones both in classical and medieval times were held in esteem and considered to be of value chiefly because of the medicinal and magical properties which they were believed to possess. With the infusion of Arabian learning in the Middle Ages, belief in the magical powers of minerals and especially of gems received an additional stimu-

lus, for notwithstanding all its wonderful achievements, Arabic science belongs to the same world as the *Arabian Nights*—a world of magic and mystery—and the man of science was the man who could control these mysterious forces by the power of secret knowledge.

Each writer on medieval mineralogy based his statements on the authority of previous writers, and was in his turn quoted as an authority by those who followed him. Finally the later encyclopedists like Caesius and Aldrovandus (or rather Ambrosinus) made it their aim to bring together every fact and fancy which had been propounded by anyone anywhere and adding but little of their own, to incorporate it into one portentous whole. Osler says essentially the same thing about the history of medicine, "From Hippocrates to Hunter the treatment of diseases was a long traffic in hypotheses."

Medieval mineralogy in fact was not a science. It was not a solid tower of learning, as Gregory Reisch (1504) pictures the knowledge of his day, but a fairy castle, the insubstantial fabric of a dream, often quaint and even beautiful, but destined to crumble away because it had no foundation in reality. It was succeeded by a true science of mineralogy built upon the basis of close observation and diligent study of the materials of the earth's crust.

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GEM MINERALS IN EARLY ARABIC LITERATURE

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The medieval Arabs wrote prolifically on almost every subject imaginable. They plumbed the depths of history, philosophy, travel, grammar, medicine and the natural sciences, often dictating their thoughts to the ever-ready scribe. The fruits of these labors are the thousands of manuscripts extant today in the archives of Cairo, Istanbul, London, Paris and elsewhere. Much of this literary legacy has yet to be translated into modern European languages. This article examines one small part of that legacy, namely, Arab contributions to the mineralogy of the gem species.

INTRODUCTION

Gem formation, composition, properties, sources, occurrences, enhancement techniques, color grading and commercial values—all were topics of interest to the early Arabs. By "early" is meant the 9th to the 14th centuries A.D., when this literature flourished by way of treatises, cosmographies and travelogs.

The men who penned these documents were of different backgrounds, ranging from scientists to international globe-trotters. A few were supported financially by aristocratic patrons.[1] The thing they all had in common was a curiosity about gem minerals.

Arabic writings on gems number in the many hundreds of pages. This article gives a brief literary survey of those writings. The scope of this survey is limited to what the Arabs had to say about several of the more important gems: ruby, sapphire, emerald, red spinel, peridot, lapis lazuli and pearl. Physical properties, enhancement techniques and imitations are discussed, insofar as they concern some of these same gem materials.

Whenever possible, Arabic-language documents were consulted in preparing this paper. Unless otherwise stated, Arabic translations are those of the author and are being published here for the first time. Where comments of my own are inserted they are set off in square brackets.

So, get ready for a trip back in time and a tour of lost mines. The players in this venue are several men,

[1]Patronage of scholarship was not uncommon in those days; the patrons themselves saw it as a way to glean prestige. The amount of prestige so obtained was perhaps limited, however, since the masses of people were generally illiterate!

long since dead, whose manuscripts are perennial in the spirit they convey. Perhaps you will find that, though the centuries may pass, life is in many ways still the same as it was then.

What the Arabs Say about Corundum

A well-known treatise written around 1240 A.D. by a man named Teifaschi describes a wide range of gem materials. Like other Arabs who wrote about gems, Teifaschi places much emphasis on *yaqut,* a term that at times embraced several gem species but seemed most often to signify corundum. He delineates its color varieties, discusses sources, and notes that "it is heavier than all other stones of the same size."

Speaking of deposits in what is now Sri Lanka, our author observes:

> Yaqut is brought from a mine named Sahiran which is on an island about forty parasangs beyond Sarandib [Sri Lanka]. The island itself is about sixty parasangs across. There is a large mountain on this island named Mount Rahun. Winds and torrents cause the yaqut to descend, after which it is collected [at the foot of the mountain] . . .

The text appears to have been garbled in its rendition, for there is no island near Sri Lanka that meets this description. In fact, this passage refers to gem material found in the area about Adam's Peak in Sri Lanka's Ratnapura district. Adam's Peak (Rahun) was often mentioned in these accounts, and not only for its minerals; it was revered among Muslims as a place of pilgrimage, for Adam himself was thought to have landed there when cast out from Paradise. Bearing in mind that Muslims have dominated Sri Lanka's gem trade since at least the 10th century, one can appreciate that these pilgrimages often doubled as business trips!

The heat treatment of corundum is also described in Teifaschi's treatise. He notes that heating is used to improve the color of ruby. In a fascinating excerpt, he relates how this enhancement technique was employed in Sri Lanka [= Sarandib, = Ceylon]:

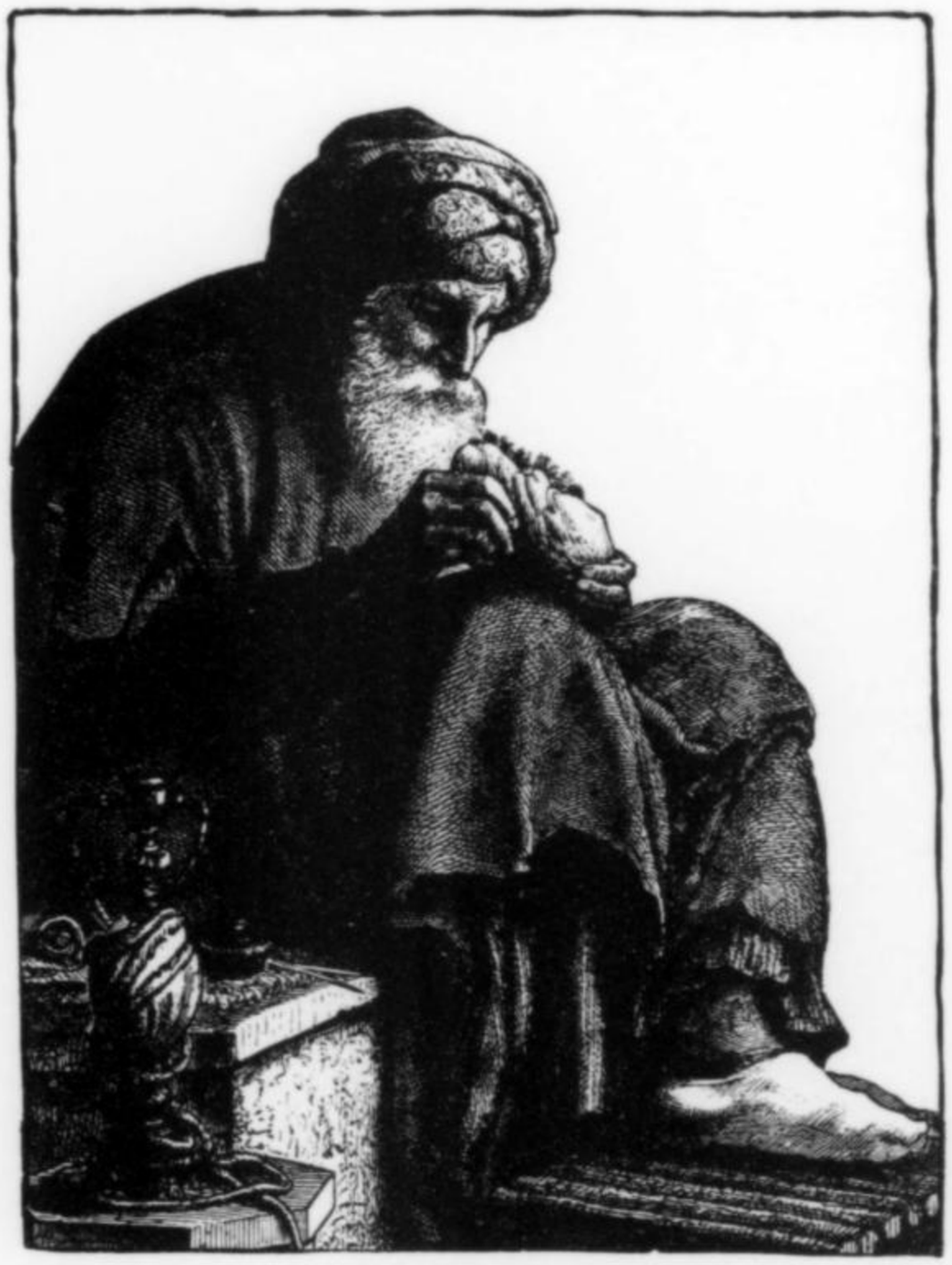
> In Sarandib and its environs, ruby is treated by fire. People take pebbles from the earth and crush and compress them into a mass with the aid of water. [This mixture] is daubed completely around a dry stone. Then, the whole thing is placed on a rock with other rocks set down around it. Dry firewood is thrown on top, lit and blown upon [with bellows]. The blowing is applied, along with more wood, till any black overtones on the ruby have disappeared.
>
> The amount of fire and the application of wood depends on the extent of the blackness present. People know this by experience. They heat treat stones for at least one hour and, at most, twenty days and nights. Then, they carefully extract the ruby, its blackness having disappeared.
>
> The ruby is not heat treated a second time. After one treatment, its color can neither improve nor diminish . . .

This passage may surprise those who think that heat treatment is a Thai innovation of the past few decades. Interestingly, the method Teifaschi describes is reminiscent of so-called primitive heat treatment procedures used today in Thailand. It is, moreover, safe to assume that similar techniques were employed for centuries on the Island of Gems; Sir James Tennent, the author of the Victorian classic, *Ceylon,* records that the Singhalese remove the blue tinge of ruby "by enveloping the stone in the lime of a calcined shell and exposing it to a high heat."

Teifaschi was not the first Arabic writer to discuss heat treatment. Two hundred years earlier a scientist named al-Biruni spoke of it in a probable reference to red spinel.

Specific Gravity; Ruby vs. Red Spinel

Abu Rayhan Muhammad Ibn Ahmad Al-Biruni (973–1050) was one of the most brilliant men of his age. During the 11th century he authored over 120 works on an incredible number of subjects, including a text of several hundred pages devoted exclusively to



Al-Biruni

gem minerals. His superbly objective mind sets him apart from contemporaries in that he always questioned, always tried to corroborate things by way of experimentation and empirical confirmation. In effect he was one of the earliest practitioners of the Scientific Method.

Al-Biruni's most valuable contributions to what are now called the sciences of gemology and mineralogy are his specific gravity experiments. The specific gravity values he derived are known to modern-day scholars of medieval Arabic literature, but have not attained much press elsewhere. For example, he gives the specific gravity of red spinel as 3.58, blue sapphire as 3.97 and ruby as 3.85. These measurements do not deviate appreciably from the currently accepted values of 3.581 for spinel and 3.987 to 4.1 for corundum. Besides spinel and corundum, al-Biruni tabulates the specific gravities of other gem materials.

It is interesting that at least some of the Arabs appear to have distinguished red spinel from ruby, which was not the case in Europe till the nineteenth century. Even with respect to nomenclature, red spinel is *balkhash,* while corundum is almost invariably called *yaqut.*

The Gems of Afghanistan; Fluorescence

Although early Arabs indicate Sri Lanka as the main corundum source, the Badakhshan region of Afghanistan is frequently mentioned for its red spinel, garnet and lapis lazuli. References to Badakhshan appear in the writings of al-Muqaddasi (10th century), al-Biruni, Teifaschi and other chroniclers. One such chronicler was an encyclopedist named, coincidentally, Yaqut (corundum!).

Shihab al-Din Abu Abdallah Yaqut Ibn Abd Allah Yaqut al-Hamawi al-Rumi (1179–1229) was most famous for his geographical encyclopedia. This magnum opus alphabetically lists cities and towns in the then-known world, defining location, commercial products, resources, weather conditions and so forth.[2] It is hundreds of pages long. Badakhshan is one of many places cited for gem deposits. Here Yaqut notes that the mountains of Badakhshan are renown for lapis lazuli and balkhash, though he adds that the latter tends to be of low quality. He goes on to say that Badakhshan produces a curious stone that glows in the dark, perhaps alluding to the strong fluorescence of some rubies and red spinels.

Yaqut

It is important to remember at this point that some of these writers—and Yaqut was no exception—felt free to recount stories and "facts" that had been passed on from earlier sources, as distorted or exaggerated as they might be. The idea of stones glowing in the dark is mentioned frequently. Fluorescence may well have been the inspiration behind this kind of story.

One passage in Teifaschi's book leaves little doubt that fluorescence was observed and even appreciated as a beauty factor by contemporaries of the day. The author distinguishes seven color-appearance types for ruby, singling out one in particular, which he calls *al-arjuani.* Teifaschi defines this appearance by analogy with "a burning coal."

Emerald vs. Peridot; The Question of Lost Mines

Much was written about emerald during these centuries, though it seems at times to have been confused with peridot. Perhaps this confusion is echoed by al-Biruni when he says that *zumurrud*—the usual Arabic word for emerald—is synonymous with *zabarjad.* Note that Zabarjad is the name the Arabs use even today for a certain island in the Red Sea; on English maps it goes by the name of St. John's, a famous but now largely exhausted source for peridot, not emerald (Wilson, 1976).

Elsewhere in his ten-page section on emerald, al-Biruni limits sources to "Egypt, the oases, Mount Muqattam and the Land of the Bujja." Mount Muqattam refers to a range of hills east of Cairo, and Bujja was the name of a tribe residing to the south. Al-Biruni goes on to list emerald mine locations cited by earlier

[2]Several geographical encyclopedias were compiled by the Arabs, though Yaqut's is the most famous. These encyclopedias had their roots in an earlier literary genre, the so-called "books of roads and highways," which described towns, cities and the distances between them. The books of roads and highways were of use to postal authorities and the military, while the latter-day geographical encyclopedias probably captured more of a general audience.

writers. In a probable reference to the so-called Cleopatra's Mines of Sikkit and Zubara, he quotes one author as saying:

> Verily, the emerald source is in Upper Egypt, along the southern Nile, in an open plain that is cut off from civilization. No other mine on earth is known to have emerald.

Still later, al-Biruni cites a chronicler to the effect that "Emerald is borne by water and mixed with sand. It is extracted from wells, along with the sand."

Finally, he relates a mining technique recorded by the Razi Brothers, who say that emerald-bearing matrix is daubed with oil, making the emerald easier to spot.

Possibly the most interesting part of al-Biruni's section on emerald is the reference to mines at the oases and Mount Muqattam. Which oases is he speaking of? And were the Muqattam hills an actual source for emerald, assuming he is not confusing emerald (*zummurud*) with some other green stone? Was Muqattam a source for emerald in times of yore? The prospect is fascinating, as historians generally regard the area of Sikkit and Zubara as the only two sources in Egypt that yielded this material (see, for example, Bauer, 1970; Bancroft, 1984; Sinkankas, 1981). The Muqattam hills are hundreds of miles to the north, in Lower Egypt![3]

Besides sources and mining tips, al-Biruni discusses the color-grading of emeralds, imitations encountered in the marketplace, and prices. The pricing information is on a table which relates value, in silver dirhams, to carat weight. For example, a 9-carat emerald is listed at 8,000 dirhams.

The Fuller Historical Perspective

The above citations barely scratch the surface in relation to what the Arabs wrote on rocks, minerals and mineraloids. As such, this article can only afford the reader a glimpse at the subject. Fleeting as this glimpse might be, however, it is important to view this material in its fuller historical perspective.

Mineralogy, gemology, petrology and metallurgy were not distinct disciplines during the Middle Ages. All were lumped together under the broader umbrella of natural science, with metallurgy seen by some as little more than a form of alchemy. Books treating of rocks, minerals and amorphous materials often included chapters on metals, advice on local gem trade practices, and bits of older poetry. One genre of Arabic literature, the cosmographies, typically contained the above information along with popular superstitions on the medicinal properties of stones, gems as amulets, exaggerated accounts about magnetic properties, etc. (Sersen, 1987).

These authors sometimes plagiarized earlier writings, but this was by no means the rule. Men like al-Biruni and Teifaschi frequently credited their sources, among them Greeks and other Arabs. Aristotle, Xenocrates, Dioscorides and Theophrastus are among the Greeks who influenced this genre of Arabic literature. The Arabs built upon this legacy, adding many contributions of their own.

Al-Kindi

One of the earliest Arab sources cited by Arab writers is al-Kindi. A scion of the Arabian tribe of Kinda in Yemen, Abu Yusuf Yaqub Ibn Ishaq al-Sabbah al-Kindi (ca. 801–ca. 866) was a polymath of the first order, not unlike al-Biruni. His literary output was tremendous, and included *A Treatise on the Kinds of Stones* and *A Treatise on the Kinds of Jewels, Precious Ones and Others.* No copy of either of these works has survived.

Al-Kindi is quoted on numerous occasions by al-Biruni and others. His books on gems are listed in *The Index,* an annotated bibliography of the 10th century compiled by the bookdealer Ibn al-Nadim.[4]

Finally, no survey of this literature is complete without mentioning the *Stone Book of Aristotle,* sometimes translated as the *Lapidary of Aristotle.* Appearing in Arabic in the 9th century, this text was often

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[3]Even if the Muqattam hills did produce emerald in the past, this does not mean there is any to be found today, at least in commercial quantities. The reason some "lost" mines tend to get lost and forgotten in the first place, is because they were mined out! Nevertheless, it would be interesting to explore the region for evidence of former mining activity.

cited by later Arab authors. It is somewhat of an enigma, as modern scholars are not sure who wrote it. Title notwithstanding, it is generally agreed that Aristotle was not the author. The *Stone Book of Aristotle* bears marks of Greek and Arab influence. Fortunately, it is preserved today; a German orientalist, Julius Ruska, published the Arabic text along with a German translation in 1912.

Availability of Source Materials

Little research has been done by modern scholars into the medieval Arabic gem-related literature. The bulk of this material is untranslated; much of it has not even been edited in Arabic from the original manuscript sources.

Since the nineteenth century, several (primarily) French and German orientalists have translated select passages and texts.[5] Unfortunately, these translations have appeared in specialized periodicals which only orientalists and Middle East historians tend to read. As a result, modern gemologists, mineralogists and others are generally unaware of this fascinating corpus of early Arab literature.

Most of the secondary-source publications consulted for this article and otherwise listed in the bibliography are available at major university libraries in the United States, England and West Germany. Arabic primary sources or photocopies thereof are more difficult to come by; people wishing to access such materials are best directed to the British Library facilities at the British Museum, London, or the library of the School of Oriental and African Studies, London University.

[4]*The Index* (*al-fihrist* in Arabic) is invaluable, in that it gives us an idea of the types of books that were popular at that time. To call it an annotated bibliography is somewhat an understatement, as Ibn al-Nadim frequently embarks on lengthy com-mentaries on these books. His inventory included manuscripts on gems, medicine, poetry, grammar, magic, law, religion, botany, astrology, astronomy and so forth. Several scholars have edited this book in Arabic. In 1970 a complete English translation appeared in two volumes (see bibliography: Dodge, 1970).

[5]French and German orientalists—in particular the Germans—researched and published numerous articles on medieval Arabic natural sciences. One German scholar who deserves special mention is Eilhard Wiedemann. Wiedemann is well-known in Germany, but not elsewhere. An intrepid scholar, a linguist and physicist, he was fascinated by medieval Arabic literature. Wiedemann's interests were not limited to Arabic gem-related materials; he also wrote articles on medieval Arabic treatises pertaining to optics, the oceans' ebb and flow, etc.

Conclusions

This paper was written in order to fill a gap. By "gap" I mean the general lack of awareness of Arab contributions to the gem and mineral sciences. It was presented as a literary survey, with the specific intention of whetting the reader's appetite to explore the subject further.

As we have seen, Arabic writings often described gems in terms of sources, occurrences, mining techniques, physical properties, treatments and imitations. Though there can be little question that Greek literature influenced some of these writings, it is equally clear that the Arabs contributed much of their own: i.e., al-Biruni's specific gravity experiments, Teifaschi's narrative on Sri Lankan heat-treatment of corundum, the distinction some Arabs made between red spinel and ruby, and numerous reports by different writers on gem sources and occurrences.

This article is by no means an exhaustive study of the Arabic "stone books." The literature goes on to describe other gem species. For example, the Arabs devoted many pages to diamond, quartz, turquoise and malachite. Lapidary methods were mentioned, with regard to polishing techniques, equipment and abrasives. There were more references to physical properties, gem treatments, imitations, sources and occurrences. Gemstone marketing centers, particularly the one that existed in Baghdad, were also addressed. A tremendous amount of material was written just on the medicinal properties of stones and the use of gems in quasi-magical applications, notably as amulets and talismans.

A bibliography follows which lists the more important English, German and French translations and studies of this literature. Arabic-language works are included. Though most of what the Arabs wrote on stones still remains untranslated, the reader can explore the subject further by way of the translations and monographs cited below.

Acknowledgments

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A Brief History of Systematic Mineralogies

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Systematic mineralogy, the scientific categorization and characterization of the components of the Mineral Kingdom, began with Agricola's De natura fossilium *in 1546, and has been revised and refined by a long succession of mineralogists ever since. Each new attempt is an interesting milepost, and a compelling collectible, in the history of mineralogy.*

INTRODUCTION

In 1804, one of Scotland's most renowned mineralogists, Robert Jameson, published the first volume of the first edition of his *System of Mineralogy*. In the Preface to that volume he reviews the history of such efforts, going all the way back to Agricola, and gives his own critical commentary. That Preface, which does not appear in later editions, is reproduced here (with some new annotations).

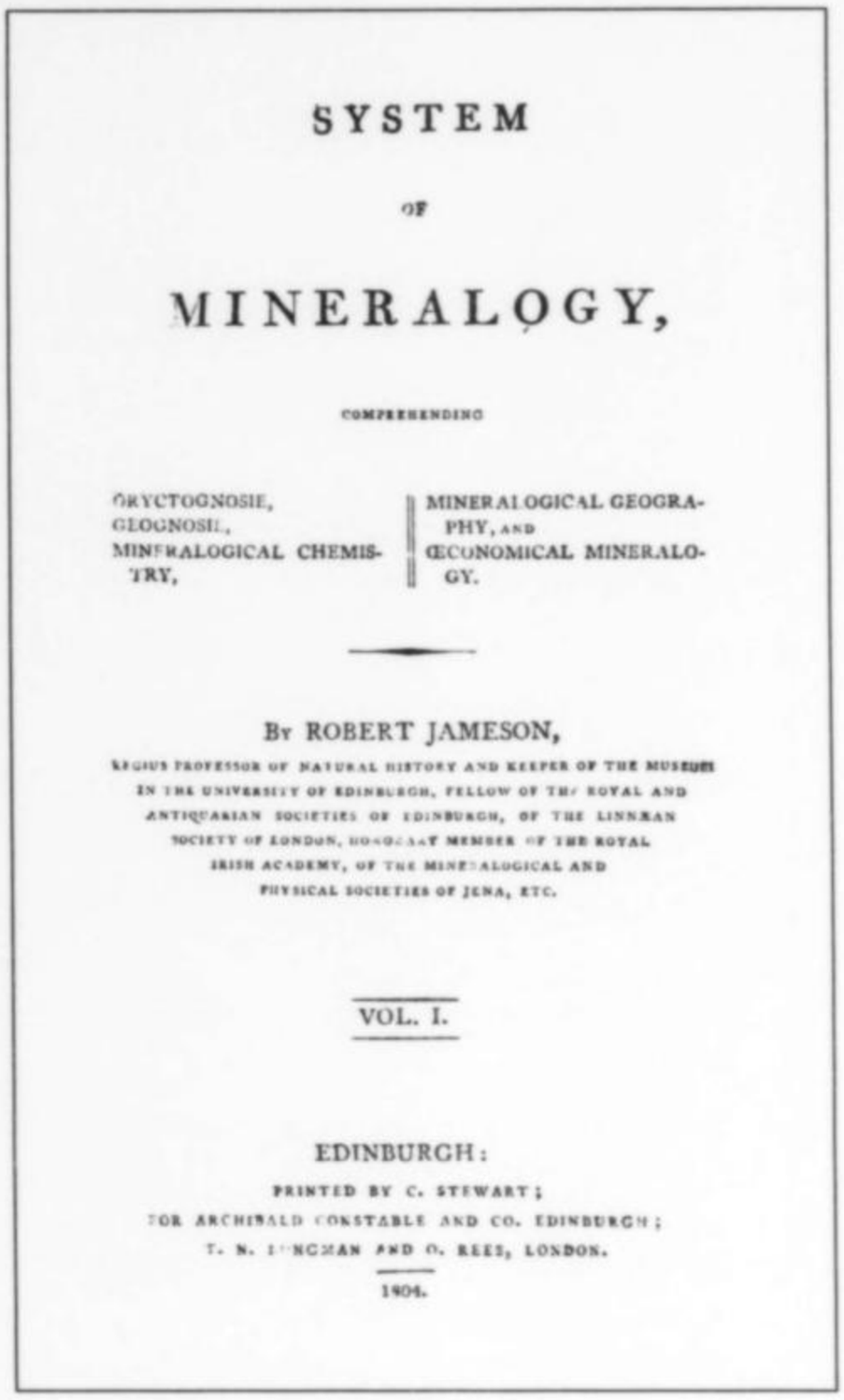
The interested reader is also referred to the excellent work by Frank Dawson Adams: *The Birth and Development of the Geological Sciences* (1938). His Chapter VI, "The birth of modern mineralogy and its development from Agricola to Werner and Berzelius," covers the same time period, more or less, but is devoted primarily to brief biographies on Agricola, Gesner, Werner, Haüy and Berzelius. These famous authors are also discussed in *The History of Mineral Collecting, 1530–1799* (*Mineralogical Record,* November-December 1994).

Robert Jameson was born in Leith, Scotland, and studied natural history under John Walker (1731–1804) at the University of Edinburgh. He traveled to London in 1793, the Shetland Islands in 1794, and the island of Arran in 1797, the latter trips resulting in his first published book, *An Outline of the Mineralogy of the Shetland Islands and of the Island of Arran* (1798). In 1800 he enrolled for two years of study at the Freiberg Mining Academy under the illustrious Werner, and was deeply impressed by Werner's theories on mineralogy and geology. Back in Scotland he continued to promote those theories, and in order to facilitate this he founded the *Wernerian Natural History Society* in 1808. Late in his life, he did finally admit that Hutton's theories on the origin of the earth's crust were probably closer to the truth than Werner's, but in mineralogy he remained committed to Werner's chemical classification.

Jameson's string of publications continued to grow, next with his *Mineralogy of the Scottish Isles* (1801), the three volumes of his *System of Mineralogy* (1804, 1805, 1808), his *Treatise on the External Characters of Minerals* (1805, with a second edition in 1816 and a third in 1817), his *Mineralogical Description of the County of Dumfries* (1805), the second (1816) and third (1820) editions of his *System of Mineralogy,* his *Manual of Mineralogy* (1821), his *Mineralogy according to the Natural History System, forming the Article under that head in the seventh edition of the Encyclopedia Britannica*

(1837), and finally his *Elements of Mineralogy* (1840). He died unmarried in 1854, and his personal collection of minerals passed to the University in 1855.

Jameson's mineralogies mark a time when Werner's (chiefly chemical) approach to systematic mineralogy was popular and spreading throughout the scientific community, mostly through the influence of his students. Werner himself was loath to publish much, so the success of his system was in large part attributable to works such as those of Jameson.



SYSTEM

OF

MINERALOGY,

COMPREHENDING

ORYCTOGNOSIE,
GEOGNOSIE,
MINERALOGICAL CHEMISTRY,

MINERALOGICAL GEOGRAPHY, AND
ŒCONOMICAL MINERALOGY.

By ROBERT JAMESON,

REGIUS PROFESSOR OF NATURAL HISTORY AND KEEPER OF THE MUSEUM IN THE UNIVERSITY OF EDINBURGH, FELLOW OF THE ROYAL AND ANTIQUARIAN SOCIETIES OF EDINBURGH, OF THE LINNEAN SOCIETY OF LONDON, HONORARY MEMBER OF THE ROYAL IRISH ACADEMY, OF THE MINERALOGICAL AND PHYSICAL SOCIETIES OF JENA, ETC.

VOL. I.

EDINBURGH:

PRINTED BY C. STEWART;
FOR ARCHIBALD CONSTABLE AND CO. EDINBURGH;
T. N. LONGMAN AND O. REES, LONDON.

1804.

Although the prospect was incomprehensible to Jameson, Werner's physiochemical system ultimately became merged with Haüy's crystallography to yield the crystallochemical approach to systematic mineralogy which is still in use today. Ed.

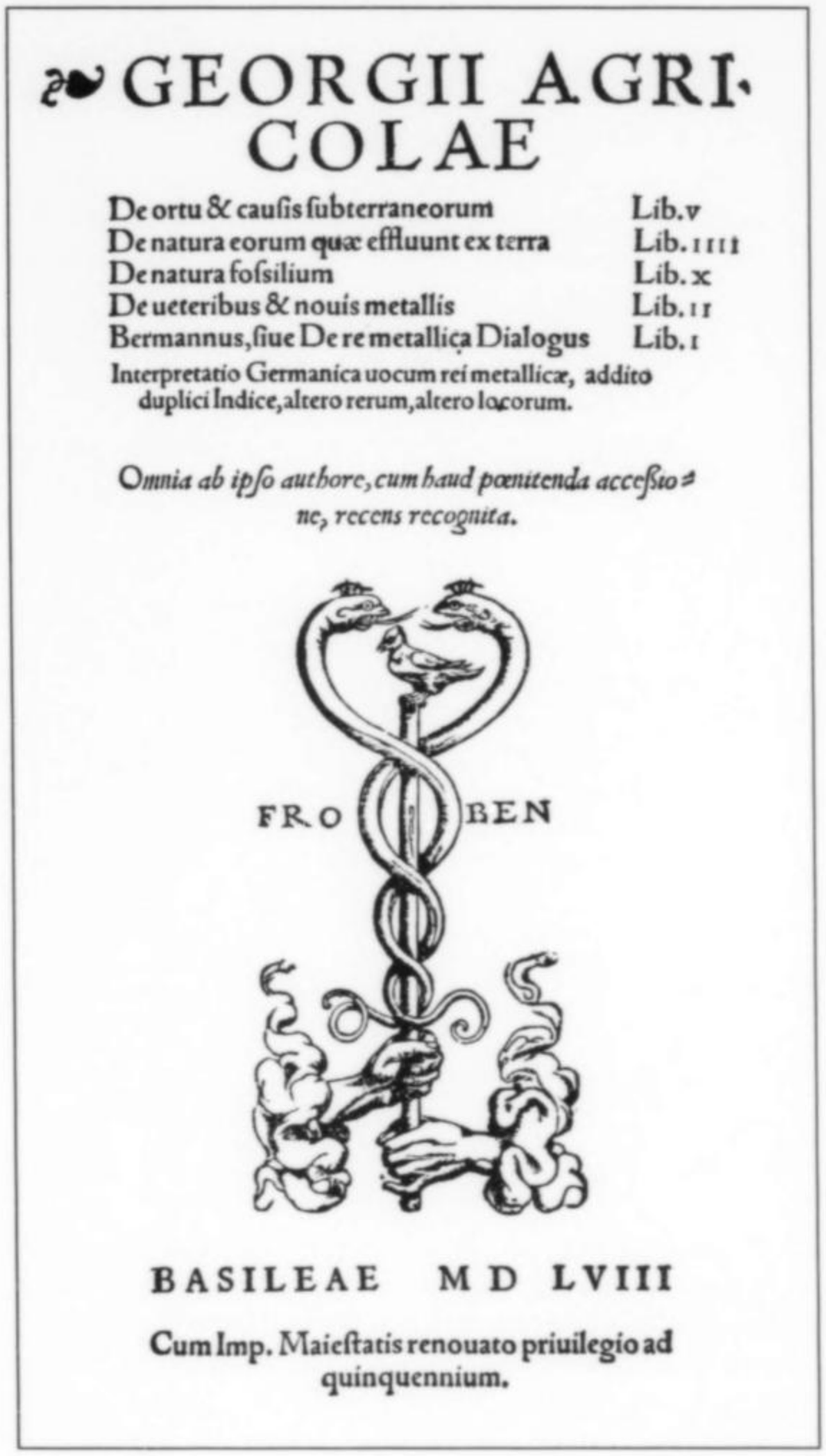
EARLY WORKS

I shall employ a few pages in giving a very short historical account of the authors who have treated mineralogy, with the view of enabling the reader to appreciate more fully the merits of the Wernerian system on which the present work is founded.

The mineralogical writings of Pliny, Theophrastus and Dioscorides have made us acquainted with the luxury of the Romans and Grecians, and their fine works of art; but they contain nothing of system, and very little of tolerable description. The first systematic mineralogist was undoubtedly the celebrated Saxon miner George Agricola. He was also the first who investigated the external characters of minerals, determined them with any degree of accuracy, and used them with judgment in the description of fossils. In his system he divides minerals into those which are composed of homogeneous parts, and those composed of heterogeneous parts. The homogeneous, or simple minerals, he subdivides into four classes, which are entitled:

1. Terra
2. Succus concretus
3. Lapis, and
4. Metallum.

The heterogeneous are divided into compound and mixed minerals.



GEORGII AGRICOLAE

De ortu & cauſis ſubterraneorum Lib. v
De natura eorum quæ effluunt ex terra Lib. IIII
De natura foſſilium Lib. x
De ueteribus & nouis metallis Lib. II
Bermannus, ſiue De re metallica Dialogus Lib. I
Interpretatio Germanica uocum rei metallicæ, addito duplici Indice, altero rerum, altero locorum.

Omnia ab ipſo authore, cum haud pœnitenda acceſſione, recens recognita.

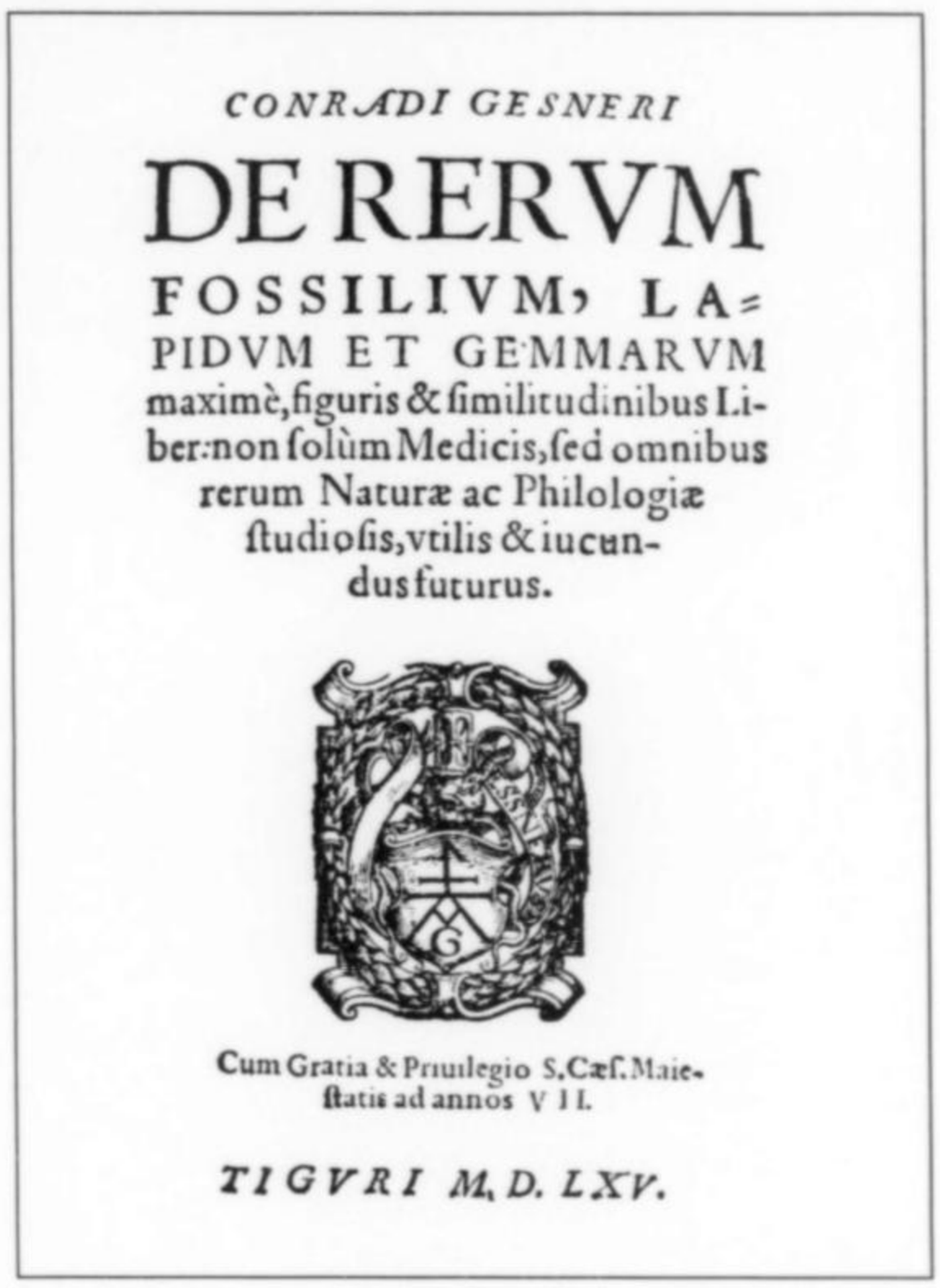
FROBEN

BASILEAE M D LVIII

Cum Imp. Maieſtatis renouato priuilegio ad quinquennium.

Nearly at the same time the famous Cardan wrote a treatise on minerals, which differs principally from that of Agricola in the saline being separated from the inflammable bodies.

Kentman's [Gesner's. Ed.] work *De omni rerum Fossilium Genere, Gemmis, Lapidibus, Metallis, &c.*, published in 1565, is nearly a transcript of Agricola's *de Natura Fossilium*. He adds to it, however, a treatise on petrifactions, entitled *Alcyonia, conchae, et alia, quae ex salso liquore maris et ex ejus spumae, cum tenuissimis sordibus permista concrescunt*.



CONRADI GESNERI

DE RERVM FOSSILIVM, LAPIDVM ET GEMMARVM maximè, figuris & similitudinibus Liber: non solùm Medicis, sed omnibus rerum Naturæ ac Philologiæ studiosis, vtilis & iucundus futurus.

Cum Gratia & Priuilegio S. Cæs. Maiestatis ad annos VII.

TIGVRI M. D. LXV.

ARTE

DE LOS METALES

EN QVE SE ENSEÑA EL verdadero beneficio de los de oro, y plata por açogue.

EL MODO DE FVNDIRLOS TODOS, y como se han de refinar, y apartar vnos de otros.

COMPVESTO POR EL LICENCIADO Albaro Alonso Barba, natural de la villa de Lepe, en la Andaluzia, Cura en la Imperial de Potosi, de la Parroquia de S. Bernardo.

CON PRIVILEGIO.

En Madrid. En la Imprenta del Reyno.

Año M. DC. XXXX.

The justly celebrated botanist Caesalpinus published, in 1602, a work entitled *De Rebus Metallicis*, which contains little deserving of notice.

In 1609 Boetius Von Boot published a treatise on precious stones, in which we find described upwards of six hundred varieties, having all particular names, a proof of the attention paid to minerals at that early period.

At this time the first Spanish mineralogist, Alonzo Barba, a Mexican priest, published his work *De los Metallos*. It contains descriptions, and methods of working minerals. He was the first who treated of amalgamation.

The great compiler Aldrovandus, in his *Museum Metallicum*, delivered a system of mineralogy extracted from the writings of Agricola, Cardan, and Caesalpinus. He was the first who drew the attention of mineralogists to petrifactions. In this path he was followed by Johnstone in his *Notitiae Regni Mineralis*, published in 1667, and by the well known Jesuit Athanasius Kircher, in his *Mundus Subterraneus*, published at Amsterdam in 1678.

Some years afterwards Woodward published his *Catalog of Minerals*. He may be considered as the first English mineralogist of note.

Becher, in his *Physica Subterranea* published at Leipzig in 1708, endeavoured to arrange minerals according to their constituent parts. He was the first writer who proposed the opinion that the difference in composition of earths and stones might be employed in their arrangement and discrimination. He also first introduced the division of metals into perfect and imperfect.

Bromel in his *Catalogus Generalis rerum curiosorum*, published at Gothenburg in 1698, retained the Becherian division of metals into perfect and imperfect, and arranged sulphur and bituminous bodies in the same class.

In the beginning and towards the middle of the eighteenth century Beyer, Büttner, and Scheuchzer, employed themselves principally in the investigation of that highly interesting class of bodies, petrifactions; although their works are disfigured by many foolish speculations, and the individual species are but indifferently ascertained, yet from this period the attention of mineralogists was more directed to the examination of great rock masses than had formerly been the case. In this point of view the labours of these

enquirers must be considered as of importance.

In 1730, Magnus Von Bromel, a scholar of Hjaerne and Boerhaave, published a system of mineralogy. He divides minerals into eight classes:

1. Earths
2. Salts
3. Sulphurs
4. Stones
5. Petrifactions
6. Calculi
7. Semi-metals
8. Metals

In 1739, Cramer published a system of mineralogy, which contains seven classes.

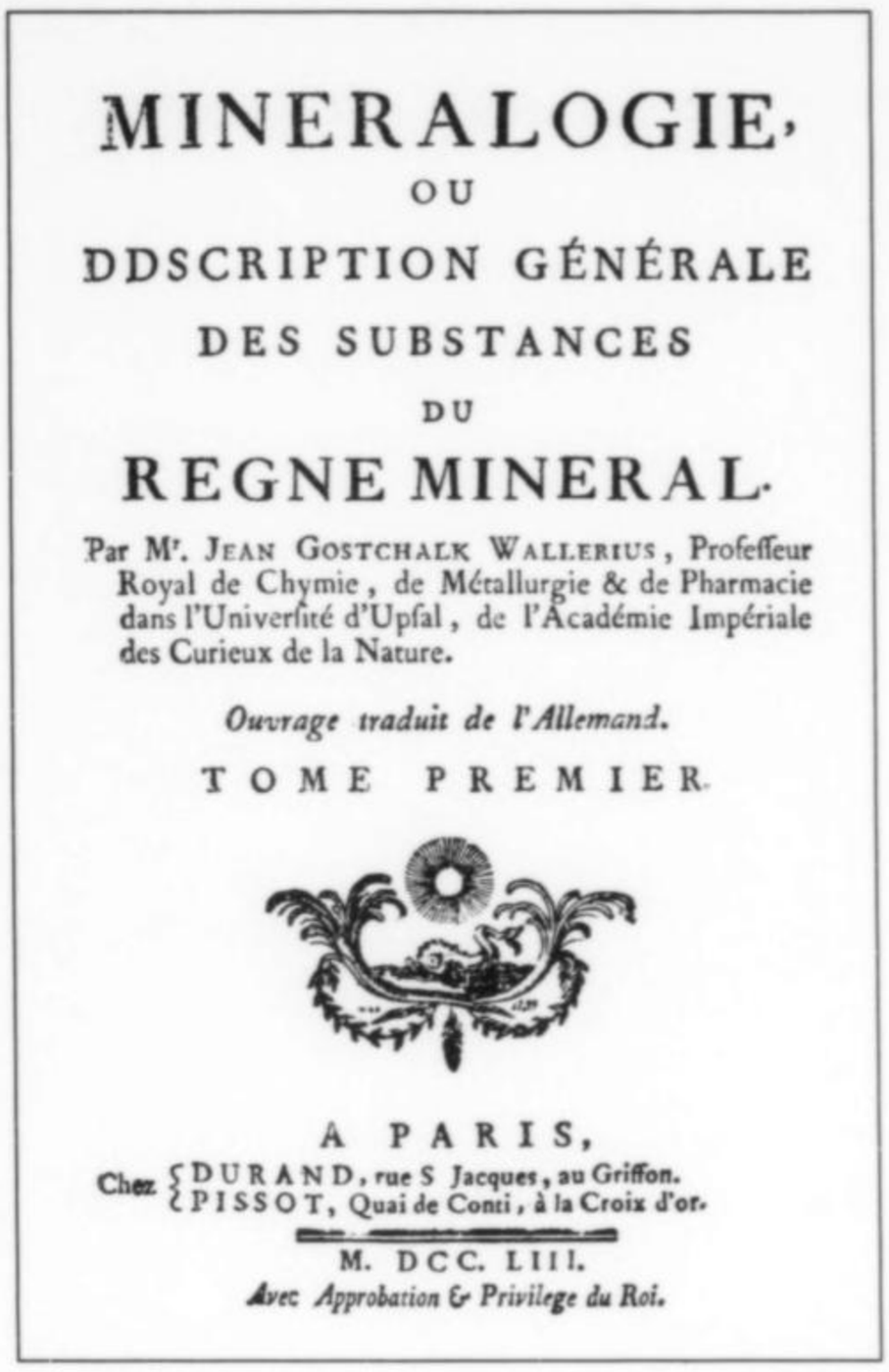
1. Metals
2. Semi-metals
3. Salts
4. Inflammable substances
5. Stones
6. Earths
7. Waters

In 1736, the illustrious Linnaeus published the first sketch of his mineral system. He divides minerals into three classes, each consisting of three orders:

1. Petra
    a. Vitrescentes
    b. Calcariae
    c. Apyrae
2. Mineralia
    a. Salia
    b. Sulphuria
    c. Mercurialia
3. Fossilia
    a. Concreta
    b. Petrifacta
    c. Terrae

This system is in many respects faulty, and its principal merit consists in having first drawn the attention of mineralogists to the study of the crystalline figures [shapes] of minerals. Although Linnaeus cannot be said to have contributed much to the progress of mineralogy, yet indirectly his labours in the other branches of natural history laid the foundation of that reformation which was afterwards effected by Werner. He was the first who established right ideas of system. He showed that its principal object was to assist the memory, and to enable naturalists to distinguish bodies from one another, and thus to ascertain if what they were investigating had been previously described by others. He also taught that no system could be of use that did not possess a uniformity in the basis of its classification and nomenclature, and a fixed and generally received language.

Nearly at the same time mineralogical chemistry was much advanced by the labours of Pott and Henckel; but of these Pott possessed the most extensive and correct chemical knowledge. He arranged earthy minerals according to their proportion of ingredients, and thus paved the way for many of the chemical systems of the present day. His four classes are the alkaline, siliceous, argillaceous, and gypseous. Death prevented this most indefatigable chymist from extending his enquiries to the metals.



MINERALOGIE,
OU
DESCRIPTION GÉNÉRALE
DES SUBSTANCES
DU
REGNE MINERAL.

Par Mr. Jean Gostchalk Wallerius, Professeur Royal de Chymie, de Métallurgie & de Pharmacie dans l'Université d'Upsal, de l'Académie Impériale des Curieux de la Nature.

Ouvrage traduit de l'Allemand.

TOME PREMIER.

A PARIS,
Chez DURAND, rue S Jacques, au Griffon.
PISSOT, Quai de Conti, à la Croix d'or.

M. DCC. LIII.
Avec Approbation & Privilege du Roi.

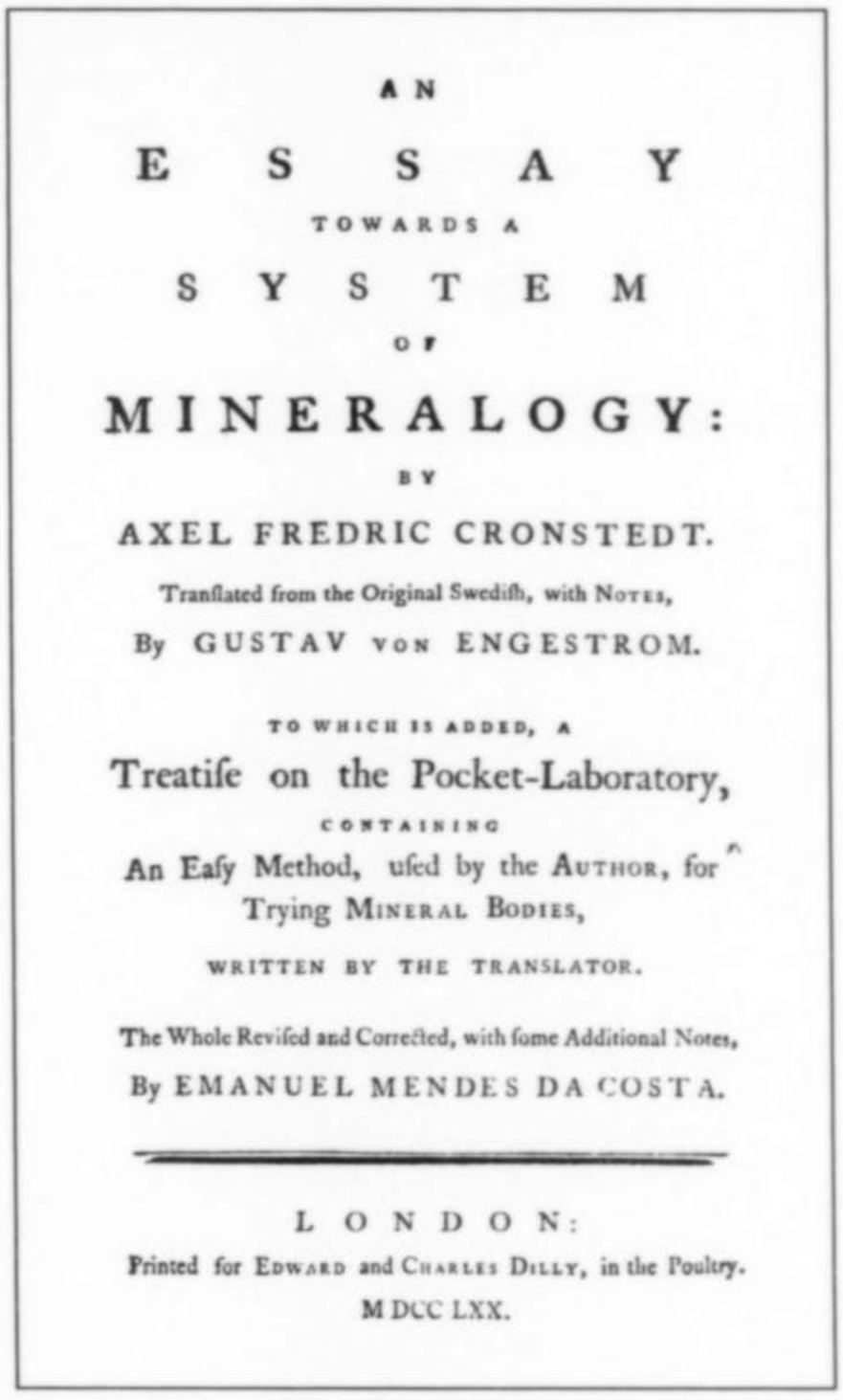
In 1747, Wallerius, professor of mineralogy at Upsalla, and contemporary with Linnaeus, published a system of mineralogy. He divides all minerals into four classes, each containing four orders:

1. Terrae
    a. Macrae
    b. Pingues
    c. Minerales
    d. Arenaceae
2. Lapides
    a. Calcarii
    b. Vitrescentes
    c. Apyri
    d. Saxa
3. Minerae
    a. Salia
    b. Sulphura
    c. Semimetalla
    d. Metalla

4. Concreta
    a. Pori
    b. Petrifacta
    c. Figurata
    d. Calculi

In this system the external characters of the species were more accurately detailed than had been done by any other mineralogist, the terminology was improved, and the synonymies of preceding authors were elucidated.

Woltersdorf, a scholar of Pott, soon after wrote a system of mineralogy, which, however, added nothing to what was then known.



AN

ESSAY

TOWARDS A

SYSTEM

OF

MINERALOGY:

BY

AXEL FREDRIC CRONSTEDT.

Tranſlated from the Original Swediſh, with NOTES,

By GUSTAV VON ENGESTROM.

TO WHICH IS ADDED, A

Treatiſe on the Pocket-Laboratory,

CONTAINING

An Eaſy Method, uſed by the AUTHOR, for Trying MINERAL BODIES,

WRITTEN BY THE TRANSLATOR.

The Whole Reviſed and Corrected, with ſome Additional Notes,

By EMANUEL MENDES DA COSTA.

LONDON:

Printed for EDWARD and CHARLES DILLY, in the Poultry.

M DCC LXX.

In 1758, the celebrated Cronstedt published a system of mineralogy. It is divided into four classes, *viz.* 1. Terrae, 2. Salia, 3. Phlogistica, and 4. Metalla.

The first class contains nine orders, 1. Calcareae, 2. Siliceae, 3. Granatinae, 4. Argillaceae, 5. Micaceae, 6. Fluores, 7. Asbestinae, 8. Zeolithicae, and 9. Magnesiae. The second class contains two orders, 1. Acida, 2. Alkalina. The third class contains but one order. The fourth has only two orders, 1. Perfecta, 2. Semimetalla. One of the most striking excellencies of this system is the strict adherence to a fixed principle as the basis of classification; it is throughout chemical, and the principles on which the orders and genera are founded are still pretty generally followed by chemical mineralogists.

The compound rocks and petrefactions which had been included in the mineral (oryctognostic[1]) system, by Linnaeus and others, were very judiciously described in an appendix by Cronstedt. The descriptions of the species, however, were, from want of attention to the external characters [physical properties], extremely imperfect, yet, as it was not so much Cronstedt's intention to write an oryctognostic system as one of chemical mineralogy, this defect must not be supposed to detract from the merit of his work.

Cronstedt was succeeded by Lehman and Vogel, but their oryctognostic labours were of little importance.

In 1768, Linnaeus published a second edition of his *Systema Mineralogicum.* In it the classes are the same with those of the first edition, but the number of orders and genera is increased. He prefixed to it an account of the external characters[2] which he employed in the description of minerals. Respecting his system of characters, Werner observes:

> There is only an arrangement of terminology which, because of the presentation, cannot be praised. The treatment is incomplete, with many gaps, and the definitions, being too brief, are for this reason obscure and incomprehensible. And finally, there is no utilization of examples in the explanations which would have contributed to an understanding of the descriptions.

Peithner, in 1778 published tables of the external characters of minerals; and Sir John Hill, in 1772, published a system of mineralogy, accompanied with tables of the external characters, resembling those of Peithner, but more extensive and determinate.

Wallerius, in the new edition of his *Systema Mineralogicum,* published at Stockholm in 1772, was the first to subject to a serious examination the principles on which mineralogists had hitherto arranged minerals. He rejected the characters drawn from use, value and geognostic[3] situation, and affirmed that classes, orders and genera should be arranged according to chemical constituents, but that species within those divisions should be arranged principally in conformity with their external charac-

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[1]Oryctognosy: An 18th-century synonym for mineralogy, sometimes used in a more restricted sense to mean the science of mineral characterization and identification.

[2]It is tempting for a modern editor to change this word to "characteristics," but the form as written is entrenched in the early literature and should be retained for historical accuracy.

[3]Geognosy: An 18th-century term for the study of the origin, distribution and sequence of minerals and rocks in the earth's crust. It was later more or less replaced by the term *geology* as early ideas were abandoned.

ters. These principles he employed in the construction of his system, which proved the most complete and possessed the most determinate nomenclature of any that had hitherto appeared. By thus combining with the chemical characters those external characters that were then known, he enabled mineralogists to discriminate minerals with more certainty than they had been hitherto able to do. Still, however, the lack of a proper mineralogical language rendered all systems and descriptions imperfect and comparatively useless. The external characters employed by Agricola, Linnaeus, Wallerius, Hill and others were either undefined or so inaccurately explained that it was difficult to understand, or avoid confounding them with one another; besides, they were employed irregularly, and even frequently intermixed with chemical, physical and empyrical characters.

The illustrious Werner early saw the impossibility of mineralogy advancing steadily without a determinate language, he therefore made this the first object of his attention, and published the result of his observations in his classical work, *Von den Kenzeichen der Fossilien*. This admirable treatise laid the foundation of true oryctognosie, I may even say of mineralogy. In it Werner has collected together all the old and known characters; described many which he himself discovered by comparing minerals together; accurately defined every character then known; gave to each an appropriate and fixed denomination; and arranged the whole in systematic order. Since the publication of this treatise, he has discovered several more very important external characters, and has much improved the descriptions of many of those contained in his early work. The system of characters as now delivered by Werner may be placed with the *Philosophia Botanica* in its most finished state.

I should now proceed to mention the different oryctognostic publications of the Wernerian school, but I shall for a short time interrupt the regularity of this view by giving a short account of the writings of two French mineralogists whose labours have in France formed a kind of national mineralogy.

The first is the celebrated Romé d'Lisle, who published an excellent work on crystallization in 1783. In it minerals are divided into three classes: the first contains saline crystals, the second stoney crystals, and the third metallic and semi-metallic crystals. He was the first, after Werner, who particularly directed the attention of mineralogists to the primitive form of crystals, of which he enumerates the following species: 1. Tetrahedron. 2. Cube. 3. Octahedron. 4. Parallellepiped. 5. Rhomboidal octahedron, and 6. Dodecahedron, with triangular planes. He considered all minerals that agreed in crystallization, hardness and specific gravity as belonging to the same species.

The descriptions of the species were the most accurate and complete that had been delivered, and

TRAITÉ
DE
MINÉRALOGIE,

PAR LE Cᵉᵉ. HAÜY,

Membre de l'Institut National des Sciences et Arts, et Conservateur des Collections minéralogiques de l'École des Mines.

PUBLIÉ PAR LE CONSEIL DES MINES.

En cinq volumes, dont un contient 86 planches.

TOME PREMIER.

DE L'IMPRIMERIE DE DELANCE.

A PARIS,

CHEZ LOUIS, LIBRAIRE, RUE DE SAVOYE, N°. 12.

(X) 1801.

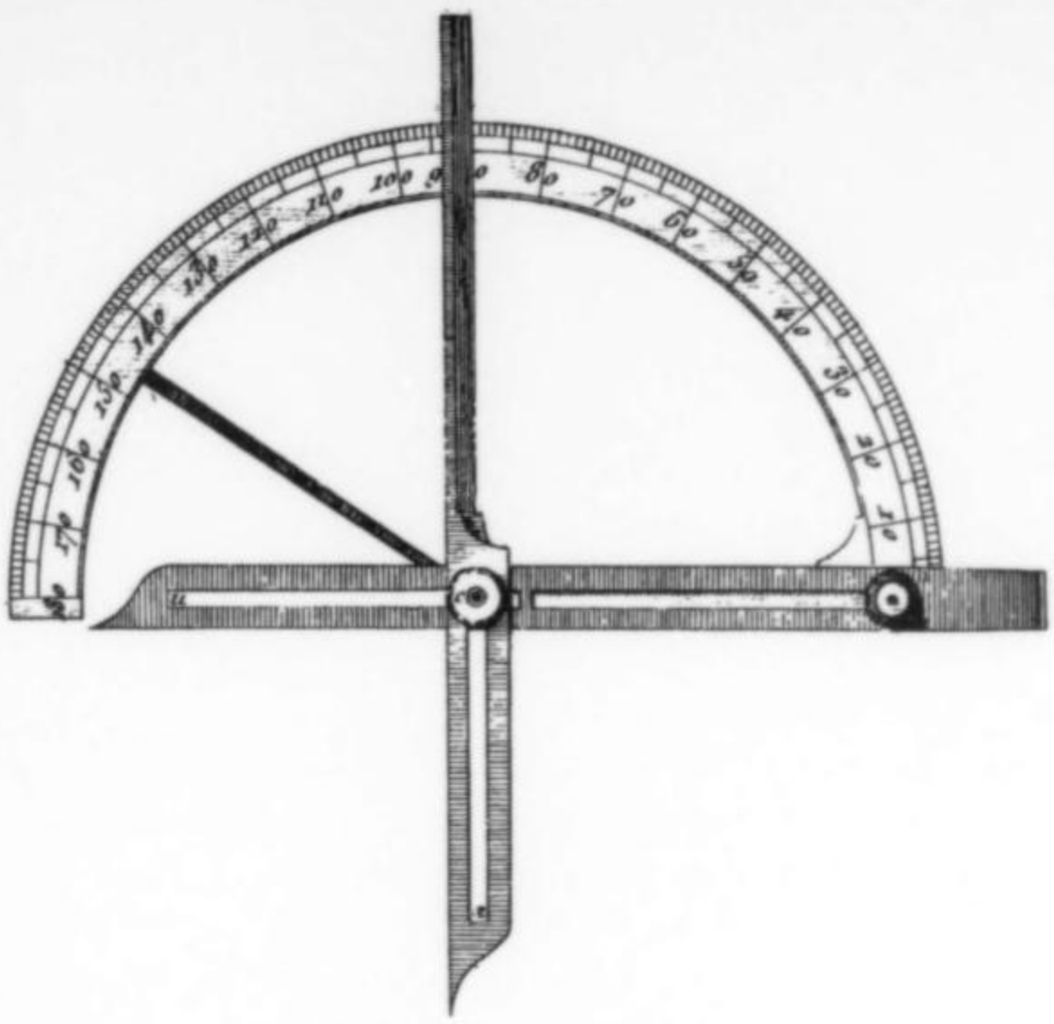
contributed more to the advancement of oryctognosy than the writings of all preceding mineralogists.

To him succeeded several other French mineralogists; of these the most remarkable and only one deserving of notice is the Abbé Haüy. This intelligent philosopher was long employed in crystallometrical researches, of which he gave an account in a treatise published some years ago. Since that period he has extended his investigations to the greater number of simple minerals; and in 1801 he published the result of his very laborious and ingenious observations and speculations in a work entitled *Traité de Mineralogie*. In it simple minerals are divided into four classes. The first comprehends the combinations of earths and alkalis with acids; it is subdivided into three orders: 1. Combinations of earths with acids. 2. Combinations of alkalis with acids. 3. Combinations of earths with acids and alkalis.

The second class contains those earthy substances into whose composition there sometimes enters a portion of alkali. This class has neither orders nor genera, but is only a series of species.

The third class consists of the combustible substances, with the exception of the metals. It is subdivided into two orders. 1. Simple combustibles. 2. Compound combustibles.

The fourth class includes all the different metallic minerals. It is subdivided into three orders. 1. Contains metals not oxydable by heat. 2. Those which are



Haüy's contact goniometer

reducible and oxydable by heat. 3. Metals which are oxydable, but not reducible by heat.

These four classes are followed by three appendices. In the first appendix is contained all doubtful or unascertained minerals. The second includes all the compound rocks. It is subdivided into three orders: the first contains primitive rocks; the second, the secondary and tertiary rocks; the third, aggregates formed by the agglutination of fragments.

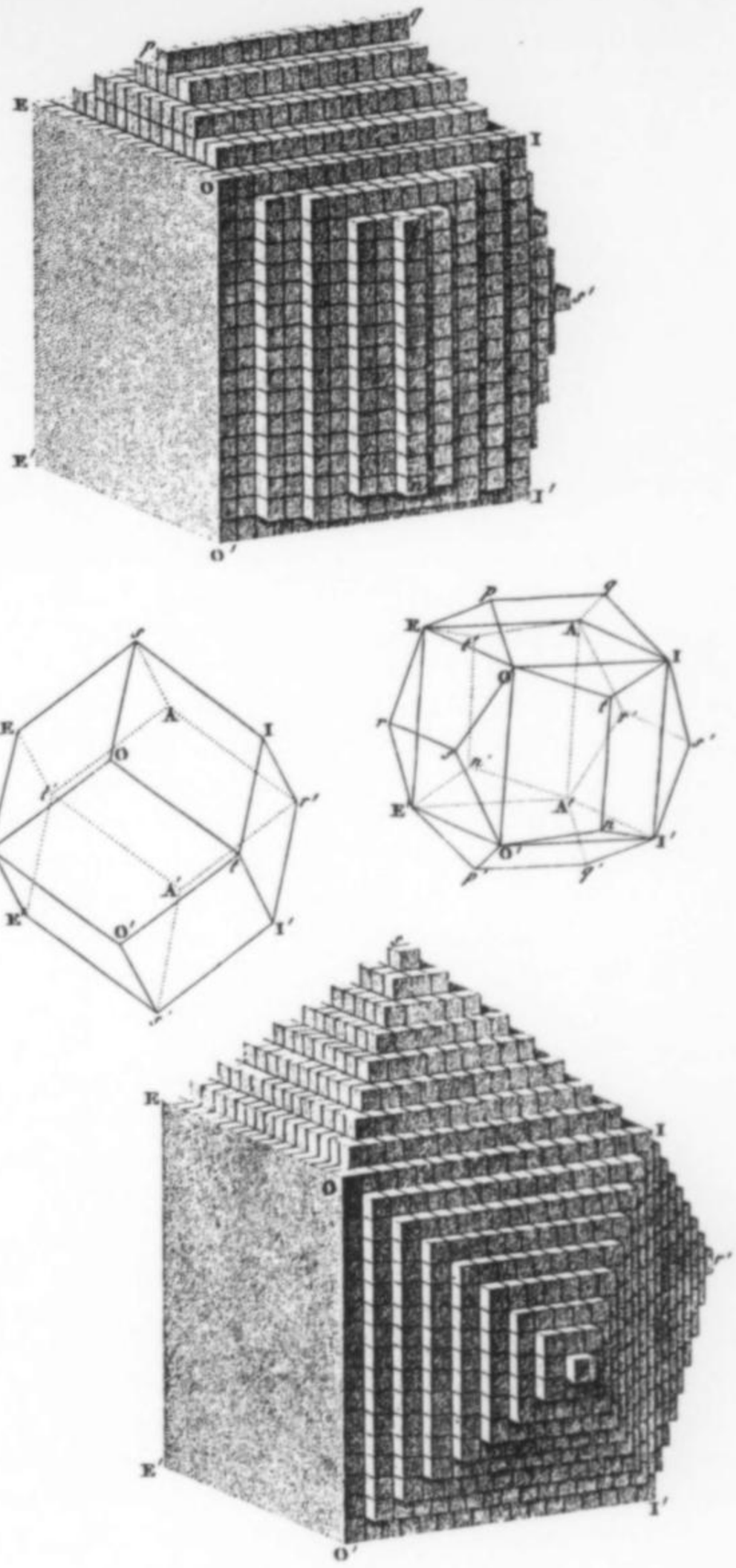
The third appendix is dedicated to volcanic productions. It is subdivided into six classes. 1. Contains lavas. 2. Thermantides. 3. Products of sublimation. 4. Altered lavas. 5. Volcanic tufas, and 6. Substances which have been formed in lava after their eruption, and cooling.

In this system the arrangement of simple minerals is almost strictly chemical; but the arrangement and description of the rocks and lavas is founded on certain fanciful ideas respecting their formation, and is extremely ill executed; but an examination of this part of the system of Haüy belongs properly to geognosy.

The species of simple minerals is determined from one character, which is called the "internal mollecule." Haüy defines the mineral species to be:

> A collection of matter whose integrant molecules are all alike, and composed of the same elements united in the same proportion.

This integral mollecule or kernel is detected either by mechanical division or by measurement combined with calculation; and, when found, is asserted to afford an invariable essential character for the species. I cannot, however, subscribe to this opinion; on the contrary, I venture to affirm, that it is not, in any



Haüy's famous stacking models

instance, the type of the species, and that it only makes us acquainted with peculiarities in the structure of a few crystallized minerals, peculiarities which may indeed be afterwards discovered in other specifically distinct minerals. That it affords no essential characters is evident because different species, such as diamond and spinelle, have the same integral mollecule; and other minerals, such as zeolite, that unquestionably belong to the same species, have different integral mollecules. That it makes us acquainted with peculiarities in the structure of but a few crystallized minerals is shown, 1. From the impossibility of detecting the integral mollecule by calculation combined with measurement, therefore all the species ascertained by this method are to be

expunged from the system. 2. From many species having the same integral mollecule; and individuals of the same species have different mollecules. Thus it appears that its existence as a peculiarity, remains but to a few species. [Ed. note: Jameson was sadly incorrect here, for Haüy's "integrant molecule" concept was very close to the modern, accepted idea of the "unit cell" in crystallography. The difficulties Jameson lists were all subsequently explained.]

That even this peculiarity, which we find in a very few crystallized minerals may be discovered in others specifically different, is proved from the case of diamond, spinelle, &c.

It appears from this that the integral mollecule cannot in any instance be considered as the type of the species, therefore, the oryctognostic system of Haüy, which is built on this supposition, must fall to the ground.

Independent of the objections stated above, there is still another, and probably a more forcible one to be opposed to the system of Haüy; it is that the greater number of minerals are not crystallized, consequently, according to the definition of Haüy, have no discoverable integral mollecule, therefore are not species. Haüy indeed suspects that they are not species!!!

The various attempts that have been made to describe and to discriminate the mineral species by a few characters, as by the primitive form, integral mollecule, or the primitive form combined with hardness and specific gravity have all proved insufficient.

In amorphous minerals, the species are determined from the colour, shape, surface, lustre, fracture, distinct concretions, hardness, transparency, and specific gravity; each species presents a peculiar suite of characters that characterize and distinguish it from all others. Also in crystallized minerals the character of the species is to be taken from the crystallizations, combined with the other characters. If, on the contrary, we would attempt to describe the species from one or a few characters, we will undoubtedly confound species that are different, and subdivide those that are similar. This renders the use of the primitive form nearly equally objectionable with the integrant mollecule. We cannot too often bring to our recollection, that every mineral species is to be determined from the aggregate of all the characters, combined with the geognostic relations; a mode of investigation which, independent of the certainty it gives to our determination of the species, prepares us for the higher study of geognosie.

Werner was early aware of the insufficiency of such methods, and in his work on the external characters, published in 1774, he gave the first examples of the true method of describing species. In these descriptions all the characters presented by the *species suite* are detailed with a certain degree of minuteness, and in a determinate order, so that we have a complete picture of it, and are furnished with characters that distinguish it from all known species, and from every mineral that may hereafter be discovered.

In 1780 he published the first part of a translation of Cronstedt's mineralogy. It was in his annotations on this work that he gave the first sketch of his oryctognostic system, and published many descriptions in conformity with the method laid down in his treatise on the external characters. In this system we find earthy minerals (for this was the only part of the system then published) divided into four genera, viz. siliceous, argillaceous, talcaceous, and calcareous; and these genera subdivided into species, subspecies and kinds. The species, as already mentioned, are not described by a few, but by all the external characters.

In 1791, he published a catalog of the great mineral collection of the then deceased Pabst Von Ohain, a captain general of the Saxon mines. In this interesting work we have a tabular view of the whole oryctognostic system, in which the method of genus, species, subspecies, and kind is continued; several additions are made to the external characters, and the arrangement of the species is in some instances changed, owing to the examination of the more complete mineral suites.

Since that period his oryctognostic publications have been confined to a few, but very masterly memoirs, in the miner's journal, so that we have still to regret the want of his own exposition of his oryctognostic system. His numerous pupils, however, have made it known in every civilized country of Europe. In Germany it has been published by Widenman, Emmerling, Karsten, Estner, Reuss, and Lens; in Spain, De La Rio has published an account of the system of his great master; Napione has done the same in Italy; in Sweden and Denmark it is also followed and taught; it has been introduced into France by an able mineralogist M. Brochant; and Kirwan, one of the most illustrious of British philosophers was the first who made it known in England.

In 1800 Brunner published a treatise entitled *Versuch eines Newen Systems der Mineralogie, &c.* It is founded solely on the external characters. It is divided as usual into four classes, *viz.* earthly, saline, inflammable, and metallic. The first class is subdivided into seven orders: the first order contains all earthy minerals which "have an earthy fracture, and are dull and opaque." 2d, Having a fine scale fracture. 3d, Having a foliated fracture. 4th, Having a radiated fracture. 5th, Fibrous fracture. 6th, Fine grained foliated fracture. 7th, Distinct compact fracture. The second class contains eight orders: 1st, Having a sourish astringent taste. 2d, Sweetish astringent taste. 3d, A rather disagreeable saltish cooling taste. 4th, Pure saline taste. 5th, Pungent saline cooling taste. 6th, Bitter taste. 7th. Weak, soapy taste. 8th, Sharp alkaline taste. The third class contains three orders: 1st, Bituminous. 2d, Coaly. 3d, Sooty. The fourth class is subdivided into eight orders: 1st, Earthy fracture, dull, or faintly glimmering. 2d, Compact fracture, common, fre-

ELEMENTOS

DE ORICTOGNOSIA,

Ó DEL CONOCIMIENTO DE LOS FÓSILES,

DISPUESTOS,

SEGUN LOS PRINCIPIOS DE A. G. WÉRNER,

PARA EL USO

DEL REAL SEMINARIO

DE MINERÍA DE MÉXICO,

POR DON ANDRES MANUEL DEL RIO

Catedrático por S. M. de Mineralogia del mismo, Socio honorario de la Sociedad económica de Leipsic y de otras extrangeras, y Correspondiente de la Real Academia Médica Matritense.

PRIMERA PARTE,

QUE COMPREHENDE

LAS TIERRAS, PIEDRAS Y SALES

CON SUPERIOR PERMISO.

IMPRESOS EN MÉXICO: POR DON MARIANO JOSEPH DE ZÚÑIGA Y ONTIVEROS, CALLE DEL ESPÍRITU SANTO, AÑO DE 1795.

quently a little metallic, lustre. 3d, Common lustre, and foliated fracture. 4th, Common lustre and radiated fracture. 5th, Common lustre and fibrous fracture. 6th, Metallic lustre and in loose scales. 7th, Metallic lustre and fluid. 8th, Metallic lustre and solid.

In his system the most dissimilar minerals are associated together; those that evidently belong to the same natural family are separated; and in no instance is there such a description of the species given as to enable us to distinguish them from one another. To exemplify this we may mention, 1st, That wood tin, fibrous malachite, red ore of antimony, cobalt bloom, and featherose antimony, are placed in the same order. 2d, Mica, selenite, potstone, hornblende, felspar, diamond spar, calc spar, heavy, spar are arranged together; and 3d, Of columnar heavy spar we have the following description: "Usually of bright white colour. Lustre pearly. Either translucent or translucent on the edges. soft; and its crystals are aggregated into columns." This is another striking instance of the insufficiency of all methods that do not embrace in the account of the species *all* its external characters, and in the arrangement of natural alliances.

Several of the works I have now mentioned were published when the Wernerian oryctognosie was far removed from its present state of perfection, and are consequently in many respects imperfect. The mineralogy of the intelligent M. Brochant, which may be considered the best account of the Wernerian oryctognostic system hitherto published, is unsatisfactory.

In the work I am now to lay before the public, I shall, in the two first volumes, deliver a system of oryctognostie, in which I shall follow the arrangement and method of description of Werner, and when I venture to deviate from the system of my illustrious master, I hope to be able to assign satisfactory reasons for the alterations I may propose.

The task which I have undertaken was to have been executed by my ever-to-be-regretted friend, Dr. Mitchell, whose long experience and consummate skill eminently qualified him for it. Unfortunately for mineralogy, this accomplished and most amiable man was removed from this transient scene before he was permitted to communicate to the world the results of his own profound observations and thoughts on a science in the knowledge of which he was only rivalled by its great founder Werner.

REFERENCES

Editor's Note: The following list of references is based on works mentioned or alluded to in the foregoing essay. In compiling these citations and annotations I have been aided primarily by (1) the catalog of the Mineralogical Record Library, (2) the catalog of the Herbert Obodda Library, (3) the *Catalogue of the Library of the British Museum (Natural History)* (1903), (4) the catalog of *The Hoover Collection of Mining and Metallurgy* (1980), and (5) especially Curtis P. Schuh's *Bio-Bibliography of Mineralogy and Crystallography* (1993).

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BARBA, A. A. (1640) *Arte de los metales en que se enseña el verdadero beneficio de los de oro, y plata por açoque. El modo de fundir los todos, y como se han de refinar, y apartar unos de otros.* En la imprenta del Reyno, Madrid, 124 p. [A partial English translation by the Earl of Sandwich was published in London (1674). German editions appeared in 1676 and 1739, and French editions in 1730, 1733 and 1751.

There was also a second Spanish edition in 1729, a third in 1770 and a fourth in 1817.]

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CRAMER, J. A. (1739) *Elementa Artis Docimasticae Duobus Tomis comprehensa, quorum Prior Theoriam, Posterior Praxin, ex vera Fossilium indole deductas, atque indubirata experimentorum, summa cum accuratione institutorum, fide firmatas, ordine naturali & doctrina apertissima exhibet.* Lugduni Batavorum. [There were also English editions of 1741 and 1764, a French edition of 1755, and German editions of 1746 and 1774.]

CRONSTEDT, A. F. (1758) *Försök til Mineralogie, eller Mineral-Rikets Upstaellning.* Stockholm, 289 p. [There were numerous other editions, in English (1770, 1772, 1788) German (1760, 1770, 1780), etc.]

DEL RIO, A. M. (1795) *Elementos de Orictognosia, ó del conocimiento de los fósiles, dispuestos, segun los principios de A. G. Wérner, para el uso del Real Seminario de Minería México.* Zúñiga y Ontiveros, Mexico City, 172 p.

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HAÜY, R. J. (1784) *Essai d'une Théorie sur la Structure des Crystaux, appliquée à plusiers genres de substances crystallisées.* Chez Gogué Mée de la Rochelle, Paris, 244 p. [His famous *Traité de Cristallographie,* in two vols. plus an atlas, appeared in 1822.]

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HENCKEL, J. F. (1725) *Pyritologia: oder, Kiess-Historie, als des vornehmsten Minerals, nach dessen Nahmen, Arten, Lagerstätten, Ursprung, Eisen, Kupfer, unmetallischer Erde, Schwefel, Arsenic, Silber, Gold, einfachen Theilgen, Vitriol und Schmelznutzung . . .* Martini, Leipzig, 1084 p. + 12 plates. [There was also a second German edition in 1754, an English edition in 1757, and a French edition in 1760. Henckel wrote several other books on mineralogy, including his *Idea generalis de Lapidum* (1734), his *Kleine mineralogische und chymische Schriften* (1756, 1769, 1774), his *Henckelius in Mineralogia redivivus* (1747, 1759), and his *Introduction à la Minéralogie* (1756).]

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Obvious Characters; with their History and Description; under the articles of Form, Hardness, Weight, Surface, Colour, and Qualities; the Place of their Production, their Uses, and distinctive English and Classical Latin Names. Baldwin Elmsly, London, 440 p.

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WALLERIUS, J. G. (1772–1775) *Systema mineralogicum, quo corpora mineralia in classes, ordines, genera et species suis cum varietatibus diviae, describuntur, atque observationibus, experimentis et figuris aeneis illustrantur.* L. Salvii, Stockholm, two vols. [There was also a second Latin edition of 1778, and a German edition of 1781–1783.]

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WIDENMANN, J. F. W. (1794) *Handbuch des oryktognostischen Theils der Mineralogie.* Crusius, Leipzig, 1,080 p. [There was also a Spanish edition published in Madrid in 1797–1798 (two vols.).]

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ADDENDUM: 1800–1962

Jameson's review necessarily covers works only up to the time of his writing around 1800. Systematic mineralogy continued to develop after that date, through the publication of numerous important works in America and Europe.

The following annotated chronological bibliography, adapted in part from Robert Hazen's 1984 article, "Mineralogy: a historical review" (*Journal of Geological Education,* **32**, 288–298) and Curtis Schuh's *Bio-Bibliography of Mineralogy and Crystallography* (1993), supplemented by works in the Mineralogical Record Library, covers some of these subsequent mineralogies which the book collector and student of history should know about.

Editor

DEL RIO, A. M. (1795–1805) *Elementos de Orictognosia.* Zuñiga y Ontiveros, Mexico City. [Del Rio, Mexico's most famous mineralogist, founded a school of mines in Mexico City in 1795 and produced this book for his students. He was a proponent of Werner's system, having studied under him in Freiberg. A second, larger edition was published in Philadelphia in 1832, and later in Mexico City in 1846.]

LUCAS, J. A. H. (1803) *Tableau méthodique des Espèces Minérales.* Paris and Strasbourg. [Lucas extracted Haüy's (1801) system of classification, and in his two-vol. second edition of 1806–1813 he incorporates material from Haüy's *Tableau Compartif* (1809) as well.]

TABLEAU MÉTHODIQUE
DES
ESPÈCES MINÉRALES,
PRESENTANT
La Série complète de leurs Caractères, et la Nomenclature de leurs Variétés,
EXTRAIT DU TRAITÉ DE MINÉRALOGIE DE M. HAÜY, ET AUGMENTÉ DES NOUVELLES DÉCOUVERTES;
AUQUEL ON A JOINT
L'Indication des Gisemens de chaque Espèce, et la Description abrégée de la Collection de Minéraux du Muséum d'Histoire Naturelle;
PAR J.-A.-H. LUCAS,
Adjoint à son PÈRE, Garde des Galeries du Muséum d'Histoire Naturelle et Agent de l'Institut National.
PREMIÈRE PARTIE.
Imprimé avec l'Approbation de l'Assemblée-Administrative des Professeurs du Muséum d'Histoire Naturelle.
A PARIS,
Chez LEVRAULT, SCHŒLL et Cie., rue de Seine, N°. 12; et à Strasbourg, chez LEVRAULT et Cie.
1806.

BRONGNIART, A. (1807) *Traité élémentaire de Minéralogie, avec des applications aux Arts.* Two vols., l'Imprimerie Carpelet, Paris. [Brongniart's classification was based on a combination of physical properties, Haüy's crystallography, and the electronegative elements present.]

BOURNON, J. L. (1808) *Traité de Minéralogie, renfermant l'introduction à la minéralogie en generale, la theorie de la cristallisation, l'etude de la chaux carbonatee proprement dite et l'arragonite . . .* Three vols., printed for William Phillips by G. Yard, London. [Although this work discussed primarily the structural relationship between calcite and aragonite, it helped promote Haüy's general contention that structure is more important than chemical composition in determining species.]

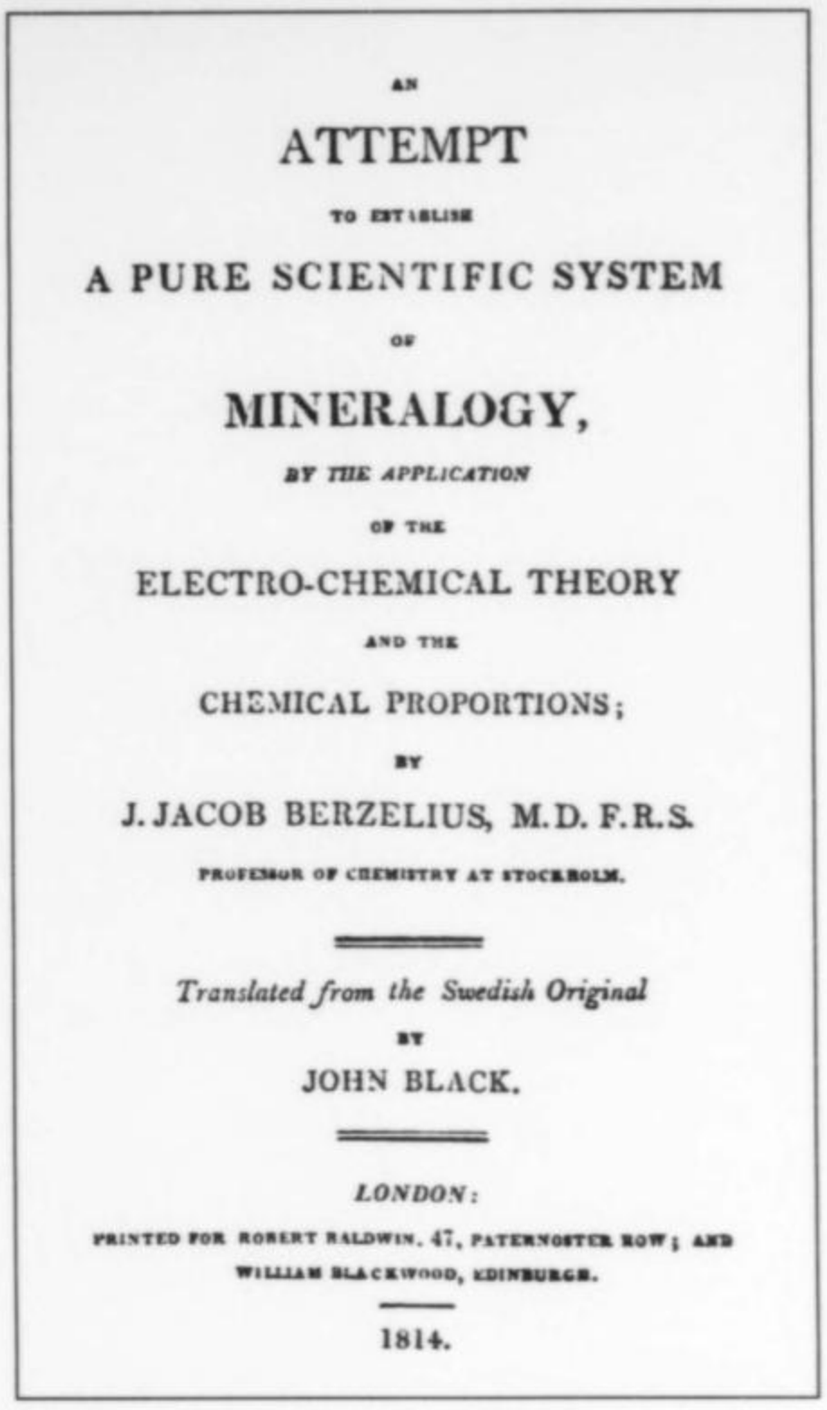
CHENEVIX, R. (1808) *Suite des Réflexions sur quelques méthodes minéralogiques.* (Paris) Published in English translation (1811) as: *Observations on Mineralogical Systems . . . to which are now added remarks by Mr. Chenevix on the reply of Mr. D'Aubuisson to the above observations.* J. Johnson and Company, London. [Chenevix, a vocal critic of Werner's classification based on physical characteristics, followed Haüy's system.]

KIDD, J. (1809) *Outlines of Mineralogy.* Two vols. in one, printed by Bliss for J. Parker and R. Bliss, London. [Kidd's classification generally follows that of Kirwan while recognizing Haüy's morphological distinctions.]

BERZELIUS, J. J. (1814) *An Attempt to Establish a Pure Scientific System of Mineralogy, by application of the Electro-Chemical Theory and the Chemical Proportions.* Robert Baldwin and William Blackwood, Edinburgh. [This is the English edition of the Swedish original published in Stockholm that same year. It proposed a chemical classification based on the most electronegative element. It stands as the first proposal in English for calculating mineral compositions on the basis of atomic theory, and utilizes Berzelius's chemical symbols for composing formulae based on atomic proportions calculated according to atomic weights.]

PHILLIPS, W. (1815) *An Outline of Mineralogy and Geology.* London. [Phillips followed a modified version of Werner's physiochemical classification in all of the works published during his lifetime. These included a second London edition of *Outline* in 1816, an American edition that same year, a third London edition in 1818, and a fourth in 1826, and also his more detailed *Elementary Introduction to the Knowledge of Mineralogy* (1816), with a second edition in 1819, and a third in 1823; there was also an American edition in 1818. After Phillips' death in 1828, Robert Allen prepared an updated edition in 1837 (known as "Allen's Phillips") without substantive changes in the system. However, when

TRAITÉ
ÉLÉMENTAIRE
DE
MINÉRALOGIE,
AVEC DES APPLICATIONS AUX ARTS;
OUVRAGE DESTINÉ A L'ENSEIGNEMENT DANS LES LYCÉES NATIONAUX.
Par ALEXANDRE BRONGNIART,
Ingénieur des Mines, Directeur de la Manufacture impériale de Porcelaine de Sèvres.
TOME PREMIER.
DE L'IMPRIMERIE DE CRAPELET.
A PARIS,
Chez DETERVILLE, Libraire, rue Hautefeuille, n° 8, au coin de celle des Poitevins.
1807.



AN

ATTEMPT

TO ESTABLISH

A PURE SCIENTIFIC SYSTEM

OF

MINERALOGY,

BY THE APPLICATION

OF THE

ELECTRO-CHEMICAL THEORY

AND THE

CHEMICAL PROPORTIONS;

BY

J. JACOB BERZELIUS, M.D. F.R.S.

PROFESSOR OF CHEMISTRY AT STOCKHOLM.

Translated from the Swedish Original

BY

JOHN BLACK.

LONDON:

PRINTED FOR ROBERT BALDWIN, 47, PATERNOSTER ROW; AND WILLIAM BLACKWOOD, EDINBURGH.

1814.

Henry Brooke and William Miller undertook to create a new edition in 1852 (known as "Brooke and Miller's Phillips") they made extensive alterations in the arrangement, resulting in a system that appears to have inspired similar changes in Dana's fourth edition (1854), with a greatly expanded discussion of crystallography.]

CLEAVELAND, P. (1816) *An Elementary Treatise on Mineralogy and Geology,* Cummings and Hilliard, Boston. [This is the first American book on mineralogy. Cleaveland follows Brongniart in combining chemical composition and crystal morphology as a basis for classification of species. A second edition appeared in 1822.]

WERNER, A. G. (1817) *Letztes Mineral-System.* Freiberg and Vienna. [The final version of Werner's systematic arrangement of minerals, published posthumously by his students. A landmark in mineralogy, despite its slim size (58 p.).]

BREITHAUPT, J. F. A. (1820) *Völlstandige Characteristik des Mineral-Systems.* Arnoldischen Buchhandlung, Dresden. [This work, along with Breithaupt's *Kurze Characteristik des Mineral-Systems* published in the same year, promotes Werner's system but with some new Latin nomenclature. Later editions appeared in 1823 and 1832, persistently rejecting the crystallochemical classification after most other mineralogists had adopted it. His more important contribution was his work on mineral paragenesis: *Die Paragenesis der Mineralien* (1849).]

MOHS, F. (1822–1824) *Grund-Riss der Mineralogie.* Two vols., Arnoldischen Buchhandlung, Dresden. [Mohs extended S. C. Weiss's four crystal systems to six, and specified the system for each species in his natural-history-method of classification. Haidinger's expanded translation into English, *Treatise on Mineralogy, or the Natural History of the Mineral Kingdom* (1825), become the standard reference on the natural history method for the next 25 years.]

BEUDANT, F. S. (1824) *Traité élémentaire de Minéralogie.* Chez Verdière, Paris. [Beudant's mineralogy was

Abraham Gottlob Werner's

letztes

Mineral-System.

Aus

dessen Nachlasse

auf

oberbergamtliche Anordnung

herausgegeben

und

mit Erläuterungen versehen.

Freyberg und Wien,

bey Craz und Gerlach und bey Carl Gerold.

1817

highly regarded in its time as the most authoritative French treatise on mineralogy. Beudant's classification was primarily chemical, with determinative emphasis on volatility and the appearance of oxidized products. A second edition appeared in 1830–1832.]

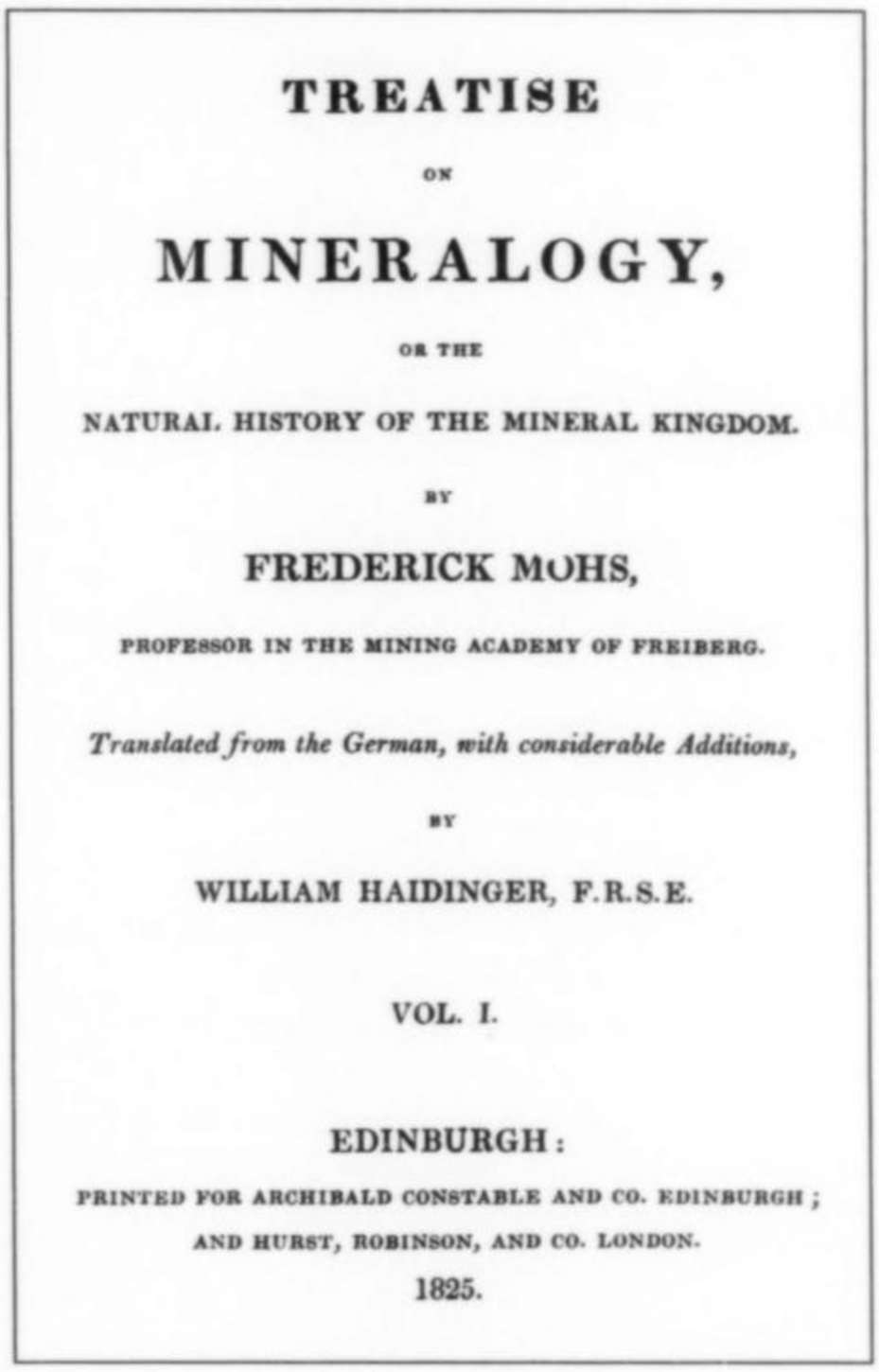
EMMONS, E. (1826) *Manual of Mineralogy and Geology.* Webster and Skinner, Albany. [Emmons' *Manual* combines the systematic classification of Mohs with the crystallography of Brooke. Much shorter and more compact than Cleaveland's *Mineralogy,* it saw service as a well-used field guide, and consequently copies in good condition are rare. A second edition appeared in 1832.]

COMSTOCK, J. L. (1827) *Elements of Mineralogy.* S. G. Goodrich, Boston. [Comstock's *Mineralogy* follows

that of Mohs, though not very competently (Comstock was self-taught). It went through a great many later editions and was a popular text in American universities. The second (1833) edition was published in Hartford and the third (1837) in New York.]

NORDENSKIÖLD, N. G. (1827) *Mineralsystem, Atomistisch-chemische Mineral System.* [This work, listed by Hazen, must be extremely rare, as it is not found in the Schuh bibliography, the British Museum catalog, the Obodda library or the Sinkankas library. According to Hazen, it is "an ambitious chemical classification."]

NAUMANN, G. A. C. F. (1828) *Lehrbuch der Mineralogie.* Berlin. [Naumann's *Lehrbuch* and his *Elemente der Mineralogie* (1846) utilized a natural history classification based on that of Mohs, and very similar to that in the first two editions of Dana's *System.* Subsequent editions of *Elemente der Mineralogie* appeared in 1850, 1852, 1855, 1859, 1864, 1868, 1871, 1874, 1877, 1881, 1885, 1897–1898, 1901 and 1907.]



TREATISE

ON

MINERALOGY,

OR THE

NATURAL HISTORY OF THE MINERAL KINGDOM.

BY

FREDERICK MOHS,

PROFESSOR IN THE MINING ACADEMY OF FREIBERG.

Translated from the German, with considerable Additions,

BY

WILLIAM HAIDINGER, F.R.S.E.

VOL. I.

EDINBURGH:

PRINTED FOR ARCHIBALD CONSTABLE AND CO. EDINBURGH;

AND HURST, ROBINSON, AND CO. LONDON.

1825.

SHEPARD, C. U. (1832–1835) *Treatise on Mineralogy.* Two parts in three vols., H. Howe, New Haven. [Shepard's *Mineralogy,* based on a modification of Mohs' system, did not achieve the popularity of Dana's *System* in America but nevertheless went far in promoting the science of mineralogy. A second edition appeared in 1844, and a third in 1857.]

ALLAN R. (1834) *A Manual of Mineralogy, Comprehending the Most Recent Discoveries in the Mineral Kingdom.* Adam and Charles Black, London. [Allan followed Werner's system, devoting 42 pages to the explanation of physical characteristics and only one page to chemical composition. A German edition appeared in 1838.]

A

SYSTEM OF MINERALOGY:

INCLUDING AN EXTENDED

TREATISE ON CRYSTALLOGRAPHY:

WITH AN APPENDIX, CONTAINING THE

APPLICATION OF MATHEMATICS

TO

CRYSTALLOGRAPHIC INVESTIGATION,

AND A

MINERALOGICAL BIBLIOGRAPHY.

WITH TWO HUNDRED AND FIFTY WOOD CUTS, AND FOUR COPPER PLATES, CONTAINING ONE HUNDRED AND FIFTY ADDITIONAL FIGURES.

BY JAMES DWIGHT DANA, A. M.

ASSISTANT IN THE DEPARTMENT OF CHEMISTRY, MINERALOGY, AND GEOLOGY, IN YALE COLLEGE; MEMBER OF THE YALE NAT. HIST. SOC.; OF THE CONN. ACAD. SCI.; CORRESPONDING MEMBER OF ACAD. NAT. SCI. OF PHILADELPHIA, AND OF THE LYCEUM OF NAT. HIST. OF NEW YORK.

"*Hæc studia adolescentum pernoctant, rusticantur.*"

NEW HAVEN:

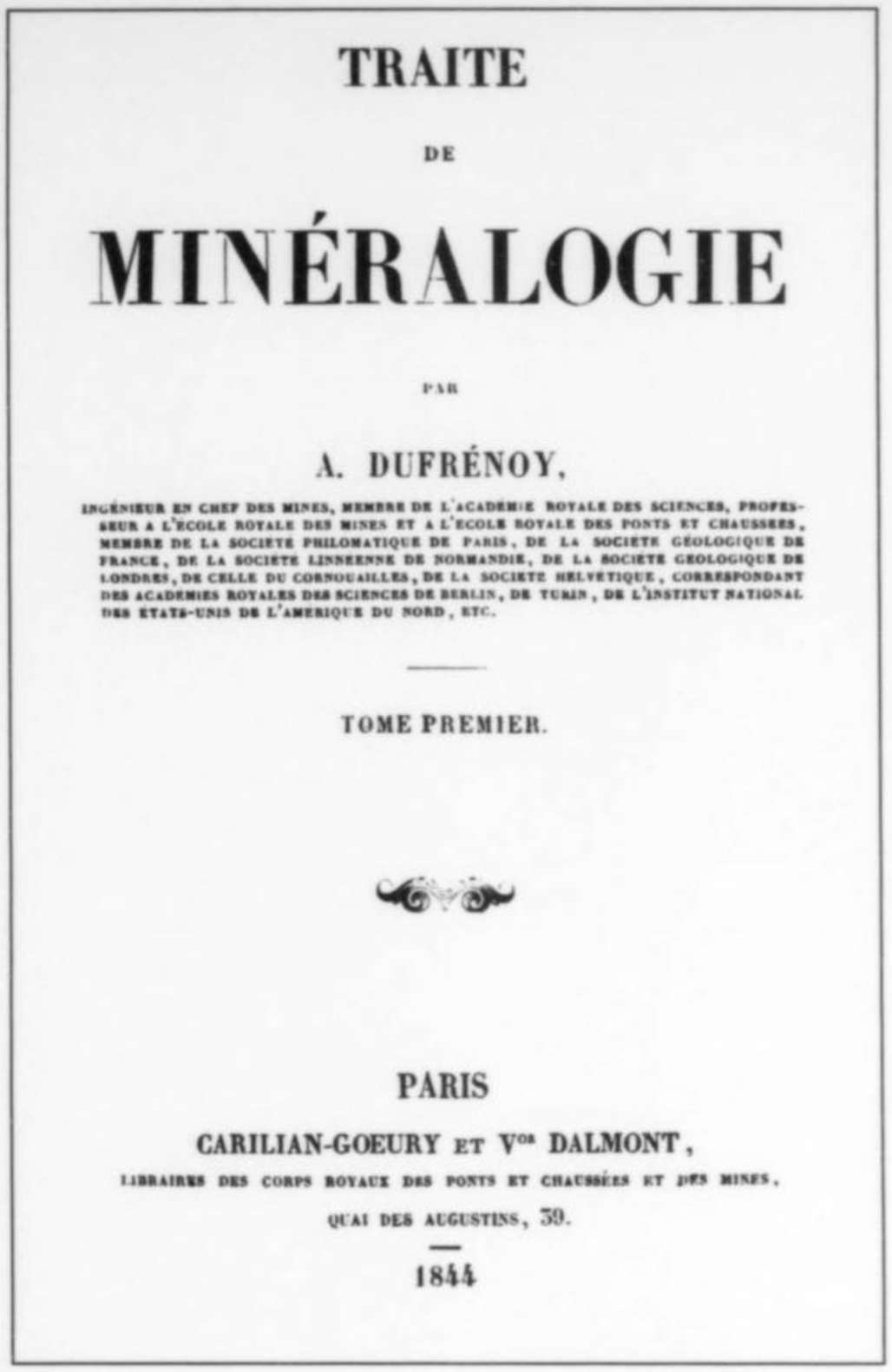
PUBLISHED BY DURRIE & PECK AND HERRICK & NOYES.

HITCHCOCK & STAFFORD, PRINTERS.

1837.

DANA, J. D. (1837) *A System of Mineralogy, including an extended treatise on Crystallography.* Durrie Noyes, New Haven. [The first and second (1844) editions utilized a natural history classification. In Dana's *Manual of Mineralogy* (1848) he begins to develop his chemical classification, which replaced the natural history scheme in the third (1850) edition of his *System.* A fourth edition appeared in 1854, a fifth in 1868, a sixth by his son Edward S. Dana in 1892 and a seventh (by Palache, Berman and Frondel) in 1944–1962. Many sub-editions exist.]

RAMMELSBERG, K. F. A. (1841) *Handwörterbuch des chemischen Theils der Mineralogie.* Two vols., C. G.


TRAITE

DE

MINÉRALOGIE

PAR

A. DUFRÉNOY,

INGÉNIEUR EN CHEF DES MINES, MEMBRE DE L'ACADÉMIE ROYALE DES SCIENCES, PROFESSEUR A L'ECOLE ROYALE DES MINES ET A L'ECOLE ROYALE DES PONTS ET CHAUSSÉES, MEMBRE DE LA SOCIETE PHILOMATIQUE DE PARIS, DE LA SOCIETE GÉOLOGIQUE DE FRANCE, DE LA SOCIÉTÉ LINNEENNE DE NORMANDIE, DE LA SOCIETE GEOLOGIQUE DE LONDRES, DE CELLE DU CORNOUAILLES, DE LA SOCIETE HELVÉTIQUE, CORRESPONDANT DES ACADEMIES ROYALES DES SCIENCES DE BERLIN, DE TURIN, DE L'INSTITUT NATIONAL DES ETATS-UNIS DE L'AMERIQUE DU NORD, ETC.

TOME PREMIER.

PARIS

CARILIAN-GOEURY ET Vor DALMONT,

LIBRAIRES DES CORPS ROYAUX DES PONTS ET CHAUSSÉES ET DES MINES,

QUAI DES AUGUSTINS, 39.

1844

MINERALOJIA

POR

IGNACIO DOMEYKO

PROFESSOR DE QUÍMICA I MINERALOJÍA EN LA UNIVERSIDAD DE SANTIAGO DE CHILE.

TERCERA EDICION

QUE COMPRENDE PRINCIPALMENTE LAS ESPECIES MINERALÓJICAS DE CHILE, BOLIVIA, PERÚ I PROVICIAS ARJENTINAS.

SANTIAGO:

LIBRERIA CENTRAL DE SERVAT I CA.

Esquina de Huérfanos i Ahumada.

1879.

Lüderitz Verlag, Berlin. [Rammelsberg's mineral dictionary became an instant classic in chemical mineralogy, and was not replaced as the standard work on the subject until 1912. The basic division of species follows Weiss's crystal classes, but is otherwise chemical.]

DUFRÉNOY, O. P. A. P. (1844–1847) *Traité de Minéralogie.* Three vols. plus atlas, Carilian-Soeury et Vor Dalmont, Paris. [Dufrénoy, writing two decades after the death of Haüy, uses a broad-based Mohs classification taking chemical, physical and crystallographic aspects into consideration while also incorporating recent research on thermal properties. A second edition, greatly enlarged (four vols. plus atlas) appeared in 1856–1859.]

ROSE, G. (1852) *Das Krystallo-chemische Mineralsystem von Gustav Rose . . .* Leipzig. [Rose advocated a crystallochemical classification modeled on that of Berzelius and resembling the system used in the third (1850) edition of Dana.

DOMEYKO, I. (1845) *Elementos de Mineralojia.* Serena. [Domeyko founded a school for chemistry and mineralogy in Chile, and produced this text for the use of his students. It gives emphasis to Chilean minerals, arranged chemically. A second edition was published in Santiago in 1860, and a third in 1879.]

RUTLEY, F. (1874) *Elements of Mineralogy.* London. [Rutley was an economic geologist, and so he designed his classification based on the most valuable essential elements. It proved to be a popular approach; the 26th edition was published in 1970.]

GOLDSCHMIDT, V. M. (1923–1937) *Geochemische Verteilungsgesetz der Elemente.* Ten vols. [Goldschmidt was a geochemist whose work brought mineral science into its quantitative, precision-oriented maturity. His ten-volume 600-page series on the geochemical laws governing the partitioning of elements in minerals constitutes the classic work on crystal chemistry.]

GREYSTONE, R. W. (1948) *Crystal Structures.* Greystone created an ambitious structural classification for minerals, based first on the format of the chemical formula (e.g. A_2B_3 or ABO_4), and then on structure type.]

Fabien Gautier d'Agoty and his *Histoire Naturelle Règne Minéral* (1781)

Wendell E. Wilson
4631 Paseo Tubutama
Tucson, Arizona 85715

Histoire Naturelle Règne Minéral *was Fabien Gautier d'Agoty's first book, and he did not even have time to finish it before suffering an early death at the age of 34. Nevertheless, it became a landmark among natural history publications, as one of the first to contain plates with printed colors. It is today the most expensive and mysterious of all color-plate mineralogies, and is surrounded by a complex story leading to an even greater but still unpublished work.*

Jean Fabien Gautier d'Agoty (1747–1781) was the fifth son of Jacques Fabien Gautier (1716–1785), a French pioneer in the development of color printing. Jacques had been an assistant and successor to the painter and engraver Jacques Christophe Le Blon (1670–1741), inventor of the chromolithographic printing process. He had experimented with color printing techniques before knowing of Le Blon, using a three-color process, but in 1737 Le Blon was granted a patent on three-color printing. The following year, Gautier was invited to join Le Blon as his assistant, and was promised a share of the profits. But the two personalities clashed, and Gautier left after working only 18 days.

Le Blon believed in the Newtonian color theory, which held that only three basic colors (red, yellow and blue) were necessary, black being made by the superposition of all three. Gautier contested this theory in many writings and public experiments; he shared with Goethe the view that black and white were also theoretically and practically essential to producing the best effect. White was provided by the paper, but black was necessary as the fourth ink color. Gautier knew that Le Blon occasionally used black as a fourth color, but only as a makeshift and he would not admit to it formally as a part of his theory.

Gautier made some four-color prints in secret, particularly a "portrait of Peter," and later made 22 more four-color prints showing historical scenes, landscapes, portraits, flowers and natural history subjects. Following Le Blon's death in 1741, Gautier was given the legal right to use the three-color process that had been exclusively the privilege of Le Blon; the privilege was for a period of 30 years, and could be inherited by his wife and sons upon his death. This was contested by Le Blon's heirs, and was blocked by an injunction until Gautier agreed to purchase the rights for 6,000 livres. Occasional disputes over these rights recurred for years.

Gautier published, among other things, a *Course in*

Anatomy (1749), eventually with 46 printed-color plates. He also wrote and published a new, complete philosophy which he called *System of the Universe,* and two volumes of "observations of natural history in physics and painting," with 24 or 25 printed-color plates. On the title page of a 1753 volume he is cited as being a member of the Dijon Academy of Sciences. He was awarded a pension of 600 livres a year for life in 1764, in recognition of his *Course in Anatomy,* and his color printing patent privilege was extended until 1773. He died in Paris in 1785, some say out of sorrow for having been struck from the Member list of the Dijon Academy.

Although he originally went by the surname Gautier, in 1741 he was signing himself Jacques Gautier d'Agoty. His eldest son used only the Gautier name, but the four younger sons preferred Gautier d'Agoty or, in later years, Dagoty. It has been suggested that his wife's name was d'Agoty, but his wife in 1741 was named Marie Anne Moreau, so it was more likely the maiden name of his mother.

Fabien Gautier d'Agoty (D'Agoty or Dagoty) was born in 1747, probably in his father's house on the Rue des Prètres St. Germain l'Auxerrois in Paris. From 1747 at least until 1755 they lived in a house on the Rue de la Harpe, but for reasons of health his father had to leave Paris in 1759, seeking cleaner air, and it is known that they were living in Nice in 1764. By 1767, however, they were back in Paris where they remained.

Fabien was taught art and color printing by his father, along with his four older brothers, all of whom had printed-color artworks and plates to their credit. In 1776 he decided to publish his own work, a collection of color-printed plates and explanatory text devoted to the three Kingdoms of Nature: animal, vegetable and mineral. He applied to the King's Council and was granted a six-year charter, during which time he would have the exclusive right to produce and sell his natural history.

He decided to begin with the mineral kingdom, following "the order which Nature seemed to suggest to me, proceeding from the simplest substances to the most complex." Being an artist and not a scientist, he contacted Balthazar Georges Sage (1740–1824), a mineral collector who was giving public lectures in chemistry and assaying at his family's pharmacy and at the Paris Mint. They had both met "abroad" at an earlier date. Sage (not a trained mineralogist himself, although he did publish a book on mineral analysis in 1772) recommended that Gautier d'Agoty make contact with the well-known Parisian crystallographer Jean Baptiste Louis Romé de l'Isle (1736–1790), whose major work on crystallography had appeared in 1772. Romé de l'Isle proved to be an enthusiastic supporter and collaborator, and ultimately wrote all the text, except the preface, for Gautier d'Agoty's book.

During the four years from January 1777 to January 1781, Gautier d'Agoty tinkered on the first plates for his book, and prepared a prospectus, or advance publication announcement. Sage reviewed the prospectus and the first illustrations in January of 1781 and "admired the truthfulness with which the minerals are represented." The prospectus was published in *Journal de Physique* in April 1781, inviting the public to subscribe.

The book was to be issued in eight or ten installments or "cahiers," each containing ten color plates and associated text (called a "decade"). The total work was to comprise no more than 100 color-printed plates showing mineral specimens, printed on "very beautiful paper" imported from Holland. The first decade, priced at 15 livres, was promised to be available in May. The second decade was scheduled for July, with the others to follow in due course.

Gautier d'Agoty, in his prospectus, discussed the difficulty involved in rendering minerals in color:

> How is it possible to render a multitude of smooth or diaphanous crystals, surfaces gleaming like polished steel, or colors as changeable as a pigeon's throat? How can one convey the infinitely varied nuances of the metallic colors and hues? These difficulties are doubtlessly the reason why nothing truly satisfying has been provided to date on this subject.

He does make an exception here for the work of "Mr. Schmiedel," whose handcolored plates showing mineral specimens he acknowledges to be "among the best we have in this genre." The reference is surely to Casimir Christoph Schmiedel (1718–1792), whose *Erz Stuffen und Berg Arten* series of plates and text was begun in 1753 and continued through the early 1770's, 46 plates in all having been issued. Very few other colored plates of minerals had been published up to that time. Johann Ernst Hebenstreit's *Museum Richterianium* (1743) contained 13, John Hill's *A History of Fossils* (1748) contained 12, and Christian Ludwig Stieglitz's *Spicilegium quarundam rerum naturalium subterranearum* (1769) contained 21. But all three of these in colored state are extremely rare, and one can't help wondering whether Gautier d'Agoty had ever seen them.

Gautier d'Agoty graciously acknowledged the owner of each specimen illustrated. This was done to give proper credit to the collectors who had loaned their specimens, and also "to avoid the criticism of inaccuracy in the representation of the objects." In other words, potential critics would be obliged to visit the collections cited and make an actual comparison between the plates and the specimens before they could legitimately criticize the fidelity of the renderings. Gautier d'Agoty was clearly confident of the quality of his work.

He began printing the color plates, and the text pages were typeset and printed in the workshop of "Monsieur" in Paris. "Monsieur" was actually Louis Xavier Stanislas (1755–1824), Count of Provence and

later crowned as King Louis XVIII.

The first and second decades appeared as promised, and Gautier d'Agoty had apparently finished the printing plates for the third and had run off copies. But he died in late 1781. The third decade was mailed to subscribers in February of 1782.

Gautier d'Agoty's widow inherited the project and, though apparently not an artist herself, was determined to see it continued somehow. Romé de l'Isle was willing to continue producing text for the plates, to supervise publication, and perhaps also to select the specimens to be illustrated. But most importantly, a new artist was needed and found in the person of François Louis Swebach Desfontaines.

How Madam d'Agoty and Swebach Desfontaines were brought together is a matter of speculation. Perhaps, being an engraver and artist himself, he had been a friend and colleague of Gautier d'Agoty, and was already sufficiently familiar with the work in progress to be a natural successor. Or it may have been Romé de l'Isle who recommended him. Romé de l'Isle had previously enlisted Arnold Carangeot (1742–1806) and Swebach Desfontaines to join a project to produce terracotta crystal model sets. Swebach Desfontaines was at that time engraver to the Count of Artois (1757–1836), brother of d'Agoty's printer, and later crowned as King Charles X. So it may have been Charles who proposed to his brother that Swebach Desfontaines would make an admirable replacement for Gautier d'Agoty. And as it happens, the journal which announced the crystal models and the appearance of the first decades of Gautier d'Agoty's book (*Observations sur l'Histoire Naturelle, sur la Physique,* etc., also known as *Journal de Physique*) had been founded by Gautier d'Agoty's father in 1752, and the editors there were familiar with both men's works. In the published notice announcing the third decade, the editor expresses the hope that some "intelligent artist" will wish to take upon himself the continuation of "so beautiful an enterprise"; in a footnote he remarks that this wish has been fulfilled and that before long the fourth decade will be delivered to subscribers.

In the announcement for decade four (November, 1782), Madam d'Agoty is praised for her zeal in discharging the undertakings of her husband. Romé de l'Isle is there acknowledged as having directed the work, and Swebach Desfontaines is mentioned as having executed the plates, with the help of another engraver named Bonvallet.

It was probably around the time when decade four was issued that Swebach Desfontaines and Bonvallet re-engraved plates 2 through 7 in Gautier d'Agoty's first decade. As with the fourth decade, they tried to duplicate his process for printed colors, at least for plates 2, 5 and 7. Apparently Gautier d'Agoty himself had already re-engraved plate 1; perhaps it had worn out before he had filled all the subscription orders received.

There appears to have been a lapse or hiatus in publication following issuance of the fourth decade. Romé de l'Isle, in his *Cristallographie* of 1783, refers to only these 40 plates; and most extant copies of the work (including Romé de l'Isle's personal copy) have no more than 40.

Some time between 1783 and 1789 or so, Swebach Desfontaines produced more plates on his own, without mention of Bonvallet or Madame d'Agoty. Two decades, with text in the style of Romé de l'Isle, and one decade without text had been issued by 1792. In the *avertissement* for Swebach Desfontaines' only other published mineralogical work (*Manuel Cristalographe*; 1792) he mentions having undertaken the completion of a series of plates begun under the auspices of Romé de l'Isle and that 70 had thus far been issued. The seventh decade is today a rarity among rarities, only two copies being known (both in England, in the British Library and the library of the Institute of Geological Sciences, London). Romé de l'Isle died in 1790, so it can be speculated that he wrote the text for decades five and six, but that seven was prepared after 1790 and for that reason lacks text. Seven is also the only decade to depict no specimens from Romé de l'Isle's own mineral collection.

Before the seventh decade had been issued, Swebach Desfontaines reprinted most of the first four decades

Gautier d'Agoty's Preface, 1781

The work we are presenting to the public is designed to interest both those who have some knowledge, and those desirous of acquiring it. In truth, its title at first glance suggests a vast project, requiring lengthy execution, and costly as well. We have devoted our efforts to removing these difficulties by means of the order which will prevail in this collection. And the Public will soon perceive that while satisfying it, we are attempting to nurture its interest. We will not deal at length with the need to have representations of the objects in their natural form and colors before our eyes. We are presenting them to provide details which it is impossible for a writer to penetrate. In fact, if it were possible to have access to all of the Natural History collections, and to study all parts thereof undisturbed, the presence of the objects would make our work almost unnecessary. But since it is impossible to obtain such assistance for ourselves, how are we to fill this gap other than by bringing objects which are distant from us closer, through representations? What remains then is to conform to the concepts of the Naturalists, and, with the representations of Nature, to place it before the eyes of the scholar as well as the student, and to reproduce it infinitely in all parts of the world.

Illustrations in black and white alone will not achieve the goal we have set ourselves, inasmuch as the truth about Natural History objects depends as much on the variety of their colors as on that of their forms. This truth has always been so widely recognized that tinting has often been added to prints in black and white, a process which cannot help but give them some added resemblance to Nature.

Due unquestionably to the eloquence, the noble style, and the sublime and profound views provided by the Count de Buffon, we find among ourselves this keen competition and definite taste for the most beautiful of the sciences, for an understanding of the entities which comprise Nature. In fact, this immortal writer seems to have planted in our souls the seed of the constant desire to question Nature and to probe deep into the most mysterious secrets.

Numerous scholars of various nations and of considerable fame have, for their part, made an effort to enrich the store of our knowledge with their discoveries. It is not my task here to praise their work: I will therefore limit myself to mention of those who have concerned themselves with my subject. Since 1776, when His Majesty granted me the pertinent charter and I undertook this work, it has been the plan to offer to the public a Natural History of the Three Kingdoms, with color plates.

I began with the Mineral Kingdom, in order to follow the order which Nature seems to suggest to me, proceeding from the simplest substances to the most complex. However, mistrusting my own knowledge, and knowing how essential it was that I consult scholars to learn from them what path I should pursue in this delicate arena, I addressed myself to Mr. Sage, not yet as celebrated among us as he is abroad, where I had become acquainted with him thanks to his reputation as a man in whom the truest merit is joined with the most courteous manners. It was he who referred me to Mr. Romé de l'Isle, a man whom Nature has endowed with the felicitous ability to identify the most delicate relationships among entities, in order to work back to their causes and to reveal their sources. It was Mr. de l'Isle who was the first to regard the Chevalier Von Linne's *Elements of Crystallography* as good, and susceptible to the level of perfection to which he raised this work, enriching us with the discoveries of the greatest naturalist the North has produced. It is in his footsteps that I advance with firm confidence and with no fear of losing my way in the labyrinth of the systems.

His *Essay on Crystallography,* a masterpiece reflecting thoughtful application and constant and painstaking effort, is perhaps the most satisfying work and that most able to inspire a love of what is true, and of his research in Natural History. Also, as soon as his study appeared, the Germans hastened to translate it into their language, and an astonished Europe saw geometry converging with chemistry, causing physics to take on an entirely new aspect which had hardly been suspected.

If the work which I am going to bring to light merits the attention of the Public, it is to the brilliance of this skillful crystallographer that I will owe my thanks. His advice confirmed in me my prior resolution to begin with the Mineral Kingdom, although the objects which comprise it are much more difficult to represent than those in the two other Kingdoms. How, in fact, is it possible to render a multitude of smooth or diaphanous crystals, surfaces gleaming like polished steel, or colors as changeable as a pigeon's throat? How can one convey the infinitely varied nuances of the metallic colors and the hues which differentiate, for example, Gray Silver [acanthite] from Galena, from Arsenical Pyrite [arsenopyrite], from Cobaltite, from

Iron Ore or Antimony [stibnite], from Molybdenum [molybdenite] or Mica? These difficulties are doubtlessly the reason why nothing truly satisfying has been provided to date on this subject.[1] Also, were it not for the aid of the crystalline or polyhedral forms which very definitely characterize each species, I would absolutely have abandoned this project.

The Mineral Kingdom is to be represented by no more than one hundred plates. They will be printed in natural colors, imitating those of each mineral, to the extent that Art can, in this genre, approximate Nature. Each plate represents one or several clearly characterized groups, and as the polyhedral or crystalline forms are one of the leading characteristics which naturalists must study, I am concentrating especially on those which are very sharp and as little distorted as possible. I am also making an effort to find several varieties associated in a single specimen, so that we may examine the objects for comparison from a single point of view, and so that the transition from a primitive form to a secondary form, or from a polyhedron to another form, can be seen at first glance.

Thus each specimen places before our eyes the angular form characteristic of each substance in the crystalline state. To render this form even more easily perceived I have depicted at the bottom of each plate, solitary and separate crystals in the same form as those shown in the group. In many instances, I have even added the varieties thereof, as well, and when the configuration in question proved too complex, I have presented the section or development of the crystal.

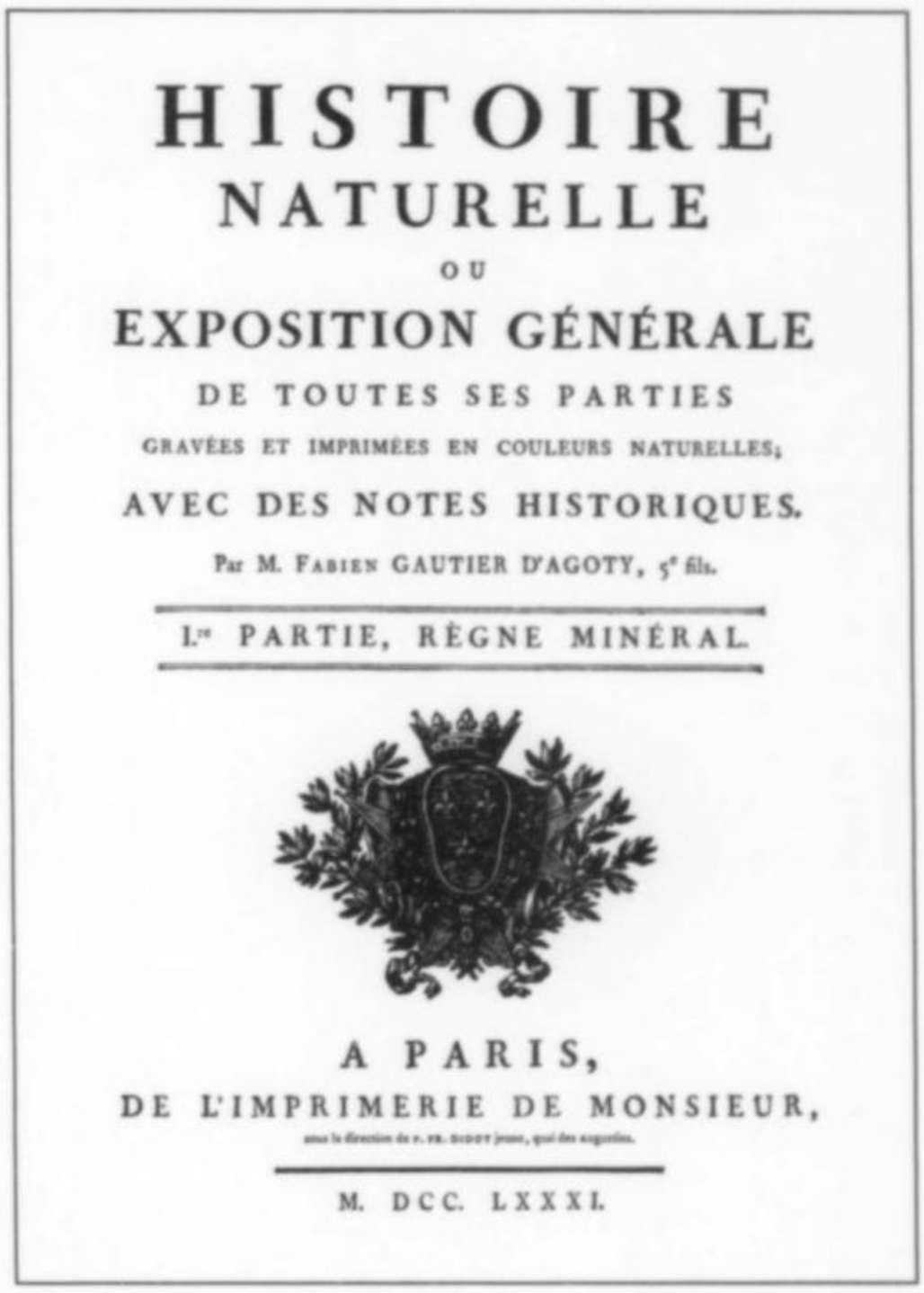
The plates are accompanied by the notes drafted by Mr. Romé de l'Isle. They provide an explanation of the groups represented thereupon, and a precise description of the polyhedral forms characteristic of each species.

I have indicated the collection from which I obtained each specimen pictured, both to give credit to the individuals who have been so kind as to collaborate in the execution of this work, and to avoid the criticism of inaccuracy in the representation of the objects.

[1]Acknowledgment is due Mr. Schmiedel here. Several of the mineral specimen plates which he had tinted in Nuremberg are among the best we have in this genre. They are, moreover, accompanied by scholarly remarks which provide what information the plates lack in terms of the true colors.

to sell with his recently published fifth and sixth decades. He also appears to have re-engraved Bonvallet's plate 37.

It appears that Swebach Desfontaines was not perfectly at home with the color printing process, because many of the later existing copies of the various plates show hand-applied colors exclusively. In some cases, plates with printed colors are intermixed with handcolored plates. One 60-plate set contains only a single printed-color plate, the rest being handcolored. The handcolored copies may loosely be referred to as "second state" to distinguish



HISTOIRE
NATURELLE
OU
EXPOSITION GÉNÉRALE
DE TOUTES SES PARTIES
GRAVÉES ET IMPRIMÉES EN COULEURS NATURELLES;
AVEC DES NOTES HISTORIQUES.
Par M. Fabien GAUTIER D'AGOTY, 5e fils.
Ire PARTIE, RÈGNE MINÉRAL.
A PARIS,
DE L'IMPRIMERIE DE MONSIEUR,
M. DCC. LXXXI.

them from the printed-color versions, but in actuality there was little consistency and many progressive alterations made over time, yielding a plethora of states.* Romé de l'Isle's copy, preserved in the Library of the American Philosophical Society, contains several versions of many of the first 40 plates, 98 in all!

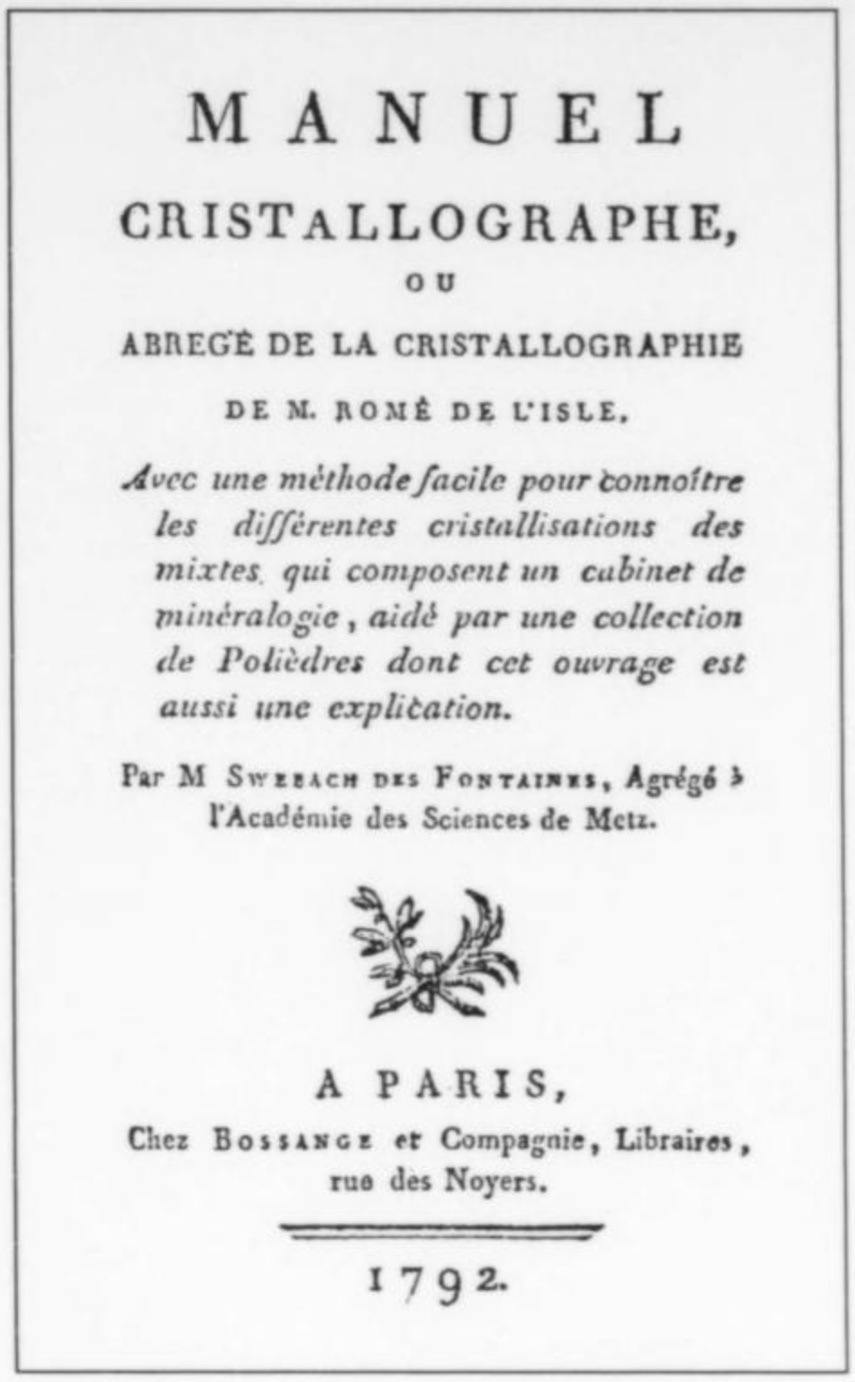
*Plates with printed colors will typically show register pin holes in the corners; these pins pierced the paper in order to hold each of the four successive printing plates in correct alignment during printing. Register errors (imprecise overlay of colors relative to each other) are still common and provide an easy

And what of Swebach Desfontaines himself? The earliest surviving record of him is in 1765, when, as Françoise Louis Fontaine, a young man from Toul, he was hired in Metz to engrave plates for a history of that city. He was still busy on the work in 1767, and his son (Jacques François Joseph Swebach-Desfontaines, destined to become a better known artist than his father) was born in Metz in 1769. Both seem to have passed at various times as Swebach, Swebach-Desfontaines, Fontaine, Desfontaine and Desfontaines. Apparently the son, at least, was better known under the name Fontaine, which was said to be merely a French translation of the German name Swebach (*Bach* meaning a brook or stream). The elder Swebach Desfontaines had been a sculptor to the Duke of Orleans. "Without formal training and supported only by his ardent imagination, [he] embraced all genres in the arts and appeared by turn sculptor, painter, engraver and mineralogist." So he is described in his son's obituary.

The father and son moved to Paris around 1780, where the father worked as an engraver for the Count of Artois, as mentioned earlier, and the son studied art under Joseph Sifrède Duplessis (1725–1802), painter to the King. Swebach Desfontaines referred to himself as "naturalist and Member of the Academy of Sciences of Metz," but there is no mention of his name in the surviving membership records of that organization.

His *Manuel Cristallographe* (1792) marks the last year in which anything of him is known. Did he die under the guillotine during the "Reign of Terror" (1793–1794)? No one knows.

Two unpublished works by Swebach Desfontaines deserve mention here. The first is a prospectus or sample of a work entitled *Histoire Naturelle, ou exposition des Morceaux, les mieux choisis pour servir à l'Etude de la mineralogie . . .* dated 1789. This was to be a collection of ten color plates, each depicting 16 different mineral specimens set into a boxwork cabinet, and each to be priced at 24 livres. That is nearly twice the cost of an entire decade from the series begun by Gautier d'Agoty, but these were to be laboriously handcolored rather than printed in color. A note on the title sheet states that the work had not been issued due to the Revolution. Three years later in the *avertissement* to his *Manuel Cristallographe,* Swebach Desfontaines reiterates his intention to publish this ten-plate 160-specimen work, but the only known copy is in the library of the British Museum (Natural History).



MANUEL

CRISTALLOGRAPHE,

OU

ABREGÉ DE LA CRISTALLOGRAPHIE

DE M. ROMÉ DE L'ISLE,

Avec une méthode facile pour connoître les différentes cristallisations des mixtes qui composent un cabinet de minéralogie, aidé par une collection de Polièdres dont cet ouvrage est aussi une explication.

Par M SWEBACH DES FONTAINES, Agrégé à l'Académie des Sciences de Metz.

A PARIS,

Chez BOSSANGE et Compagnie, Libraires, rue des Noyers.

1792.

The other unpublished work is one of the most

---

way to identify the printed-color state.

Some handcolored plates show *unpierced* bumps or black spots at the corners indicating where the pinholes on the plate were located. But in other cases, re-engraved plates show no bumps to indicate provision for pins and printed colors. And, curiously, Gautier d'Agoty himself does not appear to have used register pins in the printing of colors on plates 1–7; those plates can have printed colors but no bumps or holes. Some plates re-engraved by Swebach Desfontaines and Bonvallet do show unpierced corner bumps, indicating that they did at least tinker with the idea of producing their own printed-color plates. Consequently, at least five possible states exist for various plates: (1) original printed colors by Gautier d'Agoty, (2) Gautier d'Agoty black-ink plate handcolored by Swebach Desfontaines, (3) re-engraved plate by Bonvallet and Swebach Desfontaines with printed colors, (4) re-engraved plate by Bonvallet and Swebach Desfontaines with corner bumps but handcolored, and (5) engraved and handcolored plate by Swebach Desfontaines, without corner bumps or holes.

Which state should be considered more valuable? Some bibliophiles would naturally say the first, printed-color state, because the book is significant as a milestone in color printing, and because earliest is often considered rarest and most desirable. In this case, however, the largely handcolored copies (entirely the product of Swebach Desfontaines) may be the rarest, and certainly hold equal historic fascination.

Two of the albums of paintings by Swebach-Desfontaines (ca.1790) and title page (Mineralogy Library, the Natural History Museum, London).

amazing survivals of early mineralogical art: five (of an original six) folio-size volumes of specimen paintings entitled *Recuille Complet de Mineralogie.* It is marked as having been terminated in 1790, but one plate carries a date of 1792. These volumes appear to have been Swebach Desfontaines' personal scrapbook of specimen images, most of them hand-painted originals but a few engraved, handcolored prints from the Gautier d'Agoty series. Approximately 250 paintings are in the volumes, a number of them apparently preliminary sketches of specimens later engraved for the Gautier d'Agoty series, and many of them recognizable on the 16-specimen plates of the unpublished prospectus. Perhaps Swebach Desfontaines intended eventually to publish colored engravings of all of them; then again, perhaps they were only his personal file. The five volumes (I, II, III, V and VI) are in the library of the British Museum (Natural History). The whereabouts of volume IV, sadly, are unknown. However, following his son's death, the auction of his possessions in 1824 included one volume of colored drawings of minerals. Was this the missing volume IV, or was it his son's own work? Its location today is unknown.

THE PLATES

Because Gautier d'Agoty's book is so excessively rare, it may prove interesting for the reader here to see a complete listing of its plates. Data on the last ten come from the plate inscriptions only, as no accompanying text was published for these.

Plate I. Calcite "sand" crystals from Fontainebleau near Paris, France. Collection of Jean Baptiste Louis Romé de l'Isle (1736–1790).

Plate II. Hematite crystals from the iron mine at Rio Marina, Elba, Italy. Collection of J. B. L. Romé de l'Isle.

Plate III. Galena with sphalerite, pyrite and hematite from Pompean near Rennes in Brittany, France. Collection of J. B. L. Romé de l'Isle.

Plate IV. Galena (octahedral crystals) from Pompean near Rennes in Brittany, France. Collection of the Abbé Nolin.

Plate V. Quartz, feldspar and mica from a granite in the d'Alençon area, lower Brittany. Collection of J. B. L. Romé de l'Isle.

Plate VI. Siderite on tetrahedrite-tennantite from the Baigorry mine in the Pyrénées Atlantique, France. Collection of Balthazar Georges Sage (1740–1824).

Plate VII. Tetrahedrite-tennantite crystals on siderite (reverse side of the specimen shown in Plate VI) from the Baigorry mine in the Pyrénées Atlantique, France. Collection of B. G. Sage.

Plate VIII. Calcite crystals (no locality given; "This is the group that was discussed in the letter of Dr. Demeste to Dr. Bernard, vol. 1, p. 274"). Collection of J. B. L. Romé de l'Isle.

Plate IX. Calcite crystal groups from (Fig. I) Ecton in Staffordshire, England, and (Figs. II, III) Derbyshire, England. Collection of J. B. L. Romé de l'Isle.

Plate X. Siderite and pyrite from Viziles [Vizille], Isère, France. Collection of Mr. Besnier de la Pontonnerie, Assayer General of The French mint (the five single crystals of pyrite are from the collection of J. B. L. Romé de l'Isle.)

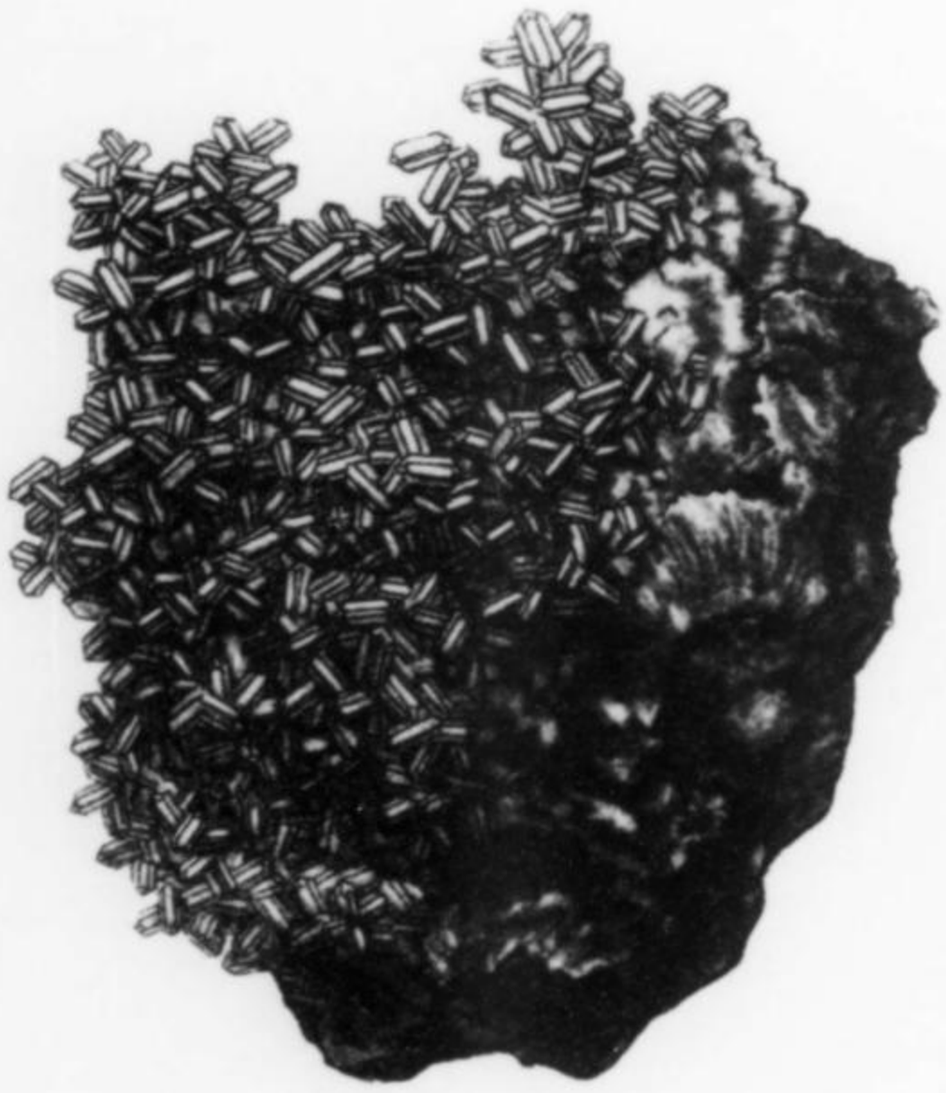
Plate XI. Gypsum crystals and groups from (Fig. 1) the salt mines of Tyrol, Austria, (Fig. 3) Siberia, Russia, and (Figs. 2, 4, 5) unnamed localities (probably also Siberia). Collection of J. B. L. Romé de l'Isle.

Plate XII. Fluorite crystal groups from (Fig. 1) the duchy of Furstenberg, Germany, (Fig. 2) a mine in Northumberland, England, and (Fig. 3) Gersdorf, Saxony. Collection of J. B. L. Romé de l'Isle.

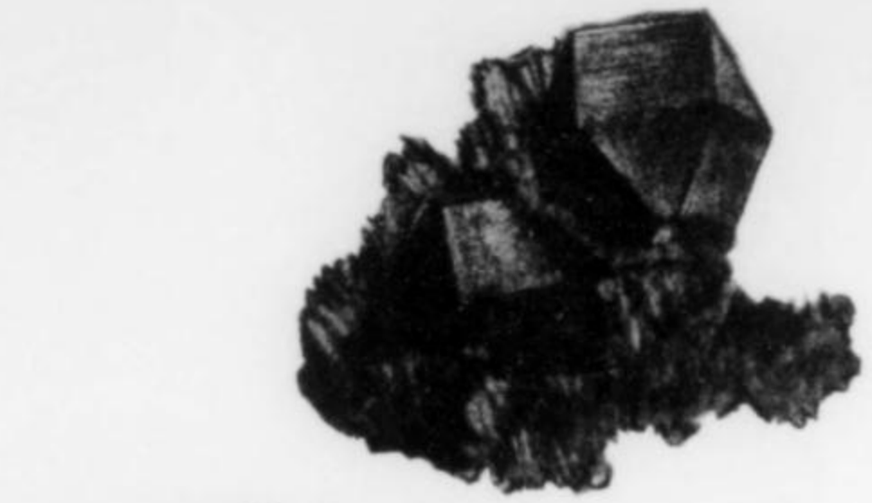
Plate XIII. Barite crystal groups from (Fig. 1) Kapnick, Transylvania, Romania, (Fig. 2) Felsobanya, Hungary, and (Fig. 3, 4) Schemnitz, Hungary. Collection of J. B. L. Romé de l'Isle.

Plate XIV. Sphalerite crystal group with quartz from Hungary. Collection of Adolarius Jacob Forster (1739–1806).

Plate XV. Sphalerite crystal groups from (Fig. 1 and probably also 2 and 3) Cumberland, England. Collection of Fabien Gautier D'Agoty (1739–1781).



Harmotome, Plate LV



Cobaltite crystal groups, Plate XXIV

Plate XVI. Cerussite from Huelgoët, Finistère, France. Collection of J. B. L. Romé de l'Isle.

Plate XVII. Secondary lead minerals from various mines: (Fig. 1, 2, 3) pyromorphite from Huelgoët, Finistère, France; (Fig. 4) pyromorphite from La Croix-aux-Mines, Vosges, France; (Fig. 5) pyromorphite from the Hoffsgrund mine near Freiberg in Breisgau, Germany; (Fig. 6) crocoite from the Pirosew mine near Ekaterinberg in Siberia, Russia; (Fig. F) cerussite from Pribram, Bohemia, Czechoslovakia; (Fig. G, H) cerussite from La Croix-aux-Mines, Vosges, France. Collection of J. B. L. Romé de l'Isle.

Plate XVIII. Epidote with quartz from the Dauphiné Alps. Collection of J. B. L. Romé de l'Isle.

Plate XIX. Tourmalines from (Fig. 1) Mt. Greiner, Tyrol, Austria; (Fig. 2, 3, 4) Castille, Spain; (Fig. A, B) Madagascar; (Fig. C, D) Ceylon; (Fig. E) Brazil; and (F, G) Spain. Collection of J. B. L. Romé de l'Isle.

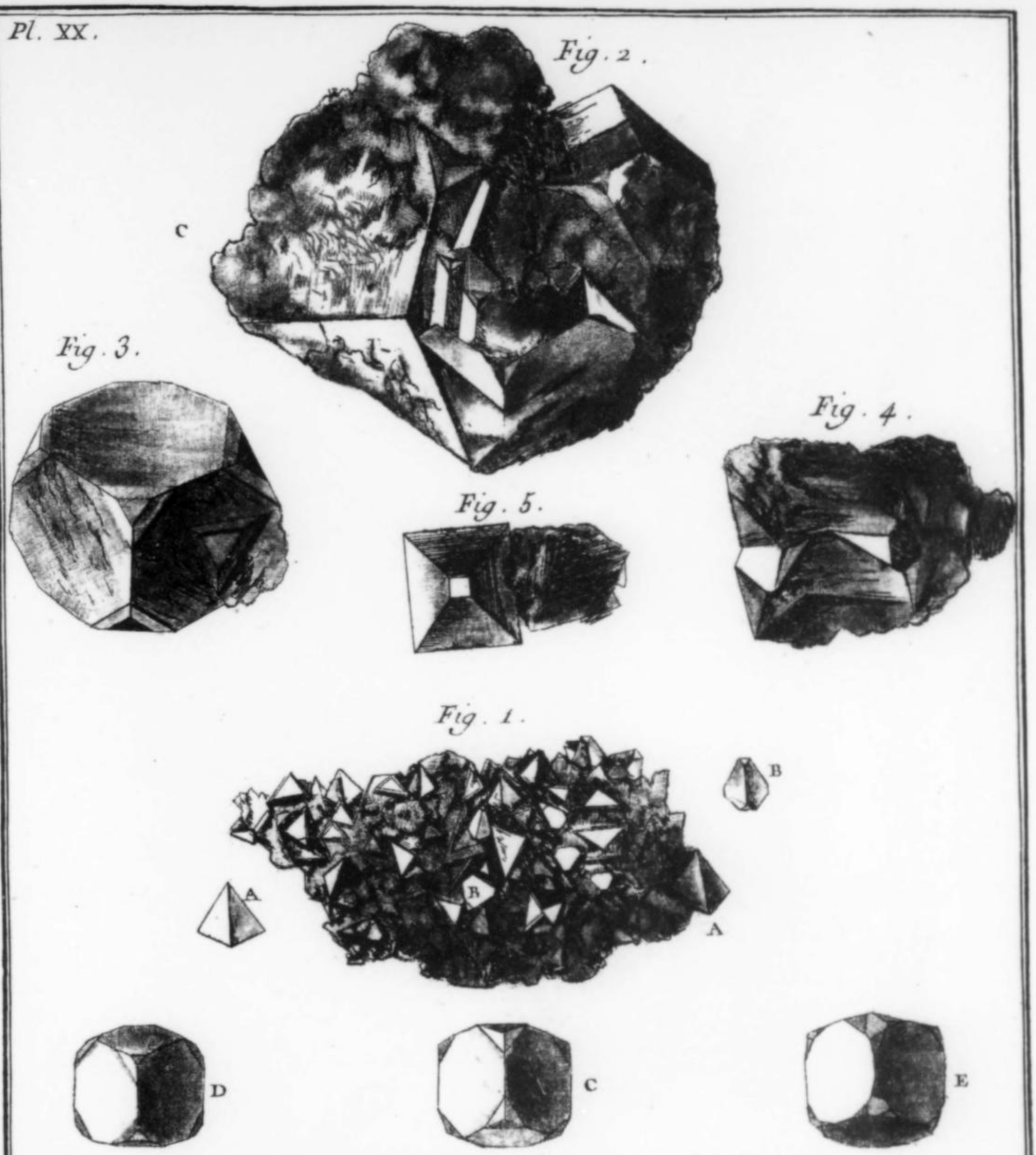
Plate XX. Chalcopyrite from (Fig. 1) the duchy of Wirtemberg; Pyrite from (Fig. 2 and probably also 3, 4, 5) Rio Marina, Elba, Italy. Collection of J. B. L. Romé de l'Isle.

Plate XXI. Smoky quartz with feldspar from Brittany, France. Collection of Mr. Bertin, Minister and Secretary of State.

Plate XXII. Sulfur crystals on calcite from Conilla near Cadix (Cadiz), Spain. Collection of B. G. Sage.

Plate XXIII. Barite from the Harz, Saxony. Collection of Mr. Joubert, Treasurer General of the State of Languedoc.

Plate XXIV. Arsenopyrite with galena, octahedral sphalerite, siderite and quartz from (Fig. 1) the Drebachs Hoffnung mine at Marienberg in Saxony; Cobaltite from (Fig. 2) Joachimsthal, Bohemia, Czechoslovakia; and Cobaltite from (Fig. 3) Tunaberg, Sweden. Collection of J. B. L. Romé de l'Isle.



Mine Jaune de Cuivre Cristallisée et différens Grouppes de Marcassites Cuivreuses.

Tiré du Cabinet de Mr. de Romé de l'Isle.

Dessiné Gravé et Imprimé par Fabien G. Dagoty 5.e Fils.

Plate XX. Pyrites; often present in uncolored state (as shown) and colored by gold leaf.

Plate XXV. Gypsum crystal group (no locality given). Collection of Mr. Joubert.

Plate XXVI. Garnet from (Fig. 2) the Styrian Alps, Austria; (Fig. 3) Tyrol, Austria; and (Fig. 4) Galicia. Collection of J. B. L. Romé de l'Isle.

Plate XXVII. Calcite with acanthite crystals (F) from the Harz [probably St. Andreasberg], Saxony. Collection of A. J. Forster.

Plate XXVIII. Proustite-pyrargyrite on calcite with small tetrahedrite-tennantite crystals, galena and quartz from [Fig. 1] the Himmelsfurst mine, Freiberg, Saxony. Collection of J. B. L. Romé de l'Isle.

Proustite-pyrargyrite with calcite from (Fig. 2) the Rose of Jericho mine at St. Joachimsthal, Bohemia, Czechoslovakia. Collection of the Abbé Nolin.

Acanthite crystals from (Fig. 3, 4) the Himmelsfurst

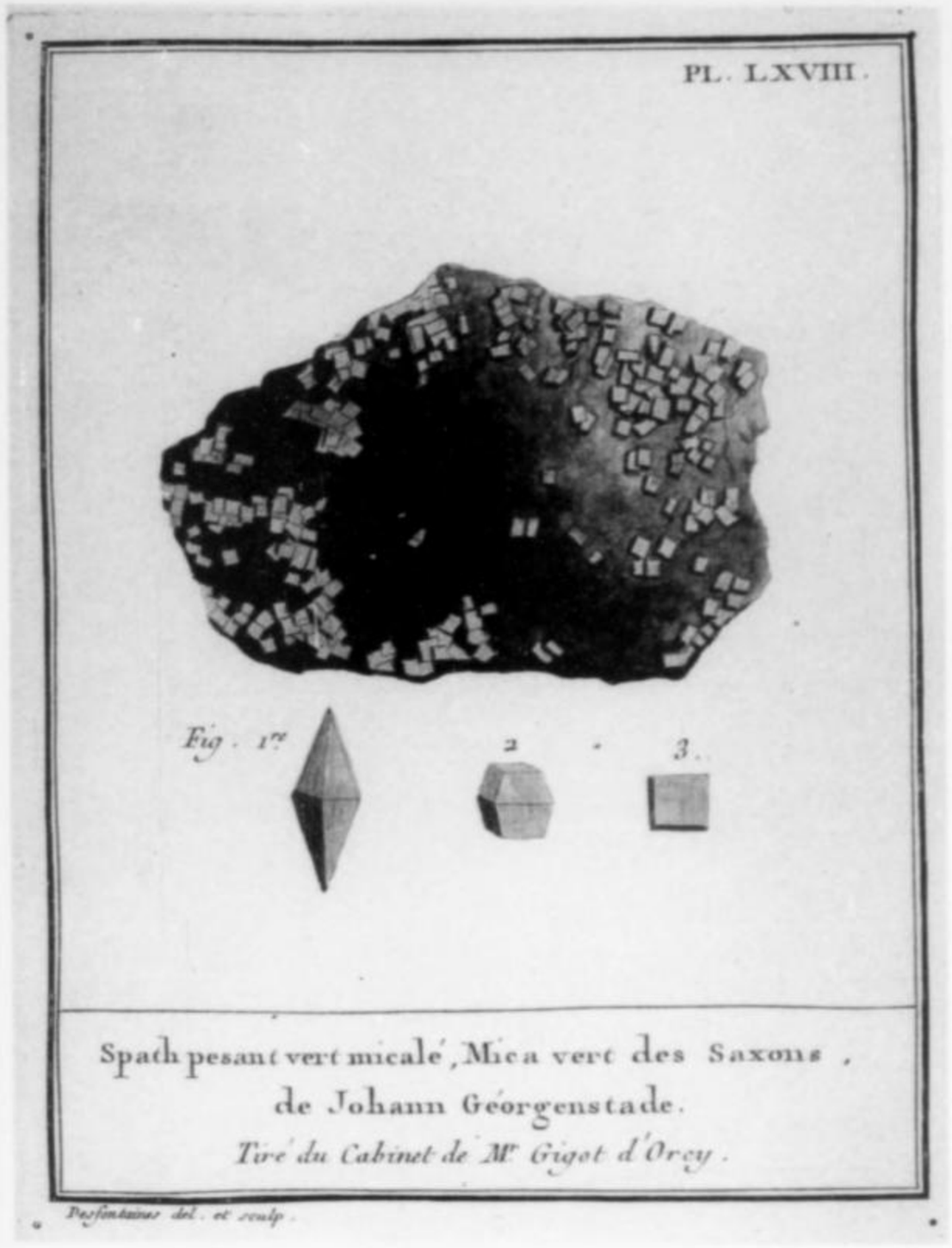
Gypsum
Tyrol, Austria
(plate 11)

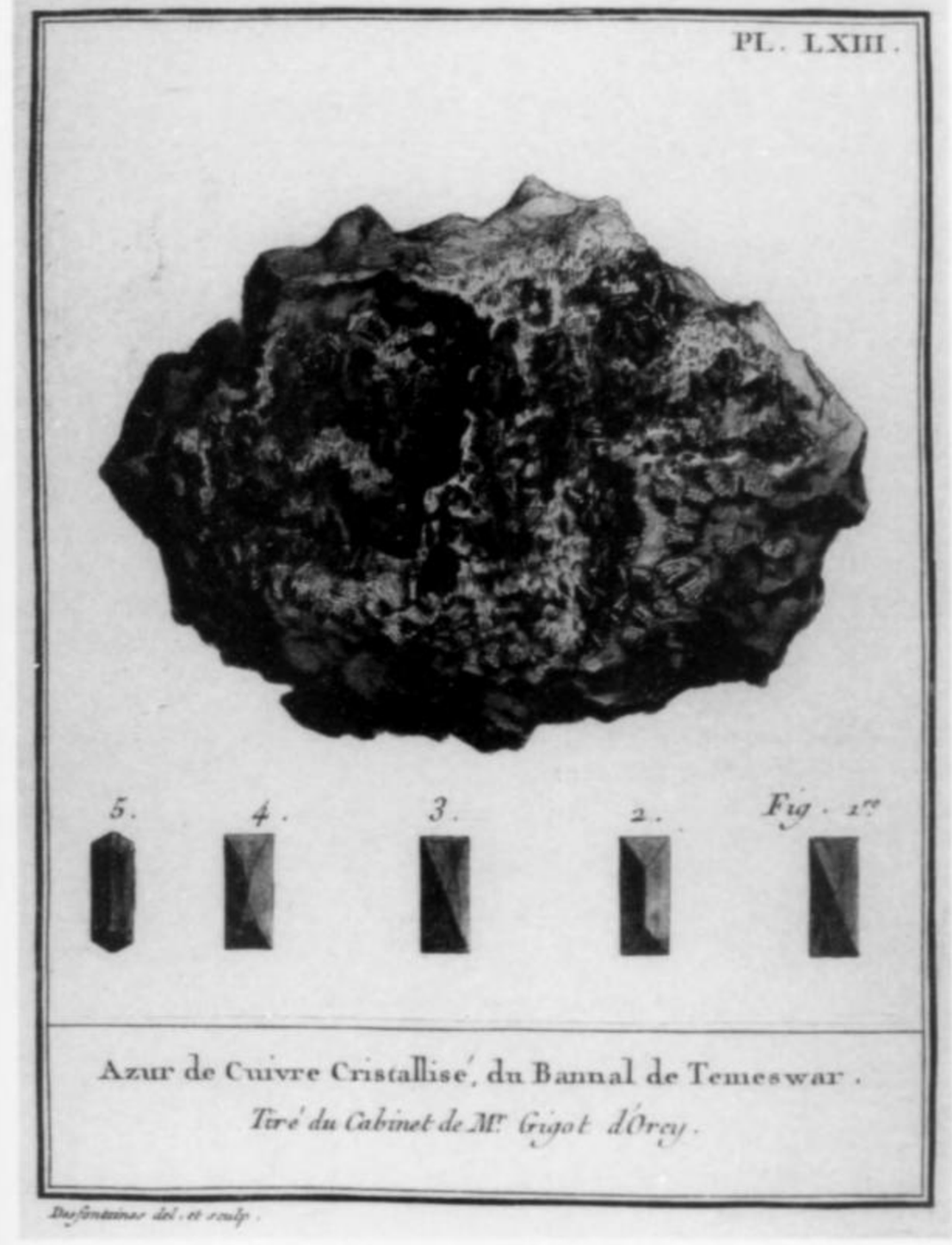
Hematite
Elba, Italy
(plate 2)

Pyromorphite
Huelgoët, France
(plate 17)

Schorl
Castille, Spain
(plate 19)

Some specimens pictured by Gautier d'Agoty





mine, Freiberg, Saxony. Collection of J. B. L. Romé de l'Isle.

Acanthite, a small cubic crystal with a curl of wire silver, from (Fig. 5) the Himmelsfurst mine, Freiberg, Saxony. Collection of J. B. L. Romé de l'Isle.

Plate XXIX. Argillaceous concretions from (Fig. 1) the Castel mine in the Saarbrucken district, Germany; and (Fig. 2) Fischbach in the county of Sponheim, Prussia. Collection of J. B. L. Romé de l'Isle.

Plate XXX. Cellular quartz from the county of Durham [Shotover Hill?] in England. Collection of A. J. Forster.

Plate XXXI. Barite crystal group (Fig. 1) with calcite from the Friedrich August mine near Freiberg, Saxony. Collection of Mr. Joubert.

Barite crystal "floater" (Fig. 2) from the same locality. Collection of J. B. L. Romé de l'Isle.

Plate XXXII. Axinite crystal groups and a single crystal, all from Balme d'Auris, 4 km from le Bourg d'Oisans, Dauphiné, France. Collection of B. G. Sage.

Plate XXXIII. Albite twins on greenish quartz with amianthus from Barèges in Haute Pyrénées, France. Collection of the Marquis de Cubieres.

Plate XXXIV. Calcite crystals [no locality given] resembling in habit the calcite "sand" crystals, shown on Plate I, from Fontainebleau. Collection of Mr. Joubert.

Plate XXXV. Hematite crystals from Elba, Italy. Collection of Mr. Joubert.

Plate XXXVI. Pink feldspar from Baveno near Lago Maggiore, Italy. (Fig. 1, B, C, D) Collection of J. B. L. Romé de l'Isle. (Fig. 2) Collection of Mr. France de Croisset, boarder at the Hôtel-de-Ville.

Plate XXXVII. Stibnite crystals penetrating barite crystals from Felsobanya, Transylvania, Romania. Collection of A. J. Forster.

Plate XXXVIII. Vesuvianite from Monte Soma, Vesuvius, Italy. (Fig. 1, 2) Collection of Mr. Cramayel. (Fig. 3) Collection of J. B. L. Romé de l'Isle.

Plate XXXIX. Quartz crystals of a carnelian-red color, from Geyer in Saxony. Collection of Gigot d'Orcy (died 1794).

Plate XL. Quartz crystallized in "roses" from the Angers area, France. Collection of the Marquis de Cubières.

Plate XLI. Calcite crystal group from Schneeberg, Saxony. Collection of J. B. L. Romé de l'Isle.

Plate XLII. Stibnite [apparently altering to stibiconite] from Lubiallac [Lubilhac] in Haute-Loire, France. Collection of the Royal School of Determinative Mineralogy at the Paris Mint.

Plate XLIII. Blue fluorite with calcite from Derbyshire, England. Collection of Gigot d'Orcy.

Plate XLIV. Hematite crystals from Framont in the Vosges, France. Collection of J. B. L. Romé de l'Isle.

Plate XLV. Cassiterite twins with quartz from Zinnwald, Bohemia, Czechoslovakia. Collection of A. J. Forster.

Plate XLVI. Manganite crystal groups from (Fig. 1, 2) Ilfeld, Harz, Saxony and (Fig. 3) Schurde in Thuringia. Collection of J. B. L. Romé de l'Isle.

Plate XLVII. Malachite, botryoidal and banded, from Siberia, Russia. Collection of A. J. Forster.

Plate XLVIII. Stalactitic hematite with manganite from Siegen, Germany. Collection of A. J. Forster.

Plate XLIX. Limonite after pyrite from England. Collection of A. J. Forster.

Plate L. Cuprite crystals with native copper and malachite (?) (no locality given). Collection of Gigot d'Orcy.

Plate LI. Purple apatite with quartz from Saxony [probably Ehrenfriedersdorf]. Collection of Gigot d'Orcy.

Plate LII. Stilbite from Iceland. Collection of Gigot d'Orcy.

Plate LIII. Pyrite [altering to limonite; no locality given]. Collection of Mr. Joubert.

Plate LIV. Topaz with quartz from Schneckenstein in Saxony. Collection of Gigot d'Orcy.

Plate LV. Harmotome from St. Andreasberg, Harz, Saxony. Collection of Gigot d'Orcy.

Plate LVI. Cerussite from the La Croix mine, Lorraine, France. Collection of the Abbé Nolin.

Plate LVII. Emerald crystals in matrix with calcite from Colombia. Collection of Gigot d'Orcy.

Plate LVIII. Stalactitic manganese oxides from Eizenzeche near Nassau-Siegen, Germany. Collection of A. J. Forster.

Plate LIX. Calcite crystal groups from (Fig. 1) Porte de France, at Grenoble, Isère, France, and (Fig. 2) the Harz, Germany. Collection of J. B. L. Romé de l'Isle.

Plate LX. Chatoyant [or iridescent] hematite from the St. Philip mine, Bannat of Temeswar, Hungary. Collection of Gigot d'Orcy.

Plate LXI. Cinnabar from Idria, Carinthia. Collection of Mr. de la Bore.

Plate LXII. Barite (?) from Freiberg, Saxony. Collection of Gigot d'Orcy.

Plate LXIII. Azurite from the Bannat of Temeswar, Hungary. Collection of Gigot d'Orcy.

Plate LXIV. Calcite crystals [from Maronne, Bourg d'Oisans, Isère, France] with quartz. Collection of Mr. Gavangeot [Arnold Carangeot].

Plate LXV. Fluorite from Northumberland, England. Collection of A. J. Forster.

Plate LXVI. Prehnite (?) from the Cape of Good Hope, South Africa. Collection of Gigot d'Orcy.

Plate LXVII. Heulandite from the Faeroe Islands. Collection of Gigot d'Orcy.

Plate LXVIII. Torbernite from Johanngeorgenstadt, Saxony. Collection of Gigot d'Orcy.

Plate LXIX. Fluorite on muscovite from Zinnwald, Bohemia. Collection of Mr. de la Bove.

Plate LXX. Chalcopyrite from Siegen, Germany. Collection of Gigot d'Orcy.

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My thanks to the late Thomas G. Vallance for much helpful information; to Curtis Schuh for providing useful references which aided materially in the completion of this work; to Eric Asselborn for assistance in properly identifying the localities mentioned in the plate captions; and to Winifred Guerchon for assistance with the French translations. My thanks also to Carl Krotki and Richard Bideaux for graciously loaning their copies of Gautier d'Agoty's book for study, and to Eileen V. Brunton of the mineralogical library at the Natural History Museum, London, for showing me the rare last decade of plates and Swebach Desfontaines' other original paintings in their collection, as well as informative accompanying file data.

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PHILIP RASHLEIGH AND HIS *SPECIMENS OF BRITISH MINERALS* (1797 AND 1802)

Robert W. Jones
3520 North Rose Circle Drive
Scottsdale, Arizona 85251

Between 1765 and 1811 Philip Rashleigh of Cornwall, England, built one of the finest collections of Cornish specimens ever assembled. A two-volume published description with colored illustrations, his original catalog, his house and most of his specimens may still be seen today.

INTRODUCTION

Philip Rashleigh is famous among mineral collectors for the superb Cornish mineral collection he assembled, and among book collectors for the beautifully illustrated two-volume description of his best specimens which he published in 1797 and 1802. These two volumes, with their handcolored engravings, stand with the works of James Sowerby as the finest English colored mineralogies produced in their day. Much of Rashleigh's mineral collection is still preserved, and is one of the few private mineral collections in the world to have survived more or less intact for nearly two centuries.

PHILIP RASHLEIGH

> In about 1765 the most celebrated of all Cornish mineral collectors started his activities: Philip Rashleigh (1729–1811) of Menabilly, near Fowey.

So wrote Embrey and Symes (1987) in their review of Cornish mineralogy and mineral collecting history.

Philip Rashleigh, M.P., F.G.S., F.R.S., F.A.S.*, was born on 28 December 1729 in Aldermanbury, London. He was the eldest son of Jonathan Rashleigh, a Member of Parliament and a distinguished Cornish landowner. He attended New College at Oxford beginning in 1749, but left Oxford without earning a degree (Stephen and Lee, 1917).

His interest in natural history manifested itself early; the young "Philip Rashleigh, Esq.; of Menabilly" is listed among the subscribers to William Borlase's *Natural History of Cornwall* in 1758. Following the death of his father in 1764 he was elected a Member of Parliament for the family borough of Fowey (or Fawy), and sat continuously until the dissolution of 1802, when he became known as "the Father of the House of Commons."

Living in Cornwall, Rashleigh was well situated to collect the superb specimens of copper, lead and tin minerals from nearby mines. As his collection grew, so did his reputation. As early as 1794, William Maton, in his *Observations on the Western Counties,* referred to Rashleigh's collection as "rich and magnifi-

*Member of Parliament, Fellow of the Geological Society, Fellow of the Royal Society, Fellow of the Antiquarian Society.

Menabilly as it stands today.

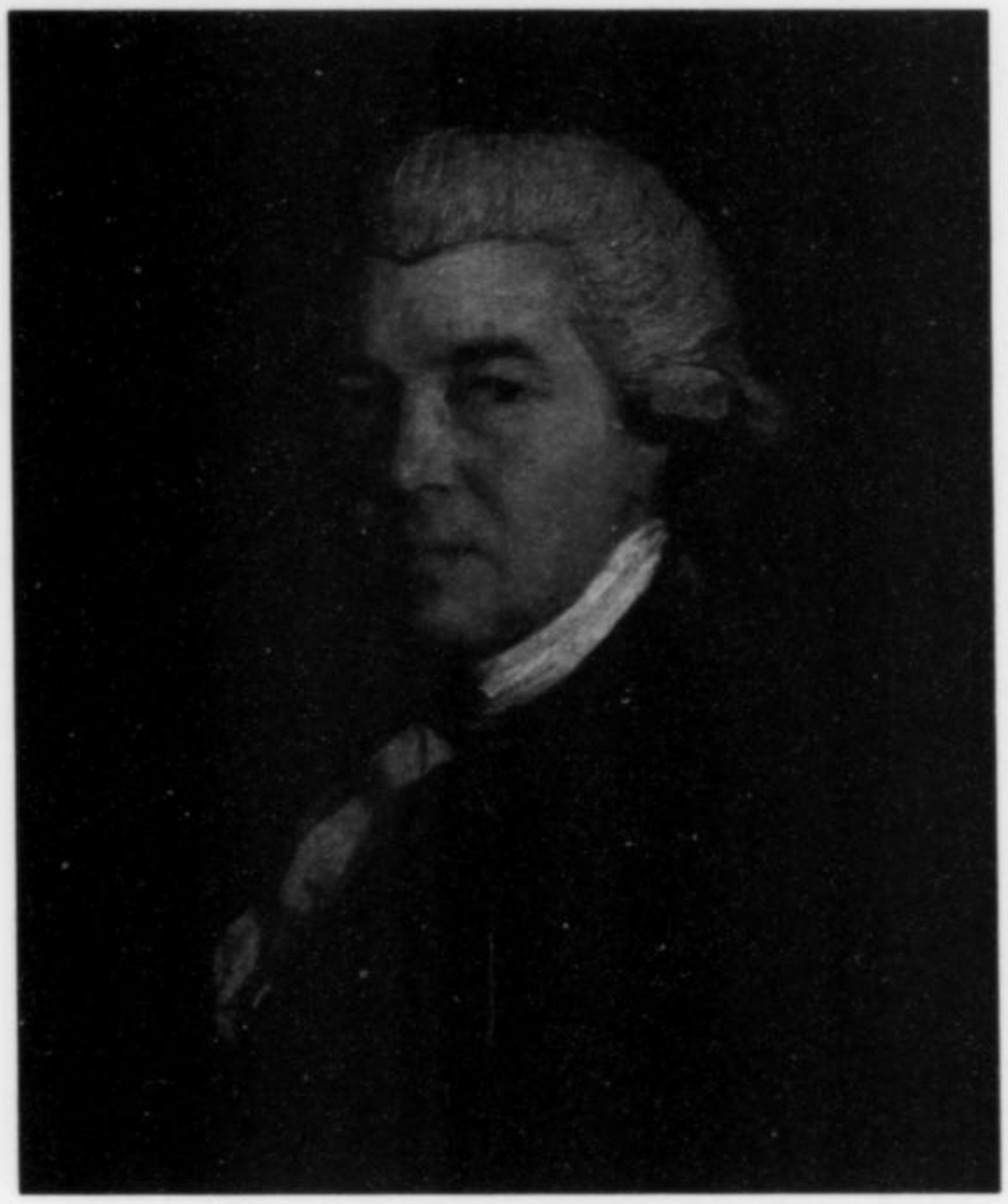
cent." Similar comments appeared in gazetteers and travel guides of the day.

Scientists and astute observers have praised Philip Rashleigh and his collection for nearly two centuries. Remarkable is the fact that this great assemblage of Cornish and worldwide mineral species has remained largely intact, for the most part housed in two venerable British institutions, the Royal Institution of Cornwall, Truro, and the Natural History Museum, London.

Almost as important as the still-intact collection is the 265-page manuscript collection catalog in Rashleigh's own hand. In reviewing the catalog, it becomes apparent that he was an early advocate of accurate locality information. Rashleigh also attempted to indicate rarity of species by noting *r, rr,* or *rrr* (for the rarest) after each specimen listed.

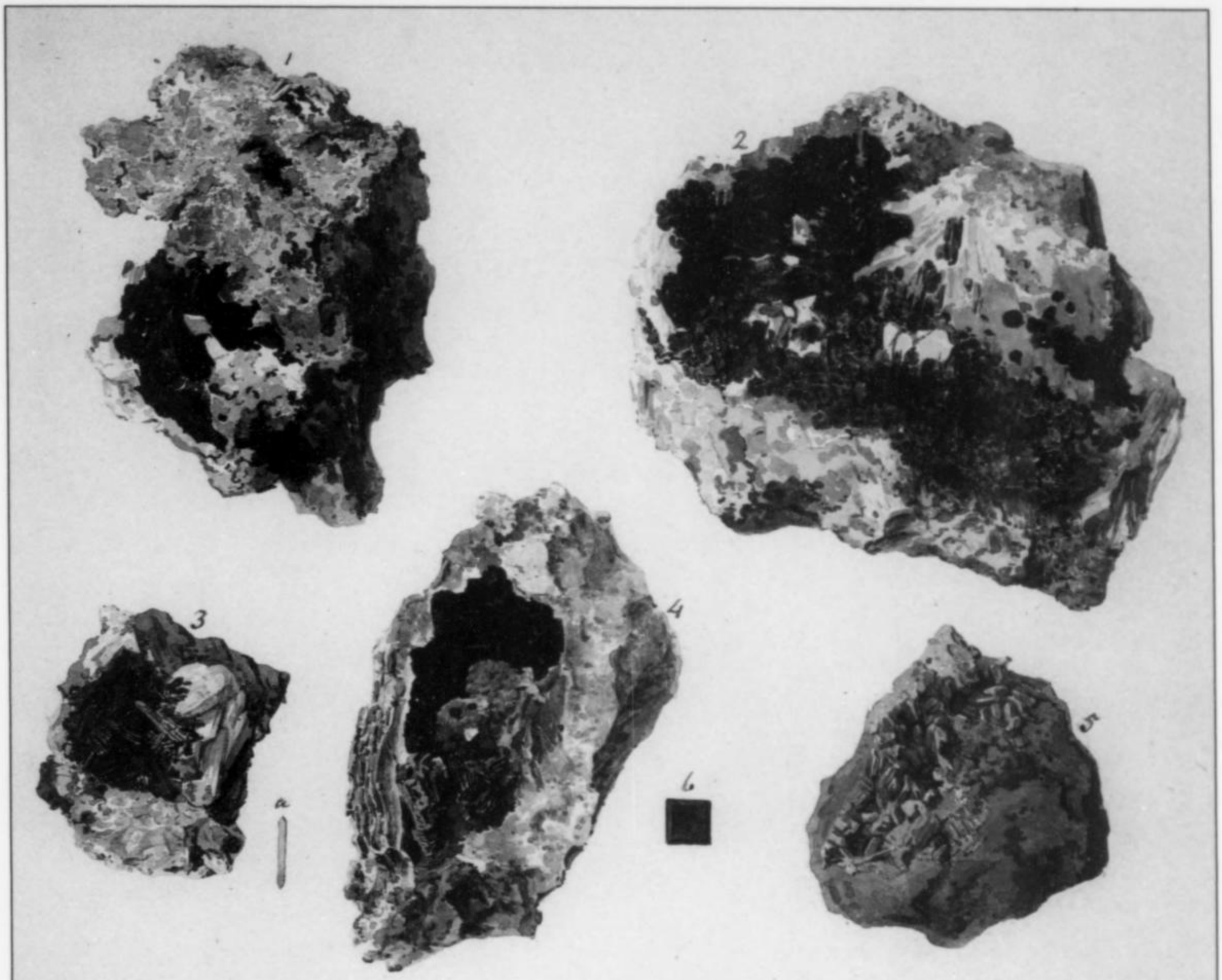
A second catalog, done by Arthur Aiken three years after Philip's death, coupled with much of Rashleigh's correspondence, provides researchers with valuable insights into mineral collecting during the man's lifetime. The major portion of the collection, its catalogs, and his correspondence are housed at the County Museum in Truro where they are still under study.

Reading through the Rashleigh correspondence one is struck by a number of his observations, which are as pertinent today as they were in Rashleigh's time. Complaints include the high price of minerals



Philip Rashleigh
(Painting by John Opie, courtesy of the Royal Cornwall Museum)

and the difficulty in getting good specimens. He grouses about outsiders coming into the area, offering too much for a specimen, and messing up the local market. And he voices a complaint about the science becoming too technical for his taste!



The original painting from which Plate 10 in volume 1 (1797) was produced, now in the collection of the Natural History Museum, London. The pictured specimens, all from Carharrack near Gwennap in Cornwall, are: chalcopyrite, olivenite, liroconite, clinoclase, chalcocite, etc.

THE COLLECTION

Throughout the literature there are various estimates of the size of Rashleigh's collection. One writer estimated it at some 25,000 pieces, surely a gross exaggeration. Rashleigh's own catalog lists 3,902 specimens but many more were uncataloged.

Russell (1952) reports that the original Rashleigh collection was housed at Menabilly, Rashleigh's ancestral home, in eight cabinets and 10 meters of wall cases with drawers underneath.

Stockdale (1824) extolled the virtues of the collection:

> Among the most remarkable specimens in this collection are green carbonate of lead with quartz, blende with twenty sided crystals and green fluors in crystals; crystallized antimony, with red blende on quartz, yellow copper ore with opal, and arseniate of copper in cubes of bright green colour.

Few collections can boast so many scientifically notable specimens. For example, Rashleigh (1797) was the first to illustrate and describe bournonite, though credit went to Count de Bournon who analyzed and described a Mexican specimen which can still be seen on display at the Museum of Natural History, Paris. (Rashleigh's correspondence suggests he was not a particular fan of Bournon, nor is Bournon listed among Rashleigh's sources of specimens in his catalog.) Rashleigh acquired several of the bournonites from Wheal Boys ("Wheal" = mine), St. Endellion. The earlier name for the mineral was, in fact, *endellionite*. The better pieces ended up in the Russell collection in the Natural History Museum, London. One has been on display there with the original description by Rashleigh.

Aside from the bournonite, Rashleigh's collection contains other specimens which went undescribed until the publication of his volumes. These include scorodite, chalcophyllite, connellite and clinoclase.

Exhibit room of the Royal Cornwall Museum, Truro, where much of Rashleigh's collection is on display.

He was also the first to illustrate and describe mendipite and bayldonite (Smale, personal communication).

During Rashleigh's collecting era some major discoveries were made. For example, a large quantity of delicate white jackstraw cerussite was found at the Pentire Glaze mine, Endellion. Most notable would have to be his stunning liroconite from Wheal Gorland. Considered the premier specimen in the Rashleigh collection, the liroconite is a single blue monoclinic crystal on matrix, along with minor crystals. The major crystal measures 3.5 cm by 1.9 cm. It came to light in 1808, from a rich oxide zone encountered at Wheal Gorland. Liroconite was also found at Wheal Unity. Both these mines have been exceptional sources of secondary oxide minerals.

Another exceptional species found in the Rashleigh collection is the series of nearly spherical clinoclase crystal groups. The largest measures 2.5 cm across on matrix, and is a rich, deep blue color, also from Wheal Gorland.

The olivenite suite in the Rashleigh collection is also exceptional. Tincroft, Illogen, was his main source of the rich green acicular crystals forming velvet sprays and linings in open vugs. The deep blue acicular crystals of connellite from Wheal Gorland and Wheal Muttrell (which was later engulfed by Wheal Gorland), plus Wheal Providence in the same area, is also worthy of note. The sharp needles several millimeters long, scattered over a copper oxide matrix, were an unknown mineral when acquired by Rashleigh.

Another noted feature of the Rashleigh assemblage of minerals, but unfortunately no longer in existence, was a grotto which he had built on the estate. It was lined with fine specimens of minerals, shells and examples of the local granites. Redding (1842) describes it:

> In the grounds there is an artificial grotto: pebbles, crystals, and shells are the materials of the building. The form is octagonal, and six of the sides contain collections of different Cornish ores of tin, silver, copper, lead, and iron. Fossils, agates, jaspers, quartz, fluor spar, together with shells, coralloides [sic], and similar objects are very appropriately arranged among them . . . One of the finest specimens of chalcedony ever discovered is treasured here [as well as] a beautiful table . . . composed of 32 specimens of Cornish granite.

It must have been something to see. Embrey and Symes (1987) show a painting of a grotto something along the lines of the one described above.

SPECIMENS

OF

BRITISH MINERALS,

SELECTED FROM

THE CABINET

OF

PHILIP RASHLEIGH,

OF MENABILLY, IN THE COUNTY OF CORNWALL, ESQ. M.P. F.R.S. AND F.A.S.

WITH

GENERAL DESCRIPTIONS OF EACH ARTICLE.

LONDON:

PRINTED BY W. BULMER AND CO.

AND SOLD BY G. NICOL, BOOKSELLER TO HIS MAJESTY, PALL-MALL, AND MESSRS. WHITE, BOOKSELLERS, FLEET-STREET.

1797.

THE BOOKS

Rashleigh had been thinking about issuing some type of illustrated description of his specimens for several years. In 1791 he wrote to his friend and fellow collector John Hawkins:

> I wish I could find a good clever man to draw and colour some of my minerals, as I think some are worth notice; I would hire such a person, if to be found on moderate terms, but I should not like an indifferent Hand.

Ultimately Rashleigh is said to have hired a prominent Cornish enamel painter named Henry Bone (1755–1834) to prepare 33 engraved, handcolored plates illustrating 194 mineral specimens. (A close examination of these plates, however, shows them to be the work of two or three different engravers.) Rashleigh wrote a brief descriptive text to accompany them, and published the volume in 1797 under the title: *Specimens of British Minerals, Selected from the Cabinet of Philip Rashleigh, of Menabilly, in the County of Cornwall, Esq. M.P. F.R.S. and F.A.S., with General Descriptions of each Article.* It was printed by W. Bulmer and Company in London, and offered for public sale through G. Nicol ("Bookseller to His Majesty") in Pall Mall and Messrs. White on Fleet Street.

Rashleigh may not have been entirely satisfied with the renderings of his specimens. In the Introduction he writes:

> There is great difficulty in representing minerals on paper, and very few artists are to be met with who have any practice or experience in this line; it will therefore not be very extraordinary if these representations should not give the satisfaction expected; though nothing has been omitted that might tend to promote that object.

Despite these misgivings on Rashleigh's part, the book was apparently a successful seller, and is recognized today as the first attractive color-illustrated mineral book to be produced in England. Inscribed copies are almost unknown, so most copies must actually have been sold rather than given away.

The original binding as issued by the printer was a blue and red marbled paperboard cover of the kind commonly produced in the 18th century. These were intended to be temporary; the buyer was expected to have the books permanently bound to his own taste. A gray paper backstrip was wrapped around the spine, and a small printed label reading *British Minerals Rashleigh 1797* was glued on.

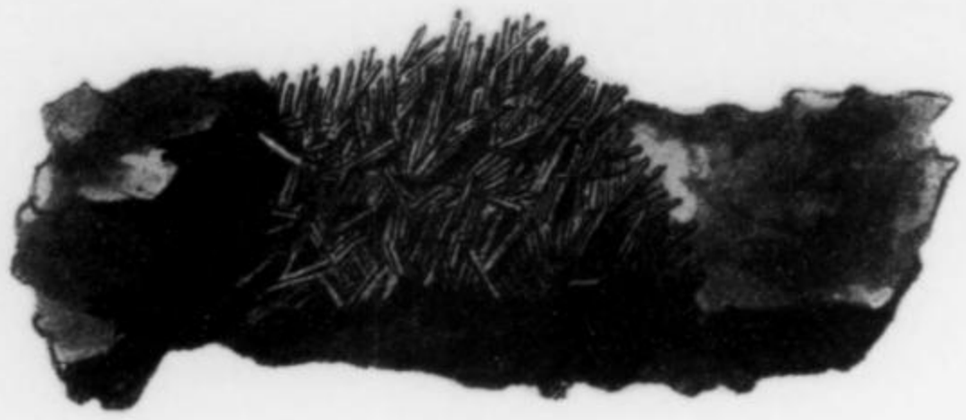
The success of the 1797 volume gave Rashleigh sufficient encouragement to begin work on a second volume. This time he employed at least three artists, two of whom had some familiarity with minerals. Rashleigh's sister Rachel was enlisted to paint some of the original "masters." (She had married the St. Austell physician, John Gould, who was apparently also a mineral collector, having been recorded in Rashleigh's catalog as supplying specimens to him.) A well-known watercolorist named Thomas Richard Underwood (1765–1836) was hired to design at least 12 of the plates. Then a London engraver named Thomas Medland prepared from these the engraved plates.

Underwood was that rare combination of a competent geologist and also a successful artist. He was a Fellow of the Geological Society, and apparently he too was a mineral collector because, like Gould, he is recorded in Rashleigh's catalog as being a source of specimens.

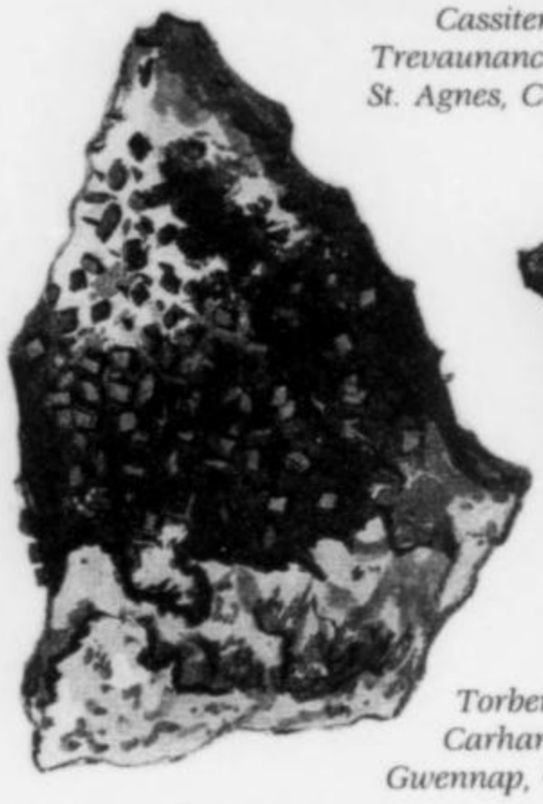
Two additional relatives of Rashleigh produced painted "masters" which remain unpublished: Miss Harriot Rashleigh and Miss F. Rashleigh. (These and all of the other originals were acquired by Sir Arthur Russell in 1944 and presented to the Natural History Museum, London).

It was around this time that Rashleigh became

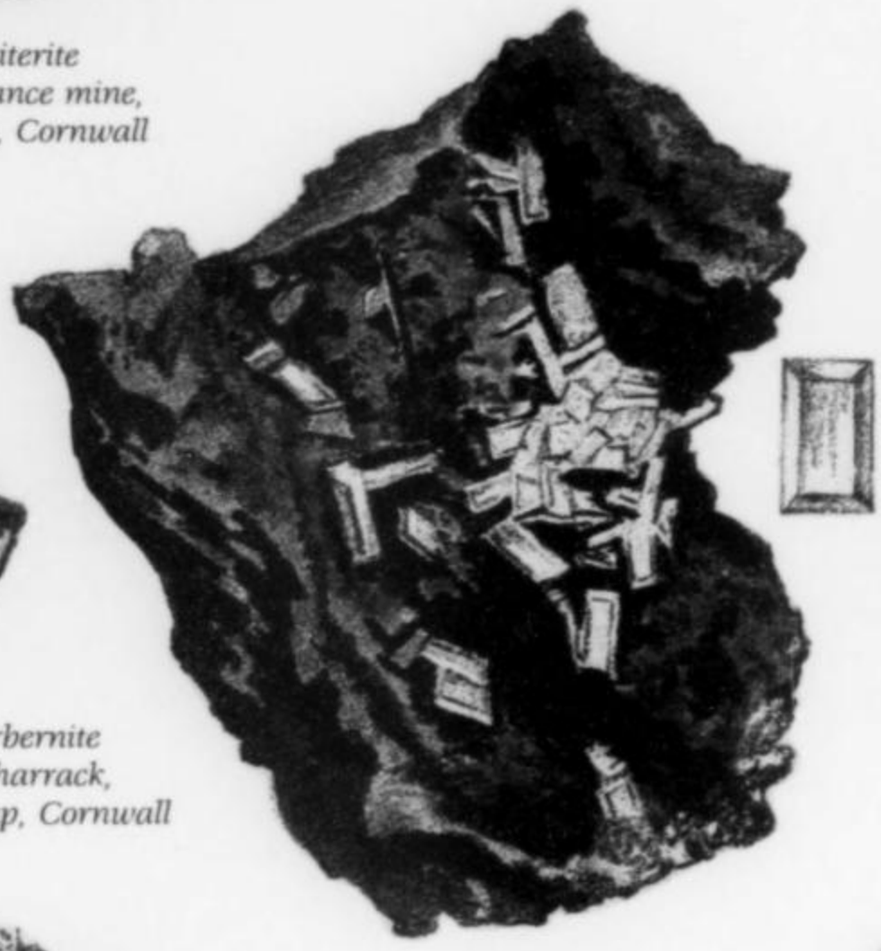
Cassiterite
Trevaunance mine,
St. Agnes, Cornwall



Olivenite
Carharrack, Gwennap,
Cornwall



Torbernite
Carharrack,
Gwennap, Cornwall



Chalcocite
Cook's Kitchen,
Cornwall

Liroconite
Huel Mutterel,
Cornwall

Cuprite
Huel Providence,
Cornwall

Cerussite
Huel Rose,
Cornwall

Some specimens illustrated by Rashleigh.

acquainted with James Sowerby, who produced for him four beautiful, still-unpublished plates depicting olivenite specimens from Wheal Unity (Russell, 1952). This contact may have encouraged Sowerby to begin producing his own series of color-illustrated mineral descriptions in 1802 (entitled *British Mineralogy: or Coloured Figures intended to Elucidate the Mineralogy of Great Britain*).

Some of the above-mentioned unpublished illustrations may have been intended for use in a third (never published) volume; one painting shows the famous liroconite, not acquired until 1811.

Rashleigh's second volume appeared in 1802, with 21 handcolored plates depicting 48 specimens and a geologic column illustrating the strata overlying the cassiterite-bearing alluvial deposit at Poth, St. Blazey. These plates are, on the average, drawn and colored in somewhat better detail than those in the first volume, so Rashleigh's efforts at improvement bore some success. Surprisingly, as recently as 1980 visitors to the Truro Museum could purchase original loose plates from the two volumes.

According to Courtenay Smale, who has made a special study of the Rashleigh collection, some 90 specimens figured in the works of Rashleigh and Sowerby remain today in the collection and are

available for study! (Here we use the term "collection" to include all known Rashleigh specimens regardless of housing.)

Stockdale (1824) reviewed the Rashleigh volumes as follows: "A very valuable work was published a few years ago, entitled, Specimens of British Minerals . . . embellished with drawings by Underwood and Bone." But not all contemporary writings were complimentary of Rashleigh's work. Constable (1808) printed a review of the two-volume work that was both complimentary and caustic. Rashleigh's effort, he said, was "highly laudable" but the brief text came in for some serious review. "We do not bestow any particular consideration on the text, which was obviously introduced merely to render the plates intelligible." Rashleigh's ". . . few explanatory observations are so unobtrusive and unpretending, that they afford little room for remark. . . ."

Constable's disdain for the text is understandable. The text consists of nothing but rather overblown figure captions, of which the following is a particularly uninstructive example:

> *Fig. 1.* - Is copper ore, with a thin coat of blue purple color over yellow copper ore, upon which are formed small crystals of copper ore, with prisms of six sides, and truncated ends of a bright steel color, lying flat on the mammillary or stalactitic ore: *a* is one of the steel-colored crystals of copper ore, a little magnified. From *Cook's Kitchen*.

There is little in these words which is not already apparent from the illustration. "Copper ores from *Cook's Kitchen*" would have been as informative. But Rashleigh admitted in the introduction to volume II that he did "not profess to be well enough acquainted with the science and nomenclature of modern chemistry." Rashleigh's collection was, in any case, assembled at a time when the nomenclature of mineralogy was rudimentary and in a state of flux. Quartz was still *silex* to some, and yellow copper ore, for example, was yet to be named chalcopyrite.

Even the very nature of the color plates was criticized; the fact that the drawings bore strong resemblance to the actual subjects wasn't enough for at least one reviewer:

> To the superficial observer, this [resemblance] may appear quite enough; and to those who merely look at minerals as children do at pictures, to regale their eyes with vivid colours, this work will be a treasure. Surely it was not for their use only that it was designed; and yet we fear few others will find it profitable.

One further complaint focused on the crystal drawings on some of the plates. "Even these detached figures are inaccurately drawn." Altogether, the review could not have brought much joy to Menabilly!

DISPOSITION of the COLLECTION

When Rashleigh died in 1811 the collection at Menabilly was willed to a nephew, William Rashleigh, since Philip had no issue. William continued collecting minerals for about 25 years, during which time he gave a portion of the collection to his son Jonathan. The major collection remained at Menabilly until 1903 when it was sold by the family to the Royal Institution of Cornwall where it remains today. That portion of the collection which went to Jonathan in 1838 was eventually traced by Sir Arthur Russell and purchased by him in 1923. Russell later obtained another small portion of the collection in 1958, in all no more than 50 Rashleigh specimens. Because of his high social standing, Russell was in a unique position to obtain entrance into the manor homes of England where old collections of "natural curiosities" might be housed. This was our good fortune for his huge collection, over 40,000 specimens now in the Natural History Museum, London, reflects his success in ferreting out such treasures including important Rashleigh pieces.

Little was done with the Rashleigh collection at Truro until 1951 when it was placed in its final arrangement on display by curator H. L. Douch, a Mrs. Knott, and Arthur Russell. Since then, diligent efforts have been made by Douch, R. D. Penhallerick and Courtenay Smale to ferret out more of this important collection's history. The Rashleigh file of correspondence and catalogs has been particularly helpful in this regard.

A few years ago I visited Menabilly, along with Courtenay Smale, through the courtesy of present-day descendant Philip Rashleigh and his wife [since deceased]. In a small, round, glass-topped table five specimens remain. One has a Russell label and one an original Rashleigh label in each writer's distinctive handwriting. Also in this glass-topped table is one of the glass models of a hailstone mentioned in the *Dictionary of National Biography* as having fallen on the Menabilly estate on Oct. 20, 1791; this model was undoubtedly made at Rashleigh's behest.

Today the Truro portion of the collection is displayed and housed in a new hall in sloping glass cases with drawers underneath. The Natural History Museum, London, has pieces on display, but the bulk is housed in the upstairs "Russell room" with that collection.

THE DU MAURIER CONNECTION

"Last night I dreamt I went to Manderley again." So wrote Daphne du Maurier as the opening line of her modern romantic legend, *Rebecca*. The book was acclaimed worldwide when it appeared and was the basis for an award-winning Hitchcock movie. When she wrote that line du Maurier was actually referring to Menabilly, Rashleigh's ancestral home.

As a teenager in the 1920's Lady du Maurier had searched out a gray moorstone house she had seen

while fishing out on Tywardreth Bay. The house was Menabilly, unoccupied at the time. Being an easily impressed teenager, Daphne fantasized about that lonely home. In her words:

> One family had lived within her walls. They had been born there. They had loved, they had quarreled, they had suffered, they had died. And out of these emotions she had woven a personality for herself, she had become what their thoughts and their desires had made her. (du Maurier, 1981)

Du Maurier went back to that house repeatedly, eventually gaining entry to the vacant edifice and describing what she saw. It is obvious that Rashleigh's Menabilly, built in 1596, played a signal role in the development of the *Rebecca* storyline. I doubt if any other mineral collector's home ever received such noteworthy treatment. Her description could have been written in the 1980's; our visit revealed much that she had seen over 50 years earlier.

One other note on literature worthy of mention here involves Rashleigh himself. Because the Rashleigh collection was well-known it was visited frequently by the scholarly and the curious. At times Rashleigh must have been curt to the curious, one of whom was Sir Walter Scott of *Ivanhoe* fame. Scott was refused entry to the collection, and so vowed to settle the score. He did so when he wrote *Rob Roy,* published in 1817.

The story tells of two brothers, one a villainous scoundrel, whom Scott purposely named Rashleigh Osbondistone! Scott's description portrays a most objectionable fellow:

> He was low of stature—bull-necked and cross-made. The features of Rashleigh were such as, having looked upon, we in vain wish to banish from our memories to which they secur [sic] as objects of painful curiosity. We dwell upon them with a feeling of dislike, even disgust.

The portrait of Philip Rashleigh hanging in the Museum at Truro (shown here) does not much resemble Scott's creation, but the name leaves little doubt whom Scott had in mind! Ironically, *Rob Roy* was published six years after Rashleigh's death so Scott's revenge was hollow.

CONCLUSION

With the publication of an illustrated two-volume work on his collection, Rashleigh made a major contribution to the mineral literature of his time. His initial description of several species, the superb rendition of species through color illustrations, coupled with his diligent cataloging, has given researchers much historically valuable information.

The fortunate happenstance that his collection has remained largely intact through the better part of two centuries, thanks to the efforts of the Rashleigh family, Sir Arthur Russell and the Royal Institution of Cornwall, makes the Rashleigh texts and collection invaluable to the science and literature of the mineralogy of his time.

ACKNOWLEDGMENTS

I am particularly grateful to Courtenay Smale of Newquay, Cornwall, who was involved in this project from its beginnings and whose counsel and generous sharing of knowledge was invaluable. Peter Embrey (now retired) granted access to the Russell/Rashleigh collection at the Natural History Museum, London. He (and Robert Symes) made possible the viewing of the unpublished drawings of Rashleigh minerals at the library, and freely shared his own extensive library for research. At the Royal Institution of Cornwall, Roger Penhallerick and H. L. Douch gave generously of their time while giving access to the Rashleigh collection for study and photography. Si Frazier and Lawrence Conklin critically reviewed the manuscript. Helpful additions to the text were provided by Dr. Wendell E. Wilson.

Special thanks go to Philip Rashleigh and his wife (now deceased) and to Richard Rashleigh, who continues to live in Menabilly, Cornwall, for allowing us to visit and photograph their ancestral home and view the interesting materials there.

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James Sowerby, His Publications and Collections

Lawrence H. Conklin
2 West 46th Street
New York, New York 10036

Great handcolored mineral books have appeared only rarely in history. James Sowerby produced two of the finest between 1802 and 1820; his five-volume British Mineralogy *and his two-volume* Exotic Mineralogy *depicted in color over 1,500 specimens from the best mineral collections in England. These fascinating and exquisitely rendered books are justifiably among the most coveted items in all of mineralogical literature.*

INTRODUCTION

For the past 40 years I have been fascinated by the superb and beautiful mineral colorplate works of James Sowerby and his descendants. As I became a serious book-collector, and then an amateur writer on the history of minerals and books, I promised myself that one day I would write about this fascinating family and their mineralogical publications.

The two Sowerby mineralogies discussed here are very high on most mineral-book collectors' lists of *desiderata,* but with perhaps fewer than one hundred (I know of only 50 so far) surviving *complete* copies of *British Mineralogy* and far fewer (I know of only 24) of *Exotic Mineralogy,* only the most affluent, and in the case of the latter title, the most diligent, collectors will be able to add these works to their libraries.

The Sowerbys were a family of naturalists, collectors, artists and publishers who, *for more than a century,* offered the public, amateur and professional alike, a large selection of important, original, illustrated works on natural history. Through their accurate illustration, careful preparation and faithful publishing of these natural history books the Sowerbys strongly influenced the development of the study and teaching of natural history in 19th-century Great Britain, especially botany, paleontology and mineralogy. As a family they wrote and illustrated more than 100 natural history works between the years 1789 and 1897.

JAMES SOWERBY

James Sowerby was born on March 21, 1757, at No. 2 Bolt-in-Tun Passage, off Fleet Street, in the city of London; he died on the other side of the Thames River, at No. 2–3 Mead Place, Lambeth, on October 25, 1822.

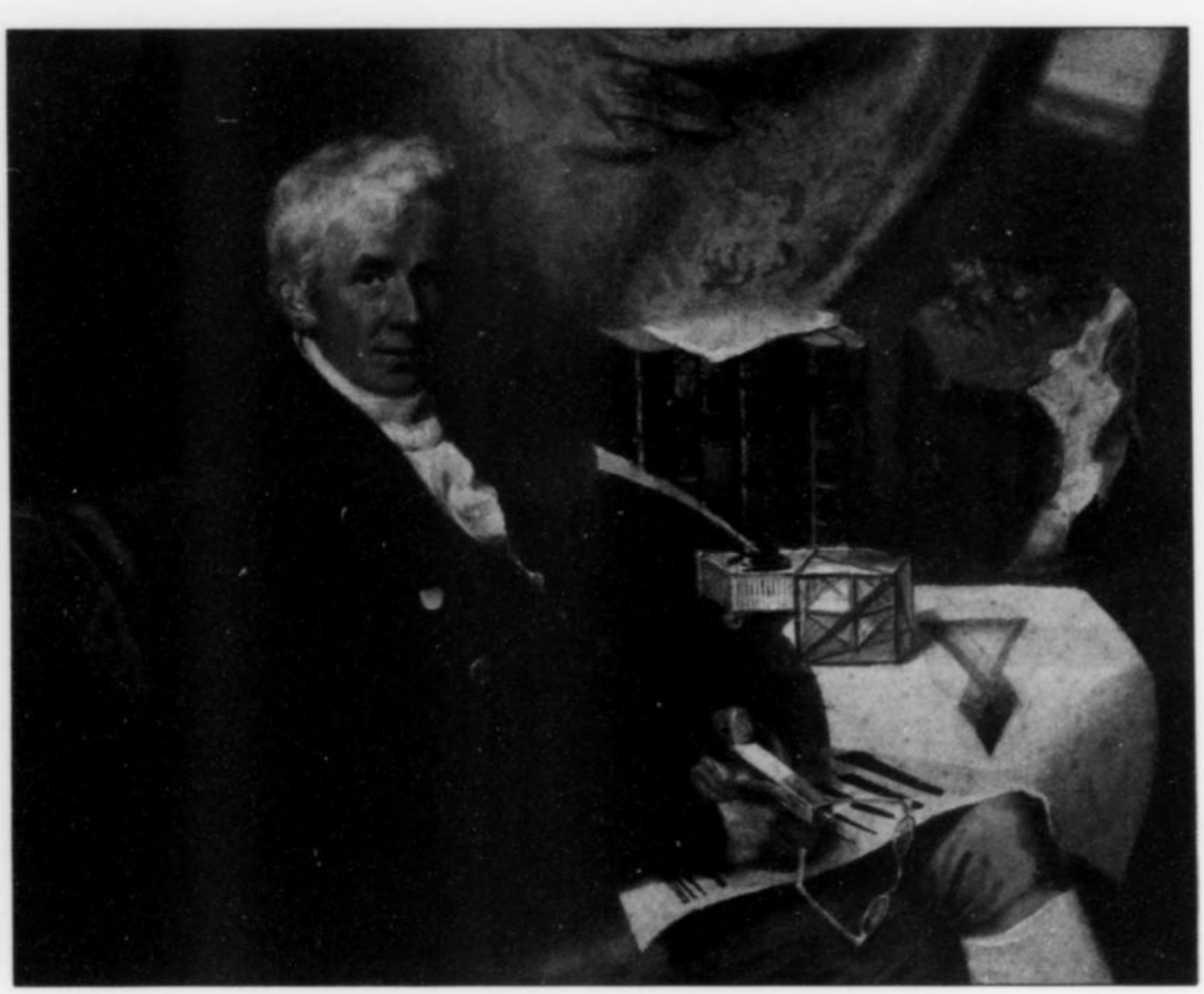
James was the son of John Sowerby, a lapidary, and his wife Arabella Goodspeed. His father died when James' eldest brother John was still too young to carry on the family business, which was on the decline owing to the vagaries of fashion involving the use of semi-precious colored stones which had previously been in great demand.

James studied art at the Royal Academy in London and began making studies of wildflowers and plants to include in his miniature portraits. This led to an association with William Curtis (1746–1799), botanist

and noted author of the magnificent *Flora Londinensis; or, Plates and Descriptions of such Plants as Grow Wild in the Environs of London* (London, 1777–1798). Curtis taught him how best to depict plants and their blossoms. Apparently James handcolored many of the plates for this Curtis publication, which has been described as "unsurpassed in the history of botanical illustration," and did the original engravings on copper for a number of them. Copies of this work are rare today and are valued in the range of $15,000 to $25,000.

on the titles of *British Mineralogy* referred to them. When James senior died in 1822, James De Carle took up the current work-in-progress, *The Mineral Conchology of Great Britain,* and saw it to completion.

In 1790 James Sowerby started the first of his illustrated works, with the descriptions supplied by Sir James E. Smith. *English Botany; or Coloured Figures of British Plants, with their Essential Characters, Synonyms and Places of Growth,* issued in parts over 23 years, was finished in 1813. This work, considered his most important, is complete in 36 volumes with



James Sowerby, aged 59, with volumes of his works and the Yorkshire meteorite. Painting by Thomas Heaphy (1816), courtesy of Mrs. Sara Sowerby.

While studying at the Royal Academy, James met and became friendly with a fellow student, Robert De Carle. De Carle invited Sowerby to his home in Norwich where Sowerby met his youngest sister, Anne Brettingham De Carle. They were much attracted to each other and, in due course, were married. In 1786 they moved into the house in Mead Place, a gift of the bride's father. The house apparently survived until the bombing of London during World War II.

They had four children who lived to adulthood, all of whom, it is assumed, at one time or another during their childhood, helped their father in the production of his books. Indeed the two eldest sons, James De Carle and George Brettingham, did substantial original work and research for the family publishing projects, completing much that was begun by their father, and it is generally assumed that the phrase "(With Assistance)" printed above the author's name

2,592 (!) handcolored plates of British plants. Buyers of this work today must exercise extreme caution. Because of its popularity, editions were published over many years, sometimes with images produced from worn out plates, parts from earlier editions and other bibliographic nightmares.

The second edition of this work was merely a restrike of the first, and mixed editions were routinely produced. Sets of the final edition (usually in 13 volumes of quarto size, with 1,936 plates), designated the third edition, appeared as late as 1892, and were illustrated with crude lithographic (albeit handcolored) copies of Sowerby's original engravings. There are also pirated editions.

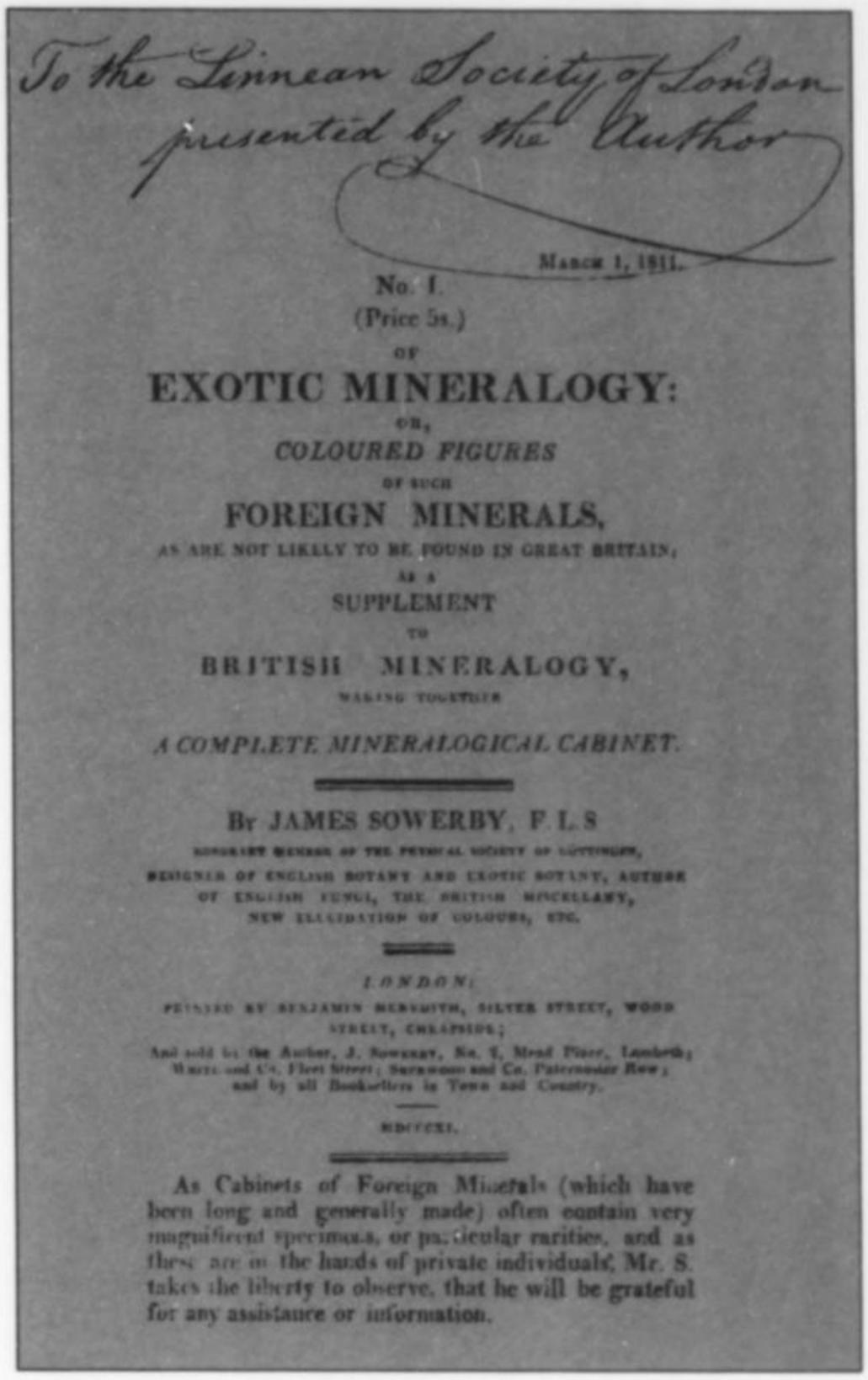
Sowerby's second most important publication, *Mineral Conchology of Great Britain, or Coloured Figures and Descriptions of those Remains of Testaceous Animals, or Shells which have been Preserved at Various Times, and Depths in the Earth* (London 1812–1846), is

actually a work of invertebrate paleontology (a term that had not yet come into use in Sowerby's day) and it recorded, for the first time, many index fossils found in England. This publication secured, certainly for his lifetime, Sowerby-the-artist's credentials as a serious student of the geological sciences. This work, too, was issued in parts, over a 34 year period (the final parts were produced by James De Carle with the help of George Brettingham), and when complete (as issued), contains 650 colored plates, each with a letter-press description, in seven volumes. It is recorded that two unauthorized (or pirated) editions of this work were produced by Louis Agassiz, the first in French in 1837 and the second in German in 1845.

In addition Sowerby supplied the 19 plates for William Smith's *Strata Identified by Organized Fossils* (London, 1816), known popularly as *Smith's Strata*. He, and then later his family, produced the colored plates for most of the eleven editions of John Mawe's *Familiar Lessons on Mineralogy and Geology* (London, 1819 through 1829) and Mawe's *Treatise On Diamonds and Precious Stones*. Sowerby almost certainly also produced for Mawe the one quarto-sized, handcolored, engraving of mineral specimens for *Travels in the Interior of Brazil* (London, 1812), although it is unsigned. (Interestingly, no colored plate accompanies the first American edition of this work published in Philadelphia in 1816, although it is similar to the London edition in every other way.)

The two Sowerby works to be discussed here are *British Mineralogy: Or Coloured Figures Intended to Elucidate the Mineralogy of Great Britain* (London, 1804–1817) and *Exotic Mineralogy: Or, Coloured Figures of Foreign Minerals as a Supplement to British Mineralogy* (London, 1811–1820).

Both the *British* and *Exotic* mineralogies were published originally in "parts" or periodical issues, and were sold by subscription. The publishers also offered complete sets of the works after all the parts had been produced. These normally show up bound, with the addition of suitable title-pages and indices. The *completed* works are usually found in five volumes for the *British* and two for the *Exotic*, each volume carrying its individual title-page, although other binding variants are known. At least one ten-volume set (five volumes of plates and five of text) exists and many sets were bound, perhaps much later, in a mineral chemistry format with no regard to Sowerby's numerical order. Complete "parts" of both works have survived in their original printed paper covers or "wrappers." (See the illustration here of Part I of *Exotic Mineralogy* in original wrappers, which is a presentation copy from James Sowerby to The Linnean Society of London, of which he was a fellow.) Evidence that at least some of the bound volumes began their life as "parts" can be observed by noticing the remains of the "stab holes" from the original stitching of the parts, *if* these holes were not later trimmed away by the binder.


To the Linnean Society of London
presented by the Author

March 1, 1811.

No. I.
(Price 5s.)
OF
EXOTIC MINERALOGY:
OR,
COLOURED FIGURES
OF SUCH
FOREIGN MINERALS,
AS ARE NOT LIKELY TO BE FOUND IN GREAT BRITAIN;
AS A
SUPPLEMENT
TO
BRITISH MINERALOGY,
MAKING TOGETHER
A COMPLETE MINERALOGICAL CABINET.

By JAMES SOWERBY, F.L.S
HONORARY MEMBER OF THE PENZANCE SOCIETY OF CORNWALL,
DESIGNER OF ENGLISH BOTANY AND EXOTIC BOTANY, AUTHOR
OF ENGLISH FUNGI, THE BRITISH MISCELLANY,
NEW ILLUSTRATION OF COLOURS, ETC.

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STREET, CHEAPSIDE;
And sold by the Author, J. Sowerby, No. 1, Mead Place, Lambeth;
White and Co. Fleet Street; Sherwood and Co. Paternoster Row;
and by all Booksellers in Town and Country.

MDCCCXI.

As Cabinets of Foreign Minerals (which have been long and generally made) often contain very magnificent specimens, or particular rarities, and as these are in the hands of private individuals, Mr. S. takes the liberty to observe, that he will be grateful for any assistance or information.

Inscribed wrapper

James Sowerby was a careful, meticulous and observant artisan and this is evident in the quality of the workmanship of the drawings he produced and the copperplates that he personally engraved and etched. The fine detail achievable by such drawing is, even to this day, preferred in some instances (medical, for one) to the most exacting photography. Indeed, in Arthur W. G. Kingsbury's article "Some minerals of special interest in South-West England," reprinted from *Present Views on Some Aspects of the Geology of Cornwall and Devon* (Truro, 1964), we read that Sowerby, with Tab. 134 on pages 63–64 of *British Mineralogy*, while figuring and describing *wavellite*, noticed and very carefully depicted "small dark circles" of a mineral that Dr. Kingsbury only recently determined to be *variscite*. This species was not described until more than 30 years after the Sowerby plate, in 1837. It is extremely rare in Great Britain.

Sowerby's technique for producing the plates was relatively simple: The copperplate-engraved outline of the mineral image was printed, usually in black ink (in a few instances colored inks were used), on an octavo-sized sheet of paper, and was then hand-tinted within the printed outlines using watercolor paints. It has been stated that Sowerby ran, in effect, a produc-

Engraved copper plate 531

Uncolored print

Handcolored print

tion line, with artisans (some family members, some paid employees) each applying one color to the print and then passing it on to the next person for the application of the next color and so on. This apparently is not so, as suggested by the survival of sets of *completely* colored original "pattern plates" (done by Sowerby himself and some marked with "directions to the colourist") for each of two different sets of his works. These treasures were actually offered for sale by Bernard Quaritch Ltd. in their catalog *Supplementa Sowerbiana; Or, a Catalogue of Books and Manuscripts Written or Illustrated by Members of the Sowerby Family,* compiled by John Collins and issued as a supplement to their Catalog No. 894 (London, 1969). The set for *Mineral Conchology,* almost complete with 643 of 650 plates, was priced at $86.40, and was still available for sale in July, 1971! The production line tradition may have got its start from the fact that the Sowerby children were, at first, allowed only to paint the "dirt" (the background area at the base under the specimens in some plates) until they were capable of more skilled work. In any case, each family member had his or her own table or desk, colors, brushes and a cupboard of drawers in which to store supplies.

A comparison of the same colored plate in different copies of the same work sometimes shows a very slight variation in quality as, apparently, some colorists were more skillful than others. On the other hand, if we examine the first plates in *British Mineralogy,* executed in 1802, and compare them with the final examples of *Exotic Mineralogy* done almost 20 years later, we notice that the same very high standards of quality were maintained over this very long period.

One of Sowerby's surviving original copperplates is currently in my own collection. It has been framed with an original printer's proof (in which the plate came wrapped), and a modern re-strike of the plate which has been colored by hand. It is Tab. (or Plate) 531, a depiction of *toadstone,* an *amygdaloidal basalt,* from *British Mineralogy.* It is quite well worn from its being pulled many times, and the printed proof actually shows more detail than now remains on the copperplate. Nevertheless, the very careful engraving skills of James Sowerby can be appreciated at first glance. It is signed and dated in the plate—"J.S. scps, [sculpsit, Latin for engraved] 1816."

In placing the era in which James Sowerby worked and assembled his collection of minerals in historical context, it should be remembered that at the time of the publication of the first part of *British Mineralogy* in 1802 mineralogy was virtually the exclusive preserve of medical doctors, and chemists were just beginning to analyze minerals.

Abraham Gottlob Werner (1749–1817), "the father of mineralogy," was still to have 15 productive years at Freiberg in which to enhance his reputation; René Just Haüy (1743–1826), the "founder of mathematical crystallography," was to continue publishing his mineralogical research for another 20 years. Indeed, in America, 1802 was the year of the legendary pilgrimage in which Benjamin Silliman of Yale College in New Haven, Connecticut, was obliged to take that institution's mineral collection "in a candle box," to faraway Philadelphia in order to have the minerals properly identified by Adam Seybert and the other experts there.

At this time books were the primary (and in some cases, the only) sources of scientific information, and these books were often purposefully written in a style which attempted to *involve* the reader. Sowerby's works were no exception, and his readers responded by supplying him with specimens and pertinent information. Sowerby's publications acted as a clear-

ing-house, as it were, for observations and discoveries among the small number of geologists, mineralogists and botanists, who were widely scattered and who had little opportunity to exchange their ideas or many of their specimens. Philip Rashleigh, author of *Specimens of British Minerals, Selected from the Cabinet of Philip Rashleigh, of Menabilly, in the County of Cornwall* (two volumes, London 1797 and 1802), actually stated that he was dependent upon the Sowerbys for news of minerals. Indeed, Arthur Aikin, in the preface to his *A Manual of Mineralogy* (London, 1814), stated. "For some of these [mineral] localities I am indebted to Mr. Sowerby's elegant work on 'British Mineralogy illustrated with coloured plates.'"

The accumulated specimens that Sowerby used in his works took on, more and more, the appearance of a museum, and in 1796 he was obliged to add a room to the rear of his house in which to store them. It was Sowerby's plan to have, eventually, a complete collection of the natural history of Great Britain. In a letter now in the British Museum (Natural History), Sowerby described his "museum" as "some thousands of minerals, many not known elsewhere, a great variety of fossils, most of the plants of *English Botany,* about 500 preserved specimens or models of fungi, quadrupeds, birds, insects, &c. all the natural production of Great Britain." In a printed prospectus of 1821 Sowerby reminded the public that "a fire is kept in the Museum every Tuesday during the winter, from eleven o'clock 'til four," but his museum did not remain intact very long after his death in 1822. His original plan of creating a major public institution was attempted by his sons. Indeed, James de Carle Sowerby (1787–1871) was eminently capable of following in his father's footsteps. Along with his friend Michael Faraday (1791–1867), he studied under Sir Humphrey Davy (1778–1829), the inventor of the Davy lamp and in whose honor the mineral species *davyne* was named. His knowledge of chemistry led him to propose a classification of minerals according to their chemical composition, and to this end he analyzed many specimens published in *British Mineralogy* and *Exotic Mineralogy.* A notice in *Mineral Conchology* printed in 1827 stated that "tickets for admission to study in Sowerby's Museum and Library may be had . . . at 10s each for three months, or £2 per annum." It should be kept in mind that Sowerby's "Museum" always sounded more formal when it was referred to in print than it was in fact. In any case by 1831 it ceased to exist.

It is not clear what the final disposition of all the minerals was, but a manuscript draft dated April, 1831 exists in the British Museum (Natural History), stating in part that it is ". . . necessary for the purpose of completing some family arrangements to dispose of the above splendid Collection, the result of forty year's labour, Messrs. J. & E. Sowerby, the administrators have determined to open it [the museum] for Private Sale, on Monday the 18th of this month." On June 23, 1831, the Stevens' Auction Rooms sold the remaining portion of the collection of minerals, stones, etc. In 1861 the *Mineral Conchology* collection of figured specimens, some 5,000 pieces, was sold to the British Museum for £400. It should be noted that this transaction was for "the general" but not, presumably, the entire collection.

In 1934 some Sowerby descendants offered to sell to the British Museum (Natural History) a group of mineral specimens that they called the "Sowerby Collection." The museum trustees suggested the nominal price of £50 for the lot, which was promptly accepted by the heirs. Included in this collection were five mineral specimens that had been depicted in *British Mineralogy,* calculated by the *buyers* to be worth nine shillings, or $2.25, each.

The list of lenders and donors of specimens to Sowerby and his museum reads like a mineralogical "Who's Who." We see such names as:

"Babington" [William Babington (1757–1833), after whom *babingtonite* was named]
"Wollaston" [William Hyde Wollaston (1766–1828)—*wollastonite*]
"Brooke" [Henry James Brooke (1771–1857)—*brookite*]
"Tennant" [Smithson Tennant (1761–1815)—*tennantite*]
"Bournon" [Jacques Louis, Count de Bournon (1751–1825)—*bournonite*]
"Heuland" [John Henry Heuland (1778–1856)—*heulandite*]
"Forster" [Adolarius Jacob Forster (1739–1806)—*forsterite*]
"Stromeyer" [Friedrich Stromeyer (1776–1835)—*stromeyerite*]
"Gmelin" [Christian Gottlob Gmelin (1792–1835)—*gmelinite*]

Other notable lenders were: Sir Joseph Banks (1743–1820), president of the Royal Society; the Hon. Charles Francis Greville (1749–1809); and "Mrs. Mawe," the wife of John Mawe (1764–1829), author of *Travels in the Interior of Brazil; Familiar Lessons on Mineralogy;* and *A Treatise on Diamonds and Precious Stones,* etc. John Mawe opened a mineral shop in 1811 after returning from a voyage to Brazil. When Mawe died in 1829 the business was carried on by his apprentice, James Tennant (1808–1881), who then succeeded him.[1]

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[1]James Tennant began his apprenticeship with Mawe when he was 16 years of age and was only 21 when Mawe died. In 1838 he was appointed a teacher at King's College, and later became professor of mineralogy there. By 1840 he had become "mineralogist to Queen Victoria" and was curator of the Baroness Burdett-Coutts mineral collection. Tennant is probably best remembered for his supervision of the recutting of the famous "Kooh-i-noor" diamond. Recent writers

BRITISH MINERALOGY:

OR

COLOURED FIGURES

INTENDED TO ELUCIDATE

THE MINERALOGY

OF

Great Britain.

BY JAMES SOWERBY, F.L.S.

HONORARY MEMBER OF THE PHYSICAL SOCIETY OF GÖTTINGEN,

DESIGNER OF ENGLISH BOTANY, AUTHOR OF ENGLISH FUNGI, ETC.

(With Assistance.)

As for the Earth, out of it cometh Bread, and under it is turned up as it were Fire. The Stones of it are the Places of Sapphires; and it hath Dust of Gold. Job xxviii. 5, 6.

VOL. I.

LONDON:

PRINTED BY

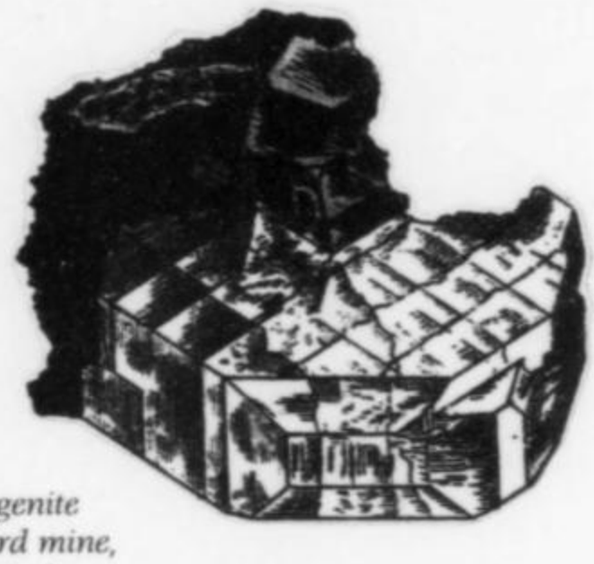
R. TAYLOR AND CO., BLACK-HORSE-COURT, FLEET-STREET;

And sold by the Author, J. Sowerby, at No. 9, Mead Place, Lambeth; and by White, Fleet-street; Symonds, Pater-noster-row; and all other Booksellers.

MDCCCIV.

Apatite
Chudleigh

Garnet
Huntley,
Scotland



Phosgenite
Cromford mine,
Matlock

Fluorite
Cumberland
or Derbyshire

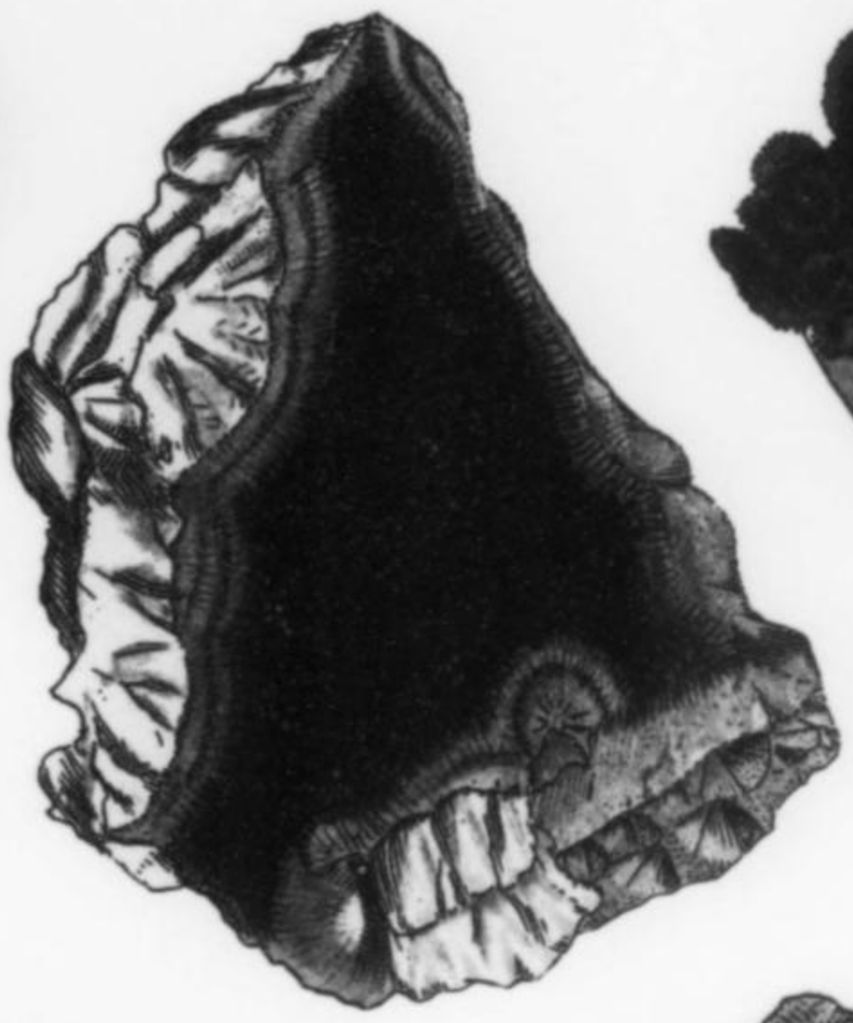
BRITISH MINERALOGY

British Mineralogy: Or Coloured Figures Intended to Elucidate the Mineralogy of Great Britain is complete with 550 handcolored plates of minerals and rocks, all, presumably, executed on copper by James Sowerby, and each accompanied by a letter-press discussion of the depicted subject, also by Sowerby. The importance of *British Mineralogy* in its time cannot be overstated. Today it is still considered the supreme work of British topographical mineralogy. It is certainly the most ambitious colorplate work on minerals *ever* published, and with its 550 plates is

---

have questioned the year of his birth, even though it is listed as 1808 in *The Dictionary of National Biography* (British). In my library, however, is a copy of a photograph of Professor Tennant on which he has recorded his nativity data in holograph, and signed as follows—"James Tennant Born Feb. 8. 1808. at Upton near Southwell, Notts." This photo was formerly in the files of George F. Kunz and was given to him by one of his many correspondents who has inscribed it thus—"Above is Prof. Tennant's autograph, written when he gave me the photograph in the classroom at King's College, London after his lecture, 17th March 1870. [signed] James T. B. Ives."

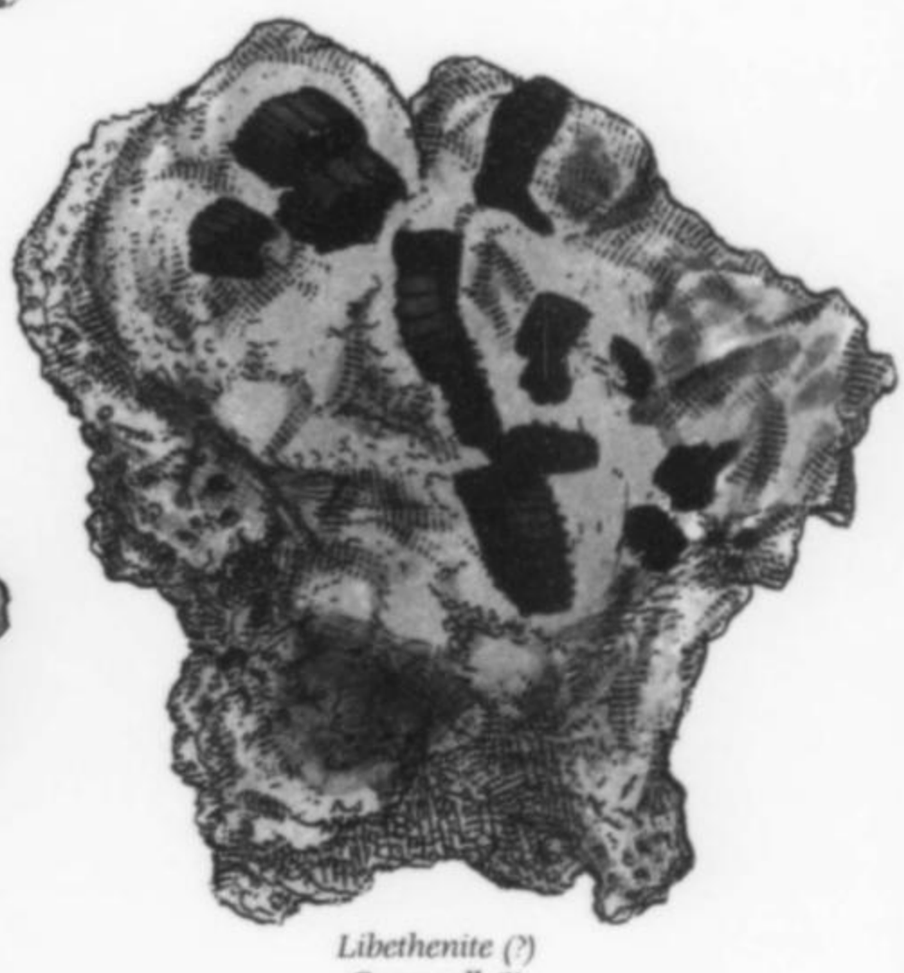
Malachite and Azurite
Cornwall (?)



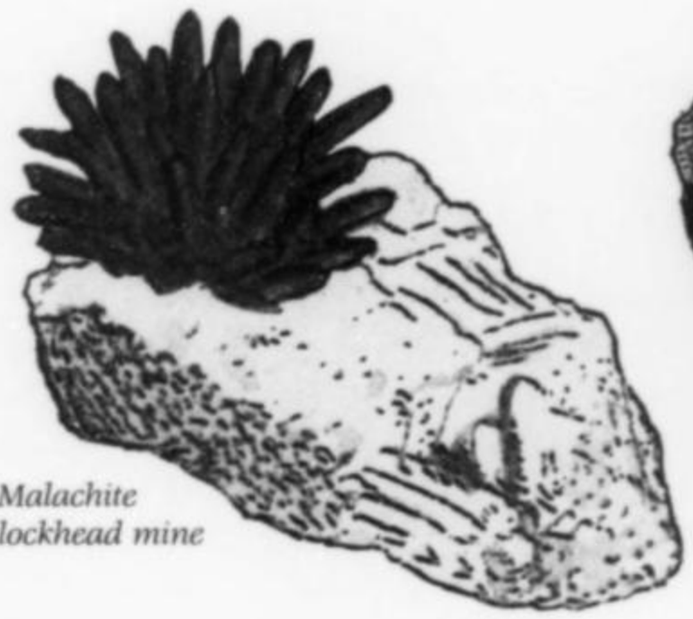
Olivenite
Cornwall
(Rashleigh collection)

Azurite
Cornwall (?)
(Rashleigh collection)

Olivenite
Gwennap,
Cornwall
(Rashleigh collection)



Libethenite (?)
Cornwall (?)



Malachite
Wanlockhead mine

Azurite
Wanlockhead mine

Some specimen illustrations from British Mineralogy.

many times more extensive than its nearest rival.

The work was originally issued in parts, called *numbers,* between 1802 and 1817. From an almost complete and probably unique set *in original wrappers* in the Obodda Library, the dates of issue of the numbers with their respective plates are listed on Table 1. The Obodda copy is highly important because, to the best of my knowledge, the information that is unique to it has never been published before. (See the discussion of *Exotic Mineralogy* for similar information for that work which has previously been published.) In B. B. Woodward's *Catalogue of Library British Museum (Natural History)* (1982) we read that: "The text at first was not always issued with the illustrations. In the copy of Vol. I [in wrappers] referred to above, it was obviously not all in the original state of issue. . . ." The publishers left it to the subscribers to collate the work. Eventually that problem was corrected, and by the year 1811, and the start of the publication of *Exotic Mineralogy,* the text and corresponding plates were being issued together.

On the front wrapper of No. I is the following:

> It was at first intended to have given a brief Catalogue of a valuable Collection which the author has been so fortunate as to procure; but, finding it necessary for that purpose to make Sketches of the various Fractures and Crystallizations of the Mineral Bodies in question, he has been advised to publish such Representations. To this advice he has the more readily consented, as he will, perhaps, be stimulated to proceed with more assiduity. The figures will be executed from actual Specimens, and the interesting Parts made conspicuous. The letter-press will be as intelligible as possible. References will be made to scientific Authors, especially Linnæus, as far as can conveniently be done.

Printed on the rear wrapper is the following:

> The descriptions will be published occasionally, about Two Sheets at a Time, as a single Sheet is subject to a Stamp Duty. It is expected to publish another Number, or more, while the Letter-press is preparing. The first Number is an Example of the Execution of the Figures, and the whole is intended as a Companion to English Botany. Any Information, or Specimens, with Habitats, &c. will be gratefully received, and duly remembered.

The price of each number (or part) started out, in 1802, at 3 shillings and 6 pence, and with number XXXI on June 1, 1805 the price jumped to 5 shillings. That price was maintained at least until number LXXVII (which brought the subscribers well into the fifth and final volume) in November of 1813.

The first of the five title pages supplied by the publisher was issued in 1804, and bears that date, although the work was begun and the first number or part was issued two years earlier in 1802. It covers the first volume of 100 plates and descriptions. The succeeding titlepages are dated 1806, 1809, 1811 and 1817. It is assumed that there was never a "book" edition *separately* published, and that *all* completed sets of the work were bound up from the parts with perhaps some parts reprinted as needed. Most of the subscribers acceded to the five volume format intended by the publisher. *Complete* sets of *British Mineralogy* are, however, considered rare in the book trade today, with shorter sets being the examples most usually offered for sale. Any publication extending over 15 years will surely have lost a number of its original subscribers along the way, and the sets they were assembling would end up incomplete.

Sowerby's attempt at perfection in the production of *British Mineralogy* is clearly demonstrated by an announcement on the front wrapper of Part No. XXVI of December 1, 1804. He states that included in this part is a new leaf of text and description that is to be substituted for pages 129 and 130 "which must be canceled." The reason was that page 129 (a right-hand page) was originally blank on the back, so that page 130 (also blank on the back) was a right-hand page, although even-numbered pages traditionally belong on the left-hand side. Sowerby corrected this aesthetically unpleasing situation by eliminating the two blank pages with the substitution of the new leaf. His wishes, however, were not always carried out by the subscribers when the completed set of parts was finally bound. This is, technically, not a "point of issue," however, since all the subscribers were issued the cancel and were free to decide on whether to employ it or not.

The work also contained advertisements, of which the following, quoted from Volume Five, is an interesting example:

> MINERALOGY
> AND
> GEOLOGY.
>
> The rapid progress these Sciences are making in England, leads us to hope that we shall soon equal the *Savans* on the continent. Mr. MAWE, No. 149, Strand, informs those who are desirous of becoming acquainted with these useful branches of *Natural History,* that they may be supplied with any specimens they want, or Collections classed and arranged, at from 2 to 50 guineas. Mr. MAWE has connexions in all the Mining districts of Europe, Brazil, North America, Ceylon, &c. from whence he receives the finest productions of those countries, and being concerned in several Mines in this kingdom, he regularly receives their finest produce; which, connected with his Manufactory in Derby, for forming Vases, &c. of the beautiful Fluor of that county, he is enabled to vend Minerals on the most reasonable terms.

New Descriptive Catalogue, price 3s.

The best Books on the subjects of Mineralogy, Geology, and Conchology, and whatever relates to those Sciences.

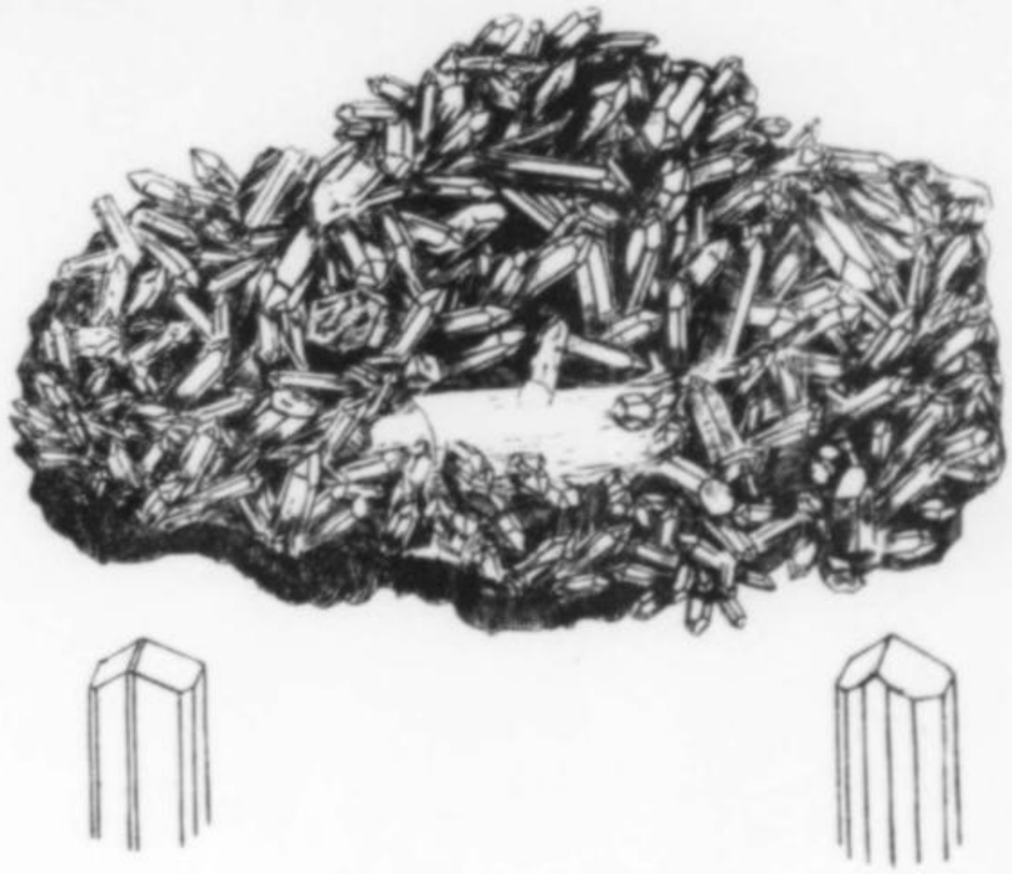
Incidentally, the leaf on which the above advertisement appears was almost always removed when the parts were permanently bound, and it is known today, apparently, in only a single example![2]

There is, so far, only one bibliographical "point" that has been noted in *British Mineralogy,* and that is the mis-numbering of Plate 421 as 221 in some copies and the subsequent correction of this error. Consequently there are first (or early) and second (or later) issues of the edition. The first or "uncorrected issue" shows the number 221 engraved on the plate, whereas the second or "corrected issue" bears the proper number, 421. This information could conceivably be used in a book-seller's catalog to praise the virtues, real or imagined, of an early (as opposed to a late) impression of the plate(s). Plates 413 and 415 have had their numbers interchanged in *all* the copies that this writer has examined, and unless a copy comes to light where this is not the case, this is not a second "point."

In his introduction to *British Mineralogy* Sowerby states quite accurately that the "undertaking [of this work] was begun at a time when we [the British] had but just become aware of how far we were behindhand in this most essential knowledge, when even the Diamond, one of the oldest jewels in the known world, had but recently been discovered to be pure carbon" (by Smithson Tennant in 1796).

One of the most historically interesting plates in *British Mineralogy* is "Tab. CCCXXXI. ARGILLA electrica. White Tourmaline." Depicted is a mass of terminated quartz crystals, in the center of which is a large, white, prismatic crystal whose rhombohedral nature is clearly indicated by the two crystal drawings at the bottom of the plate. Sowerby states:

> This substance which seems almost new to the whole mineralogical world, not being spoken of by any author, was sent me in 1804. It was said to be found in a mine in St. Justs in Cornwall. I speak of it as new, being really a white Schorl or Tourmaline; for though Tourmaline is said to occur of all the colors in mixtures of yellow, red



> and blue, yet it is not mentioned as ever having been found colorless or white until now; therefore this is the rarest known.

It was, indeed, rare, except that now we know that Sowerby's "White Tourmaline" is actually the first description and crystal drawings of the mineral *phenakite,* which was not recognized as a new mineral species until its description by Nils Nordenskjöld in 1830. It was named phenakite by him, from the Greek for "deceiver," alluding to its deceptive appearance. Nordenskjöld considered that it could be confused with quartz however, not tourmaline. Incidentally, in the copy of *British Mineralogy* formerly in the library of Richard Hauck, penciled to the right of the printed words White Tourmaline are "Phenacite" and the initials "AR" which identify Sir Arthur Edward Ian Montagu Russell (1878–1964), a mineral collector extraordinary from Great Britain. Russell referred to this plate in 1920 when he wrote a paper on a later occurrence of phenakite in England. There were a few other such notations in Russell's holograph, but it could not be determined for certain if this copy was his very own. Sir Arthur's adventures and his generosity regarding minerals are fully and warmly covered by Embrey and Symes in their excellent book *Minerals of Cornwall and Devon* (London, 1987).

Sowerby can be forgiven for a lapse into nationalism when he stated, near the end of Volume V of *British Mineralogy,* in the description of Tab. 548:

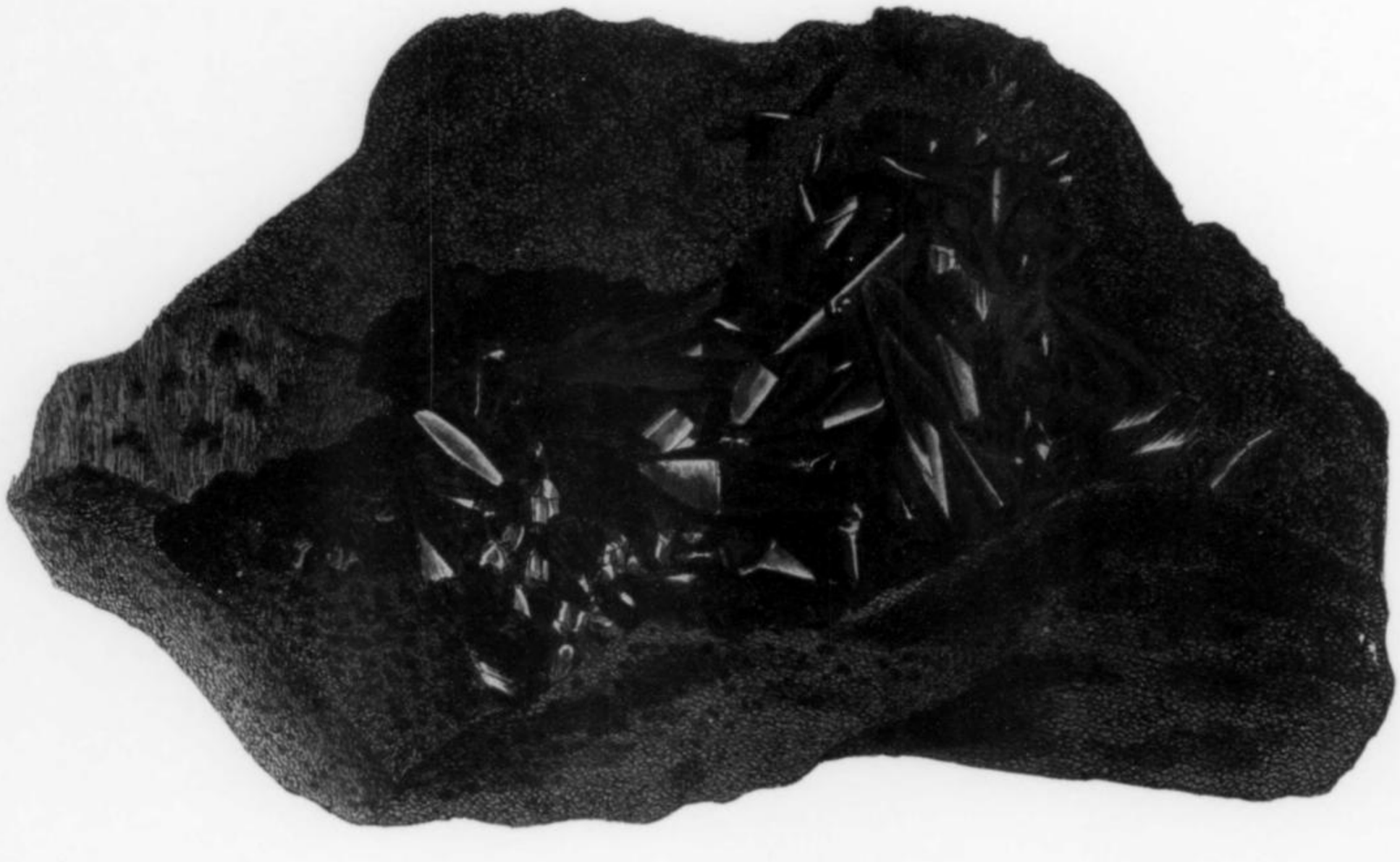
> Before closing this work, it is a pleasure to meet with a triumphant and unexpected example of the produce of a country [England] hitherto but rarely quoted for any thing fine. The magnificent Tourmalines, of which I now figure two specimens, may vie with any thing of the kind brought from foreign climes . . .

The tourmalines (schorl) from near Bovey Tracey, Devon, are indeed fine and actually superb (although

---

[2]The copy of *British Mineralogy* containing the Mawe advertisement was listed for sale by William Patrick Watson of London as number 92 in his *Catalogue Three.* The price asked was £6000 which, on October 26, 1992, equaled $9,500. It is the same copy listed by Antiquaariat Junk at 19,000 Dutch florins ($12,000), and Mr. Watson informed me that he and A.J. were partners on the book.

The original pyrargyrite specimen (right), now in the collection of Steven Smale, and the corresponding image in Exotic Mineralogy *(plate 33). The specimen, probably from Saxony, measures 7.7 cm. Sowerby borrowed it from the collection of his friend W. Edmund Rundell. Sowerby drew the image (correctly) on the engraving plate, but the resulting print is a reverse image. All Sowerby plates are mirror images of the actual specimens. Photo by Jeff Scovil.*

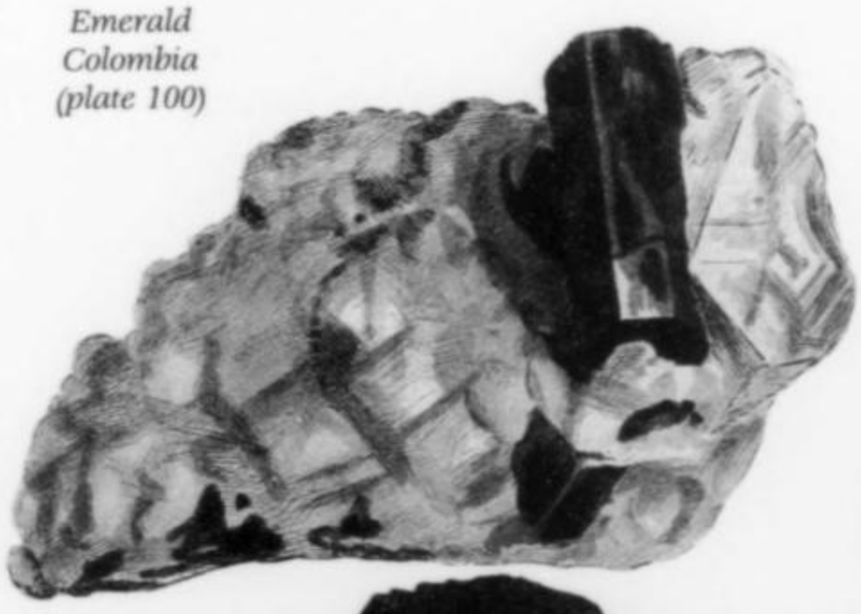


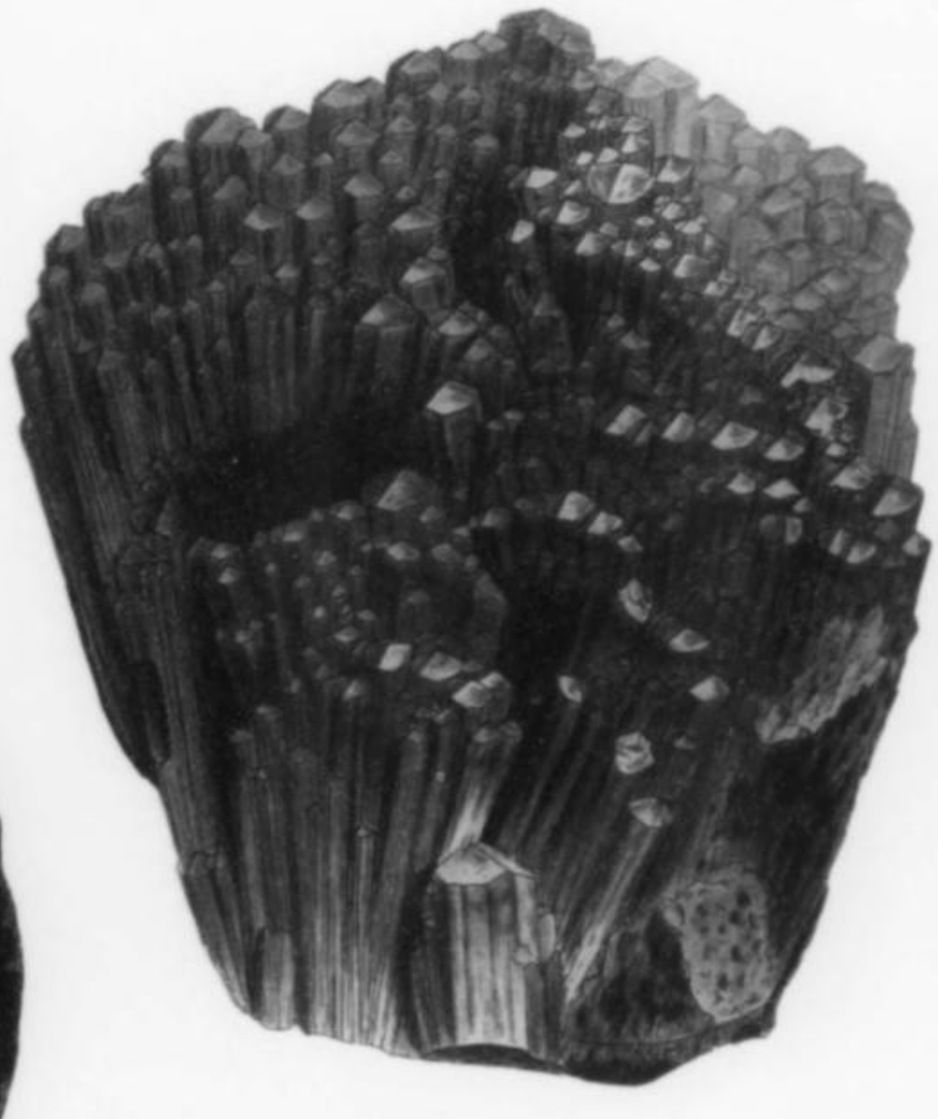
Crocoite from Berezov, Russia (plate 4), "the best part of" a specimen from the collection of Charles Greville.

Cyanotrichite
Oravicza, Romania
(plate 109)

Sulfur
Sicily
(plate 117)

Emerald
Colombia
(plate 100)





Elbaite
Burma
(plate 89)

Specimen illustrations from Exotic Mineralogy.

some *British Mineralogy* plates depict specimens that are most unattractive) and in their day, before the tourmaline production from Brazil and elsewhere, must have created quite a sensation. Incidentally, the specimens from this occurrence probably rank today as the finest tourmalines ever found in Great Britain. Their collecting history is most interesting, and Sowerby was informed that "a barn was built with some of the largest and finest specimens before it was observed by a Gentleman in the neigbourhood." The barn was pulled down to recover the minerals from its foundation, and it is recorded that some specimens in private collections were seen with evidence of mortar remaining on them! A modern depiction of one of these crystals, the largest known, can be found on page 125 of *Minerals of Cornwall and Devon,* cited above.

Excellent apatites were found there too, and they are described separately by Sowerby in the next plate, Tab. 549. John Mawe wrote a paper "On the Tourmaline and Apatite of Devonshire" in *The Quarterly Journal of Science* in 1818. Sowerby also states in the tourmaline description that he was "favoured with the choice of Mr. Brooke's and Dr. Somerville's specimens, collected on the spot by them together." It is apparent that in addition to these pieces, many of the other specimens illustrated in the 550 plates were part of Sowerby's own collection at the time, and this might explain the mediocrity of some of them. This assumption becomes more likely when one compares these less attractive specimens to the examples depicted in *Exotic Mineralogy* wherein Sowerby, with the entire world as his territory, could be more selective without trying to be as comprehensive in the coverage of these foreign specimens.

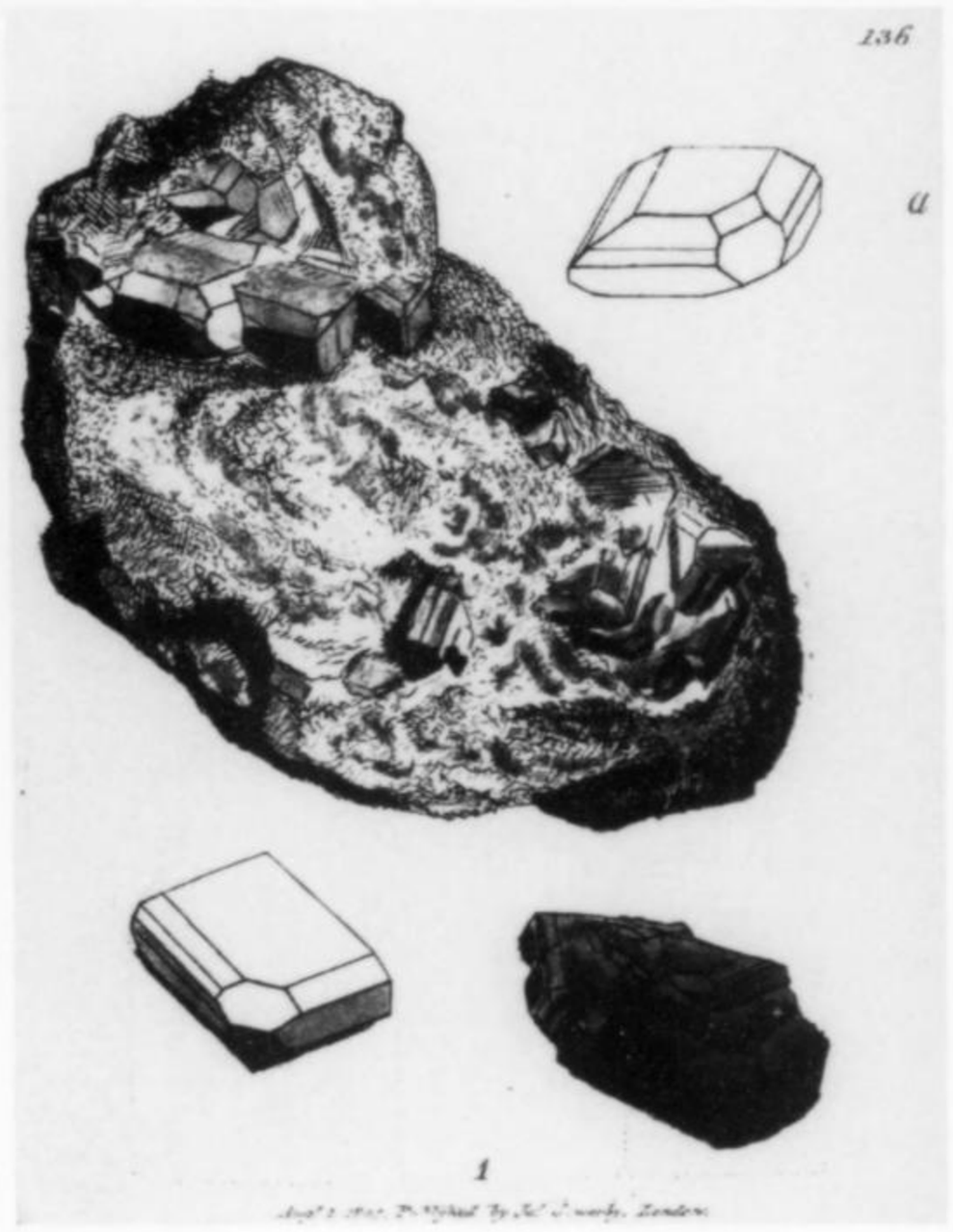
In *British Mineralogy* Sowerby tried to bring some order out of the then-current mineralogical chaos, and he concocted an elaborate Linnean-style, binomial Latin classification as the heading for each mineral description. Mineral names were used infrequently and the chemistry of the mineral was generally listed first, for instance "Zincum carbonatum," followed by "crystallized Carbonate of Zinc" or "Zincum oxygenizatum (siliciferum), Silical Oxide of Zinc." Here he added "Class 3. Metals. Ord. 1 Direct Combinations. Gen. 4 Zinc. Spec. 1 Oxide. Sect. 2. Silical."

An early visitor to Mead Place, Eric Thomas Svedenstierna (1765–1825) of Sweden, noted that Sowerby was at that time organizing his mineral collection according to Haüy's system. Sowerby gave up completely on his binomial Latin classification in *Exotic Mineralogy.* This visitor also noted that Sowerby's collection of minerals was growing rapidly.

A recent depiction of a fine specimen that was originally illustrated in *British Mineralogy* appears on page 77 of *Minerals of Cornwall and Devon,* wherein the authors, in typical British understatement, inform us:

> This specimen (BM 1976, 246) [chalcocite] was bought in 1976 from the dealer Brian Lloyd, who acquired it as part of the Neeld collection formed in the early nineteenth century. It is so closely similar to the one owned by '___ Lounds [should be Lowndes] Esq.' figured by James Sowerby in his British Mineralogy (1817 vol. 5, Tab. DXVIII), *that it may well be the same.* (Italics added.)

I and others I have consulted are all convinced that this specimen is *indeed* the original illustrated specimen.



Bournonite, plate 136

How interesting it is to study Tabs. CXXXV and CXXXVI and see two fairly easy-to-identify examples of what Sowerby called "PLUMBUM cupreoantimoniatum sulphureum" and to read further that Jacques Louis, Count de Bournon (1751–1825) had determined much of their habits of crystallization. We are, of course, looking at examples of the mineral which, shortly after the Sowerby depiction, was named *bournonite* by Robert Jameson in 1805.

Although the nature of meteorites was not fully understood in the early 19th century, James Sowerby knew full well the value to his public of anything new and unusual, and to the best of his ability he exploited one of the first recorded English falls, "The Yorkshire Meteorite." This famous stone fell, duly observed, at approximately 3 p.m. on Sunday, December 13, 1795, and was fully appreciated by the owner of the property on which it landed, one Major Edward Topham,

who even went so far as to erect a tablet at the site of the fall which read as follows:

Here
On this Spot,
December 13th 1795, fell from the Atmosphere
An extraordinary Stone!
In Breadth 28 inches,
In Length 30 inches,
and
Whose weight was 56 pounds!
This Column
In memory of it was erected by
Edward Topham
1799

Apparently, by 1804 this "extraordinary stone" had become the property of James Sowerby and his Museum for "the Sum of Ten Guineas [ten and one-half pounds] to be paid [to Edward Topham] at present and the Work [British Mineralogy] complete of the first Impression of the Plates and elegantly bound and lettered" according to the terms put down in a letter from Edward Topham to James Sowerby, dated November 1. What would a book-collector of today give to own (or even to see) that particular set, all "elegantly bound and lettered"? Most sets known to this writer that have survived in their contemporary coverings (not the paper wrappers, of course) have been rather modestly bound, usually in 1/2 or 3/4 leather with decorated, usually marbled, paper-covered boards. The most "elegantly bound" copy that I know of is a fine, tall set in full contemporary stiff vellum with gilt lettering and gilt decoration that retains the bookplates of the Earl of Tyrconnell.

Of course, Topham had to wait 13 years until the completion of *British Mineralogy* in 1817 to have this deal consummated, and, assuming he got his set promptly, he lived to enjoy it for only 3 years. However, this cash and barter deal proved to be a good investment indeed for the Sowerbys. In addition to the obvious value of the meteorite's presence in the family museum and all the publicity it garnered for more than 30 years, the British Museum purchased it from them in 1837 for the sum of £250. The price is believed by modern-day experts to have been an exorbitant one for its time, and perhaps this account waited to be balanced out by those 9-shilling specimens illustrated in *British Mineralogy* that were sold by the Sowerby descendants almost 100 years later!

Today, the "Wold cottage chondrite," as the Yorkshire meteorite is now called, weighs only 45.5 pounds, down from its original weight of 56 pounds. It is known from correspondence in the British Museum (Natural History) that Sowerby exchanged fragments that he broke off this meteorite for natural history specimens sent to him by his correspondents. Sowerby relates the story of this meteorite in great detail in *British Mineralogy,* including a long account of it by Topham, as part of a 19-page discussion (his longest) with Tab. CI.

A watercolor portrait of James Sowerby (see p. 86) rendered by Thomas Heaphey (1775–1835) in the year 1816, and still in the possession of his descendants, shows him seated with volumes from his *English Botany, British Mineralogy,* and *Exotic Mineralogy.* Also depicted is a large crystal model and, dominating the painting, apparently still most prestigious after more than 20 years, even with its rather fresh looking (Sowerby-inflicted?) broken surfaces, *The Yorkshire meteorite.*

Sowerby's goal was to produce a *complete* popular mineralogy based on British specimens alone, but eventually realizing that not every mineral then known could be found in England, and that some might never be found there, he began a second series of mineral copper-plates and descriptions in order to complete his plan; he called it *Exotic Mineralogy,* the "exotic" meaning from outside Britain.

EXOTIC MINERALOGY

Exotic Mineralogy: Or, Coloured Figures of Foreign Minerals, as a Supplement to British Mineralogy was also issued in parts, between 1811 and 1820 as enumerated in Table 2. The index to *Exotic Mineralogy* was sent to the subscribers in 1835.

The information in Table 2 is based on a nearly complete and probably unique set in original wrappers in the British Library. It lacks only the final part or parts after number 27 and the index; the information above is taken from the Woodward catalog. Number 17 was, in effect, a double number as it included the final text and plates for Volume I and the first text and plates for Volume II. It was at this time that Sowerby projected completing a total of 33 parts, but never reached that number. Because no part in wrappers later than Number 27 has survived it is not clear whether one or two parts completed the work. In either case, there were 10 more pages (141–151) and six more plates (CLXIV–CLXIX).

The wording of the title as it appears on the first wrapper is slightly different (and, I think, a little better than that used on the book title pages): *Exotic Mineralogy: Or, Coloured Figures of Such Foreign Minerals as are Not Likely to be Found in Great Britain, as a Supplement to British Mineralogy, Making Together a Complete Mineralogical Cabinet.* On the front cover of this first wrapper Sowerby made his pitch: "As Cabinets of Foreign Minerals . . . often contain very magnificent specimens or particular rarities, and as these are in the hands of private individuals, Mr. S. takes the liberty to observe, that he will be grateful for any assistance or information."

Exotic Mineralogy is complete with 167 *colored*

EXOTIC MINERALOGY:

OR,

COLOURED FIGURES

OF

FOREIGN MINERALS,

AS A

SUPPLEMENT

TO

BRITISH MINERALOGY.

BY JAMES SOWERBY, F.L.S.

HONORARY MEMBER OF THE PHYSICAL SOCIETY OF GÖTTINGEN,

DESIGNER OF ENGLISH BOTANY AND EXOTIC BOTANY, AUTHOR OF ENGLISH FUNGI, THE BRITISH MISCELLANY, NEW ELUCIDATION OF COLOURS, ETC.

LONDON:

PRINTED BY BENJAMIN MEREDITH, SILVER STREET, WOOD STREET, CHEAPSIDE;

And sold by the Author, J. Sowerby, No. 2, Mead Place, Lambeth; White and Co. Fleet Street; Sherwood and Co. Paternoster Row; and by all Booksellers in Town and Country.

MDCCCXI.

plates, plus one *uncolored* plate, for a total of 168, with letter-press descriptions for each, although most bibliographies including a most recent one call for 169 plates. No plate numbered 73 was ever issued, and on the rear of the wrapper for Part XVI the author explains why: "This plate [93] was formerly intended to have been published as tab. 73, but more figures being required, the two plates of Turquoise are numbered in succession, 92 and 93." In some copies of this work the *turquoise* plate was printed bearing the original engraved number "73" and was not changed to the corrected number "93" until sometime later, thus creating the first and second issues of this edition. The first, or "uncorrected issue" retains the original engraved number 73 and the second or "corrected issue" displays "93"—a "point" to be looked for if one wishes.

Exotic Mineralogy, with its 167 colored plates, is second in importance only to Sowerby's own earlier work, *British Mineralogy,* in the mineral color-plate book category, and had that work never been published, *Exotic Mineralogy* would be the most significant publication *ever* in terms of size, scope and quality of workmanship. In my opinion, the only possible comparable works are Rashleigh's *Specimens Of British Minerals* (1797–1802), containing only 54 (albeit, quarto-sized) colorplates and, perhaps, but to a significantly lesser degree, the color-plate German language works *Das Mineralreich in Bildern* (1858) by J. G. Kurr, and F. A. Schmidt's *Mineralienbuch* (1850).

On the rear wrapper of Part XVII of *Exotic Mineralogy,* in a notice from the publisher, we read:

> It being necessary to form two volumes of this work, which will be completed in sixteen more Numbers [a total never reached] we recommend the possessors of it to have the first volume put in boards without cutting [the edges of the pages], that the two may be arranged according to an Index which will be given in the last Number.

So, it would be reasonable to expect to find an occasional Volume I of *Exotic* in contemporary boards, and I know of, but have not examined, such a volume. Incidentally, the subscribers to *Exotic Mineralogy* did not receive a printed index until *fifteen years* after receiving the final part. A separate index, including an "advertisement," was supplied by the Sowerbys in 1835, with instructions that it was to be bound at the end of Volume II. It is not surprising, therefore, that we find copies of the work complete but with the index lacking.

By the time of the completion of Volume I of *Exotic,* Sowerby had noticed two problems that we today see occasionally in his works, namely the off-setting of the pigments and gum-arabic from the plates, sometimes resulting in their adhering to adjacent leaves; and the off-setting of the ink from the letter-press descriptions. So, he cautioned his subscribers (and their binders) with a half-page note-from-the-publisher included in Number 17, which note, incidentally, is a rare survival. I know of only two copies. Such a note would have been routinely removed when the volume was permanently bound. It states:

> One of the plates in this Number [Tab. 104, a large Chessy, France azurite, richly colored with blue pigment and coated with gum arabic for luster] being from necessity coloured with a substance very deliquescent in its nature, renders it particularly proper at this season of the year to caution our Readers against suffering the book to be laid in a damp place . . . [and to] keep the Numbers always in a dry place . . . give directions to Binders never to damp or beat [which is excessive flattening of the sheets of] the volumes . . . but only to *dry-press* them well, as from their [the binders'] ignorance, coloured prints are frequently spoiled, and by their beating, the letterpress commonly sets off on the plates.

In some of the numbers of the copy of *British Mineralogy* in-parts in the Obodda library, are tissue-guards presumably supplied by the publisher, but which would have been removed during binding. In

an almost complete Volume I of *Exotic* in parts are *no* surviving tissue guards. Most mineral-book collectors of my acquaintance, when confronted with off-setting, and the occasional stuck-down plate, simply assume that Sowerby stacked wet painted plates or wet inked text sheets together.

Exotic Mineralogy is, for some yet-to-be discovered reason, a *much* rarer work than *British Mineralogy* on the antiquarian book market. In one series of entries, extracted by a bibliophile from booksellers' catalogs between the 1940's and the 1980's, *complete* copies of *British* were available for sale *fifteen times* whereas only a *single offering* of *Exotic* was present. And this becomes even more surprising when one considers that *Exotic,* in only two volumes, was much easier to complete than its companion work. The legendary George Frederick Kunz library, now at the United States Geological Survey, owns only the first volume (although the Kunz copy may have been complete originally). It has been suggested that the nationalistic pride that resulted from their seeing *native* minerals depicted in *British Mineralogy* prompted gentlemen of the period to become subscribers, and that the *exotic* (or foreign) specimens were, simply, of significantly less interest to them. But, if one is to take Sowerby at his word, he seemed quite satisfied with sales of the book, and he wrote in the preface of Volume II of *Exotic* in 1817 that:

> It was under the impression that about 100 plates of Minerals not known in Great Britain would have been a sufficient Appendix to *British Mineralogy,* for the student, that I commenced this work; but since 1811 so many new species and strongly marked varieties have crowded upon me, *and so anxious have been my friends to see every thing extraordinary commemorated . . . I trust that the utility of the work having been acknowledged by the reception the first volume has met with . . .* (italics added) will render it equally interesting, and make the extension acceptable.

All should agree that these are not the words of an author-publisher who is unhappy with the reception of his work by the public. Perhaps the answer will never be known.

Sowerby's introductory remarks in the preface of Volume I of *Exotic* are also of interest:

> It was under rather peculiar disadvantages that my work upon British Minerals with figures was begun, as Mineralogy was considered merely as an appendage to Chemistry, and it was thought that figures would not elucidate it; but Mineralogy has now gained more importance, [perhaps due in part to the success and popularity of *British Mineralogy*] and figures have been found much to facilitate the study of that, as well as of the other branches of science. It is almost enough that a Mineralogist should know how far this empire is blessed with native Minerals, which since my work has been in its progress, are so much augmented, that but few are to be added, even from the whole remaining part of the globe. Indeed most former English authors, depending chiefly upon foreign information, did not know what was to be found at home; thus while the British Minerals require five or six volumes, the Exotic ones may be figured sufficiently complete in only one more, perhaps. The little catalogue [*Catalogue of British Minerals, Chiefly in the Collection of James Sowerby.* London, 1811] which I have just published will serve to show this, and as I do not profess to enter largely into a collection of Exotic Minerals, I am happy to say that the generosity of those who possess the most perfect Cabinets fully supersede the necessity of so doing.

Although Sowerby stated that he did not want to collect foreign minerals, at least on the same scale as his British minerals, apparently he had many. It can be safely assumed that he was extremely careful in giving full credit to whomever supplied a specimen for illustration, yet for many of the depicted specimens he cited nothing in the way of provenance, leaving the reader to assume that those specimens were his own.

The death in 1809 of the Honorable Charles Francis Greville (a mineral collector extraordinary and one of Sowerby's closest colleagues), during the time of the writing of *Exotic Mineralogy,* apparently gave the author some very nervous moments. We read in the description to Tab. IV:

> This beautiful specimen [of crocoite is] from the mine of Berezof, near Catherinbourg, in Siberia. The remarkable richness of colour that it possesses is nearly peculiar to itself, and is very characteristic of the truly orange and scarlet. Specimens so fine as the present are very valuable; this is the *best part* [italics added] of a superb one in the Collection of my late friend the Hon. Charles Greville, whose liberality invited me to partake of his matchless cabinet, with the pleasantest freedom, and I am happy to show this [the crocoite] as a proof of his generosity, which may be seen also in *British Mineralogy* and as our Government has secured them [the Greville minerals] in the British Museum, *I may still hope to find a continuance of such favors.* (Italics added.)

Apparently Sowerby's fears were groundless, and he stated in the preface to Volume I, which was written after the *crocoite* description:

> The first subject begun for this work. viz. the superb Chromate of Lead [crocoite], was drawn at my much to be lamented friend's, the Hon. Charles Greville, and I depended greatly on his

> matchless collection, and by application to the Trustees of the British Museum, who have so honorably interested themselves in securing this treasure to their country; *I have to thank them for the free access to it which I now enjoy.* (Italics added.)

Sowerby, for artistic purposes, often illustrated *only parts* of certain specimens, as noted above, without so indicating, and took other liberties in his illustrations, such as restoring or idealizing broken or incomplete crystals; one case in point is tab. CXVII, sulfur, surely one of the prize engravings of *Exotic Mineralogy.* In the description the author tells us that he "selected for this purpose the most magnificent group of crystals [of sulfur] ever brought to England; *but as the mass upon which they repose is very broad, I have omitted a great portion of it, using principally the central parts, and condensing them a little.*" (Italics added.)

The Greville collection was a very important one and its sale to the British Museum was reported by Archibald Bruce in number 2 of his *American Mineralogical Journal* published in New York City in 1811. The article, on page 122, is as follows:

> Mr. Greville's Cabinet.
>
> This splendid collection of minerals has been lately purchased by the British government for 13,727 £. sterling, and now forms a part of their National Museum. The commissioners appointed to examine and value this cabinet, in their report to the committee of the House of Commons, concurred unanimously in giving a public testimony of the merits and services of Count Bournon, to whose exertions and talents the systematic arrangement of this collection is due.

Bruce also reported that Greville had purchased the "celebrated" mineral collection of Baron von Born, brought it to England, and "afterwards added an immense number of minerals from every part of the globe. . . . Thus his collection, before his death, had become, for the beauty of the specimens and their immensc variety *the first in the world.*" (Italics added.)[3]

One of the great treasures of the Greville collection was pictured by Sowerby in *Exotic* as Tab. LXXXIX. It is a marvelous group of tourmaline crystals from Ava (Burma), that was valued at the time at the very significant sum of £500! It is so large that Sowerby, in order to show the great specimen at natural size, was forced to engrave it on a double-sized copperplate, and he then had to fold the resulting print to fit it in the book.

For *Exotic Mineralogy* Sowerby dropped his awkward attempt at mineral classification, except for the Latin binomial title. In place of the later subdivisions he listed the various names by which the mineral was known at the time and cited numerous authorities, such as Bournon, Daubenton, De l'Isle, Emmerling, Haüy, Jameson, Karsten, Kirwan and Werner.

Sowerby had another opportunity, as he had in *British Mineralogy,* to discuss meteorites. In this instance an eight-page summary of the knowledge of the time included, in the discussion for Tab. 163, a very interesting personal experience as follows:

> Fig. 3. is from my specimen of the Iron found near the great Fish River; it was obtained at the Cape of Good Hope, and brought to England by Fichtel . . . [It is known today as the Cape of Good Hope meteorite.] This is extremely pure and compact; it is considerably harder, but otherwise much of the texture of Lead; it is not elastic when sawn into slices, but is easily rendered so by hammering; a shaving taken from the surface by a chizel is elastic without any further operation; it is so ductile and free from flaws that it may readily be rolled into sheets thinner than paper without cracking; its hardness is such that it takes an excellent polish, its lustre is superior to that of pure Iron, and its colour nearer that of silver. These properties rendered it an excellent material for a sword blade, consequently, upon His Majesty the Emperor of Russia visiting England, I had a slice 2 inches and three-fourths long, 2 inches wide, and nearly three-fourths of an inch thick, hammered at a low heat into a blade 2 feet long, and 1-1/2 inch wide, which welded into a steel haft, and mounted, I presented to his Majesty as a memorial of his visit.

The following inscription was engraved on the blade:

---

[3]For some reason, Greville, whose older brother was the very important Earl of Warwick and who was a nephew of Sir William Hamilton (1730–1806), author of the magnificent *Campi Phlegræi, or Observations on the Volcanoes of the Two Sicilies* . . . (Naples, 1776) with more than 50 magnificent handcolored plates, is not listed in the British *Dictionary of National Biography.* Archibald Bruce may have cited the reason when he wrote in his *American Mineralogical Journal*—"It may be easily supposed, that with the name and influence of the house of Warwick, the genius of such a man as Mr. Greville would not leave untried the more usual walks of ambition: *but having sided against the Court* [the King] *in the memorable American war* [of the Revolution] *he lost its favour,* [italics added] and philosophy had him for her own [that is, he was denied the political offices that would normally have been offered to a person of his social position]. He did not however, refuse to his country the knowledge of his comprehensive mind." Or, perhaps the *D.N.B.* simply missed him.

> This Iron having fallen from the Heavens, was upon His visit to England, presented to His Majesty Alexander, Emperor of all the Russias, who has successfully joined in Battle to spread the blessings of peace throughout Europe, by James Sowerby F.L.S., Honorary Member of the Physical Society of Gottingen, &c., June, 1814. [On the other side of the blade was engraved:] Pure Meteoric Iron found near the Cape of Good Hope.

One wonders what the knifesmiths of today, who believe that they are the originators of meteoritic iron knife blades, would think if they knew they were merely following a tradition originated by an Englishman in the year 1814.

Sowerby further remarked that "His Imperial Majesty [Czar Alexander] has expressed his approbation, by sending me a superb Emerald ring set with Diamonds, for which I feel Highly grateful." The ring apparently still survives in the hands of a Sowerby descendant.

For collectors of minerals in general, *Exotic Mineralogy* is rather more interesting than the narrower-in-scope, more specialized, *British Mineralogy,* and many of the depicted specimens are still highly prized today. For instance, the Colombian emeralds in Tab. C. (with their locality given as "Peru," of which present-day Colombia was once a part), certainly two of the finest matrix specimens known, are called by Sowerby "the pride of the collection at the British Museum." In Tab. CLVIII we see Kongsberg, Norway, silver specimens that would quicken the pulse of any modern-day collector.

We can read a little about Sowerby's "network" in Tab. CLXII. Writing of a rare example of "Argentum (sulphureum) flexile" (= sternbergite) he said that "the only specimen in England is the one figured; it was found in Mr. Partsch's cabinet of Minerals at Vienna, among the ores of Tellurium, and was brought to England with it by my son G. B. [George Brettingham] Sowerby."

Collectors of today know well the usual means of acquiring mineral specimens (that is field collecting, exchanging and purchasing), but Sowerby, in the description for Tab. XL, adds an entirely new dimension. He tells of Mr. Allan's (Thomas Allan, 1777–1833, after whom *allanite* was named) good fortune in obtaining a collection of Greenland minerals that were part of the booty on board a Danish vessel captured by a British privateer. We read later, in the discussion of Tab. LVIII (*allanite*), that the specimens belonged originally to Karl Ludwig Giesecke (1761–1833), a German mineralogist. What story lay behind the fact that in 1813 the very same Thomas Allan described and named *gieseckite*? In this description Sowerby gives us some clues as he relates:

> It [the mineral about to be named allanite] was placed in the hands of Dr. Thomson [Thomas Thomson, 1773–1852, after whom *thomsonite* was named] who, having analyzed and described it, gave it a name after its proprietor [owner, that is, Allan] not knowing at the time the person to whom it would have been more handsome and more correct to have done that honour [i.e. Giesecke].

These were uncharacteristically strong words from Sowerby, and are not equaled elsewhere in either publication. In Tab. CI. (the description of gieseckite) the cat is out of the bag, and Sowerby related:

> The persevering researches of Sir Charles Giesecké, in Greenland, have been productive of several new and many rare Minerals, some of which a less intelligent Mineralogist would have passed over. *The fortune of war had for some time deprived him of the honour due to his discoveries;* [italics added] but now his merit is every where fully admitted.

There is one enticing and provocative little tidbit in the description to Tab. CXVI in which the author thanks "Professor Herrmann" for a drawing of (or, possibly, for the crystal itself) a specimen of "sulphuret of antimony" (= stibnite) illustrated as part of the plate. It is just barely possible that this is a reference to Professor Charles W. A. Herrmann (1801–1898), who was the subject of my short article in the *Mineralogical Record* (vol. 25, p. 225). Herrmann's obituary states that he was "educated at the University of Breslau, and turned his attention to the study of stones with such good effect that after his graduation, he became Professor of Mineralogy at the university." Since Herrmann was born in 1801 and Tab. CXVI was published in 1818 he would have been a very young professor indeed, but it *is* possible and perhaps he was another one of Sowerby's many correspondents.

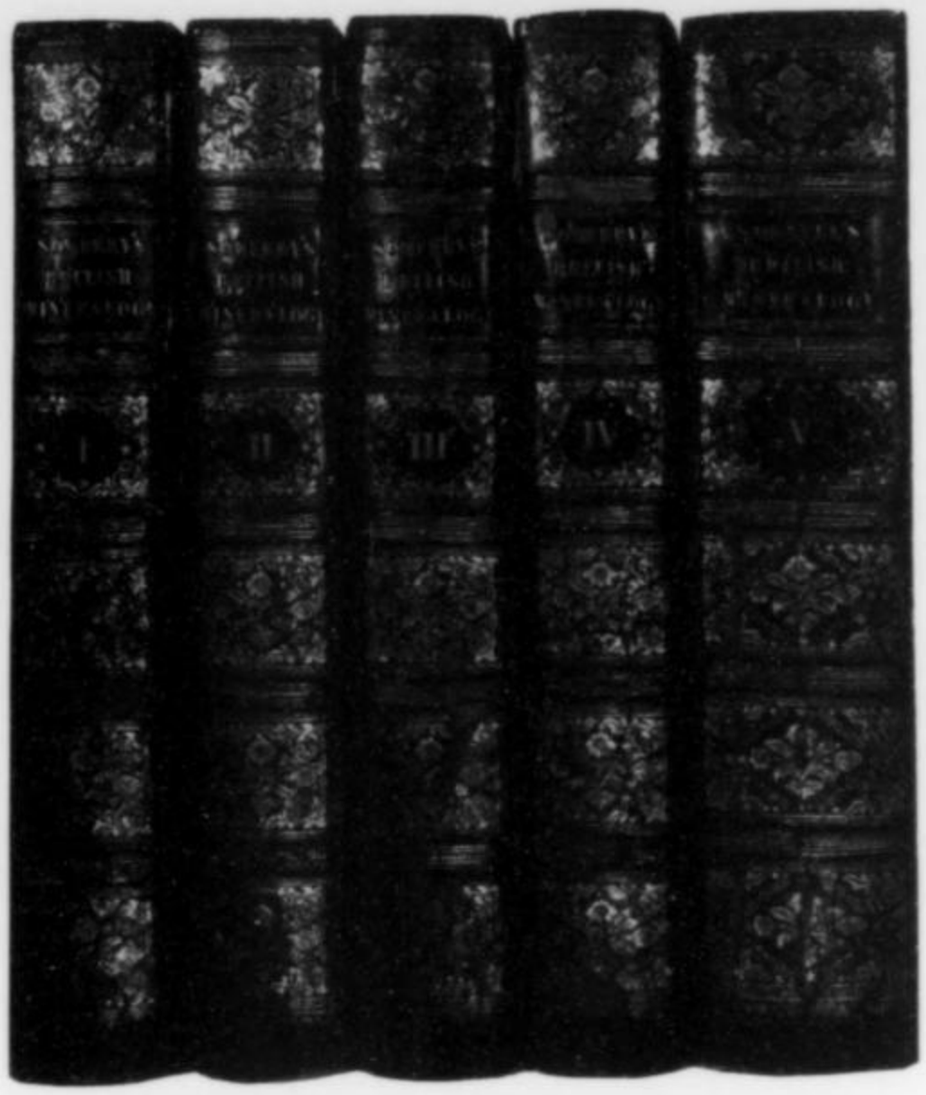
Did Sowerby cheat a bit when he included a *Welsh* specimen in his *Exotic* collection? (Or did 19th-century Englanders regard Wales as a foreign country?) In Tab. LXXXII he described *aplome,* a variety of garnet, and remarked that "it bears a considerable resemblance to common Garnet, but is distinguished from it by the striæ along the short diagonals of the faces. . . ." He added, "I am informed by Mrs. Mawe, from whom the Count [Bournon] obtained it that it was found in digging a well in some part of North Wales." He apologized by adding, "When I completed *British Mineralogy* I had not ascertained this fact." Mrs. Mawe is mentioned elsewhere in this work as a lender of mineral specimens and seems always to be associated with what we call today, "thumbnails" or thumbnail-sized minerals. Sowerby took a similar detour in Tab. CXXX when he discussed a not-too-exotic Scottish staurolite.

Sowerby committed an error in Tab. XXXI, but it was probably only of the typographical variety. In the

description of a specimen of molybdate of lead (wulfenite) from Carinthia, he refers the reader to a projected plate which he said would be number 158, and which he said would discuss "yellow phosphates from Wanlock-head mine, near Glasgow." At that time no plate 158 was even planned and although the number 158 was eventually used by him, it describes native silver.

American minerals make a very good showing in *Exotic Mineralogy* when one considers the primitive state of mineralogy and mineral collecting in America at this time. They are represented by Tab. VI "Ferrum columbiatum . . . or Columbite," a specimen that came from an unspecified locality which is thought to be a Connecticut or Massachusetts pegmatite. According to tradition it was sent to Sir Hans Sloane in London by the American John Winthrop or possibly his grandson, John Winthrop the Younger, in the 18th century. Tab. LX describes "Ferrum chromiferum" or *chromite* from a site near Baltimore, Maryland, which almost certainly must be the Bare Hills. Tab. LXXV discusses "Magnesia hydrata. Hydrate of Magnesia" or *brucite,* named later for Archibald Bruce (1777–1818) who discovered the species and who presented the figured piece to the British Museum. The description for Tab. LXXXIV, "Zincum oxygenizatum, Oxide of Zinc" or *zincite* from the Franklin area in New Jersey notes that its discoverer was also Archibald Bruce.

Sowerby lavished particular care and attention on the *diamond,* devoting two plates to it (Tabs. CXVIII & CXVIX), although the second plate is merely one of crystal drawings and is uncolored. In the discussion of these plates we learn that the great blue diamond that was later to be known as the "Hope Diamond" apparently belonged at that time to "Daniel Eliason, Esq." of London. Mrs. Mawe's cabinet was again called upon to supply no less than eight of the figured diamond crystals, gratefully acknowledged, of course, by the author.



A complete set of British Mineralogy *in a contemporary binding.*

BOOK MARKET PRICES

A little bit of the history of the retail pricing of *British Mineralogy,* mostly from my personal experiences, might be interesting. Before my book-collecting days, in 1940, Henry Sotheran, London bookseller, had offered a complete copy for $30. About the year 1960 I bought my first copy from Hugh A. Ford for $90 and sold it shortly thereafter for $125. The next copy to come my way, in 1972, was bound in contemporary three-quarter calf and I sold it for $600. In 1974 the booksellers Antiquaariat Junk listed a copy for $950. My third copy came from Antiquariaat Junk in 1979 for, a price more than double the price of that 1974 set, $2,050. It was in a contemporary German binding of rather unattractive, mottled, black paper-covered boards with orange labels, and was bound in ten volumes, five of plates and five of text. Less than one year later, in 1980, my next set came *also* from Antiquariaat Junk, but this time at $4,500, which was more than *double* (again) the price of the previous copy. (When I was writing this I was reminded of the Pete Seeger folksong "We all keep-a-doppleing . . . ," but Seeger was not referring to sets of *British Mineralogy.*) It was, however, a fine, tall copy, sumptuously bound in full contemporary stiff vellum with decorative markings in gilt, and it came from the library of the Earl of Tyrconnel, retaining his armorial bookplates. This copy I sold to Richard Hauck in 1982, at cost, but with the understanding that I could retrieve it in exchange for another copy in the future. (I really loved that set and was sad to have parted with it.) My next copy did not come until 1990, and I paid $3,500 for it. It had been rebound in modern, full, dark-green calf by the prisoners of Warwick (Massachusetts) State Penitentiary and was of reasonably good workmanship. It had some penciled holograph notations by Sir Arthur Russell with his initials, and I used it to reclaim my vellum-bound set from Richard Hauck.

Since 1990, *things Sowerby* appear to have heated up significantly. At a New York City auction sale on August 18, 1992, a really poor set with much damage to all titlepages, one that some booksellers might catalog as "a fair copy only," sold for $5,280 to a European dealer who bought it, without inspection, for resale. Informed insiders, myself included, were betting that it would be returned to the auction house, but, apparently, we were wrong. More recently, Antiquariaat Junk (which firm I truly believe is a price trend-setter for this work and, of course, other important books too) listed a set in "contemporary half-green-calf, slightly rubbed," for 19,000 Dutch florins which, on October 22, 1992, amounted to

$12,350. Incidentally, in that same list they offered a copy of *Exotic Mineralogy* in "half-green-calf, slightly rubbed" which may have been bound *en suite* with the *British* (but was not so stated) for 21,000 Dutch florins or $13,700. The retail price these days for a fine, complete set of *British Mineralogy* seems to be around $12,000 and moving upwards (naturally), and somewhat more for a copy of *Exotic*. The traditional gap in price between *British* and *Exotic,* which exists mostly in the mineral-book-collecting world and not in the general book market, seems to be narrowing. This movement, in my opinion, is correct. Whereas it is true that *Exotic Mineralogy* is a very rare book, *British Mineralogy* is a much more important work and when you come right down to it, the latter contains three times the number of colorplates of the former!

Since this article was begun, a lovely, limited, reprint edition of *Exotic Mineralogy* in two volumes, complete with facsimiles of *all* of the mineral plates in fine color, has been produced by Wendell E. Wilson and the Mineralogical Record Library. One can only hope that, with sufficient encouragement from the readers, a complete *British Mineralogy* will be next.

CONCLUSION

The Sowerbys were unique. As a family their accomplishments are beyond comparison, and there will almost certainly never be another like them. Mineral and book collectors, especially those who want and can afford the wonderful Sowerby mineral works, will be forever grateful for these beautiful publications.

***Table 1.* Dates of issue for numbered parts of *British Mineralogy*.**

	Volume I	
No. I	November 1, 1802	Plates I–IV
No. II	December 1, 1802	Plates V–VIII
No. III	January 1, 1803	[Plates IX–XII]
No. IV	February 1, 1803	Plates XIII–XVI
No. V	[March 1, 1803	Plates XVII–XVIII]
No. VI	April 1, 1803	Plates XIX–XXIII
No. VII	May 1, 1803	[Plates XXIV–XXVIII]
No. VIII	June, 1803	Plates XXIX–XXXII
No. IX	July 1, 1803	Plates XXIII–XXIV
No. X	August 1, 1803	Plates XXXV-XXXIX
No. XI	September 1, 1803	[Plates XL–XLIII]
No. XII	October, 1803	Plates XLV–XLVIII
No. XIII	November 1, 1803	Plates XLIX–LII
No. XIV	December 1, 1803	Plates LIII–LVI
No. XV	January 1, 1804	Plates LVII–LX
No. XVI	February 1, 1804	Plates LXI–LXIV
No. XVII	March 4, 1804	Plates LXV–LXVIII
No. XVIII	April 1, 1804	Plates LXIX–LXXII
No. XIX	May 1, 1804	Plates LXXIII–LXXVI
No. XX	June 1, 1804	Plates LXXVII–LXXX
No. XXI	July 1, 1804	Plates LXXXI–LXXXIV
No. XXII	August 1, 1804	Plates LXXXV–LXXXVIII
No. XXIII	September 1, 1804	Plates LXXXIX–XCII
No. XXIV	October 1, 1804	Plates XCIII–XCVI
No. XXV	November 1, 1804	Plates [XCVII–C]
	Volume II	
No. XXVI	December 1, 1804	Plates CI–CIV
No. XXVII	January 1, 1805	Plates CV–CVIII
No. XXVIII	February 1, 1805	Plates CIX–CXII
No. XXIX	March 1, 1805	Plates CXIII–CXVI
No. XXX	April 8, 1805	Plates CXVII–CXX
No. XXXI	June 1, 1805	Plates CXXI–CXXVIII
No. XXXII	August 1, 1805	Plates CXXIX–CXXXVI
No. XXXIII	October 1, 1805	Plates CXXVII–CXLIV
No. XXXIV	December 1, 1805	Plates CXLV–CLII
No. XXXV	February 1, 1806	Plates CLIII–CLX
No. XXXVI	April 1, 1806	Plates CLXI–CLXVIII
No. XXXVII	June 1, 1806	Plates CLXIX–CLXXVI
No. XXXVIII	August 1, 1806	Plates CLXXVII–CLXXXIV
No. XXXIX	October 1, 1806	Plates CLXXXV–CXCII
No. XL	December 1, 1806	Plates CXCIII–CC
	Volume III	
No. XLI	February 1, 1807	Plates CCI–CCVIII
No. XLII	April 1, 1807	Plates CCIX–CCXVI
No. XLIII	June 1, 1807	Plates CCXVII–CCXXIV
No. XLIV	August 1, 1807	Plates CCXXV–CCXXXII
No. XLV	October 1, 1807	Plates CCXXXIII–CCXL
No. XLVI	December 1, 1807	Plates CCXLI–CCXLVIII
No. XLVII	February 1, 1808	Plates CCXLIX–CCLVI

No. XLVIII	April 1, 1808	Plates CCLVII–CCLXIV
No. XLIX	June 1, 1808	Plates CCLXV–CCLXXII
No. L	August 1, 1808	Plates CCLXXIII–CCLXXX
No. LI	October 1, 1808	Plates CCLXXXI–CCLXXXVIII
No. LII	December 1, 1808	Plates CCLXXXIX–CCXCVI
No. LIII	February 1, 1809	Plates CCXCVII–CCCIV

Volume IV

(Volume III actually ended in the middle of the previous number with Plate CCC.)

No. LIV	April 1, 1809	Plates CCCV–CCCXII
No. LV	June 1, 1809	Plates CCCXIII–CCCXX
No. LVI	August 1, 1809	Plates CCCXXI–CCCXXVIII
No. LVII	October 1, 1809	Plates CCCXXIX–CCCXXXVI
No. LVıII	December 1, 1809	Plates CCCXXXVII–CCCXLIV
No. LIX	February 1, 1810	Plates CCCXLV–CCCLII
No. LX	April 1, 1810	Plates CCCLIII–CCCLX
No. LXI	June 1, 1810	Plates CCCLXI–CCCLXVIII
No. LXII	August 1, 1810	Plates CCCLXIX–CCCLXXVI
No. LXIII	October 1, 1810	Plates CCCLXXVII–CCCLXXXIV
No. LXIV	December 1, 1810	Plates CCCLXXXV–CCCXCII
No. LXV	February 1, 1811	Plates CCCXCIII–CCCC

Volume V

No. LXVI	April 1, 1811	Plates CCCCI–CCCCVIII
No. LXVII	June 1, 1811	Plates CCCCIX–CCCCXVI
No. LXVIII	August 1, 1811	Plates CCCCXVII–CCCCXXIV
No. LXIX	October 1, 1811	Plates CCCCXXV–CCCCXXXII
No. LXX	December 1, 1811	[Plates CCCCXXXIII–CCCCXL]
No. LXXI	February 1, 1812	Plates CCCCXLI–CCCCXLVIII
No. LXXII	April 1, 1812	Plates CCCCXLIX–CCCCLVI
No. LXXIII	June 1, 1812	Plates CCCCLVII–CCCCLXIV
No. LXXIV	August 1, 1812	Plates CCCCLXV–CCCCLXXII
No. LXXV	February 1, 1813	Plates CCCCLXXIII–CCCCLXXX
No. LXXVI	July 1, 1813	Plates CCCCLXXXI–CCCCLXXXVIII
No. LXXVII	September, 1813	Plates CCCCLXXXIX–CCCCXCVI
No. LXXVIII	November 1, 1813	

The work was completed four years later and, if the usual format was adhered to, six or seven more parts were issued after No.77, but the publication schedule apparently slowed down significantly. The work concluded with Plate DL (550) in 1817.

Table 2. **Dates of issue for numbered parts of *Exotic Mineralogy*.**

Volume I.

Number 1, pages 1–12, plates I–VI — March 1, 1811

Number 2, pages 13–24, plates VII–XII — June 1, 1811

Number 3, pages 25–38, plates XIII–XVIII — Aug. 1, 1811

Number 4, pages 39–50, plates XIX–XXIV — Oct. 1, 1811

Number 5, pages 51–62, plates XXV–XXX — Dec. 1, 1811

Number 6, pages 63–71, plates XXXI–XXXVI — Feb. 1, 1812

Number 7, pages 73–86, plates XXXVII–XLII — April 1, 1812

Number 8, pages 87–98, plates XLIII–XLVIII — June 1, 1812

Number 9, pages 99–110, plates XLIX–LIV — Aug. 1, 1812

Number 10, pages 111–122, plates LV–LX — July 1, 1813

Number 11, pages 123–134, plates LXI–LXVI
Sept. 1, 1813
Number 12, pages 135–146, plates LXVII–LXXII
Nov. 1, 1813
(It was at this point that Plate LXXIII [73, the turquoise plate] was omitted.)
Number 13, pages 147–158, plates LXXIV–LXXIX
March 1, 1817
Number 14, pages 159–170, plates LXXX–LXXXV
May 1, 1817
Number 15, pages 171–182, plates LXXXVI–XCI
July 1, 1817
Number 16, pages 183–191, plates XCII–XCVIII
Sept. 1, 1817
(The re-issued turquoise plate appears here as plate XCIII, or 93.)
Number 17, pages 192–195, plates XCIX–CIV
Nov. 1, 1817

Volume II

(Volume II begins with platė 101 in Number 17.)
Number 17, pages 1–12, issued with plates as above
Number 18 pages 13–24 plates CV–CX
Jan. 1, 1818
Number 19, pages 25–36, plates CXI–CXVI
March 1, 1818
Number 20, pages 37–52, plates CXVII–CXXII
May 1, 1818
Number 21, pages 53–64, plates CXXIII–CXXVIII
July 1, 1818
Number 22, pages 65–76, plates CXXIX–CXXXXIV
Sept. 1, 1818
Number 23, pages 77–88, plates CXXXV–CXL
Nov. 1, 1818
Number 24, pages 89–100, plates CXLI–CXLVI
Jan. 1, 1819
Number 25, pages 101–112, plates CXLVII–CLII
March 1, 1819
Number 26, pages 113–124, plates CLIII–CLVIII
May 1, 1819
Number 27, pages 125–140, plates CLIX–CLXIII
March 1, 1820
Number 28, pages 141–151, plates CLXIV–CLXIX

ACKNOWLEDGMENTS

A special thank you to Robert Thomas Curran, Jr. The following people also provided help and ideas:

Louis Zara, Carl Krotki, Stephen Smale, Richard Hauck, Herbert Obodda, Wendell Wilson (special thanks to Wendell Wilson and The Mineralogical Record Library for supplying me with a complete photocopy of *Exotic Mineralogy* before the reprint edition was available), Si and Ann Frazier, Bob Tichelman, Stephen Pober, Richard Bideaux, Joseph Freilich, E. R. Schierenberg, Curtis Schuh, William Patrick Watson, Frederick Blake, Timothy Johns, David Block and Ed Rogers.

I am compiling a census of all extant copies of Sowerby's *British* and *Exotic* Mineralogies and would appreciate hearing from any reader who has copies of either of these works, or who knows of copies that are privately or institutionally owned (complete or not). I should also appreciate hearing of any other related material by, or about, the Sowerbys.

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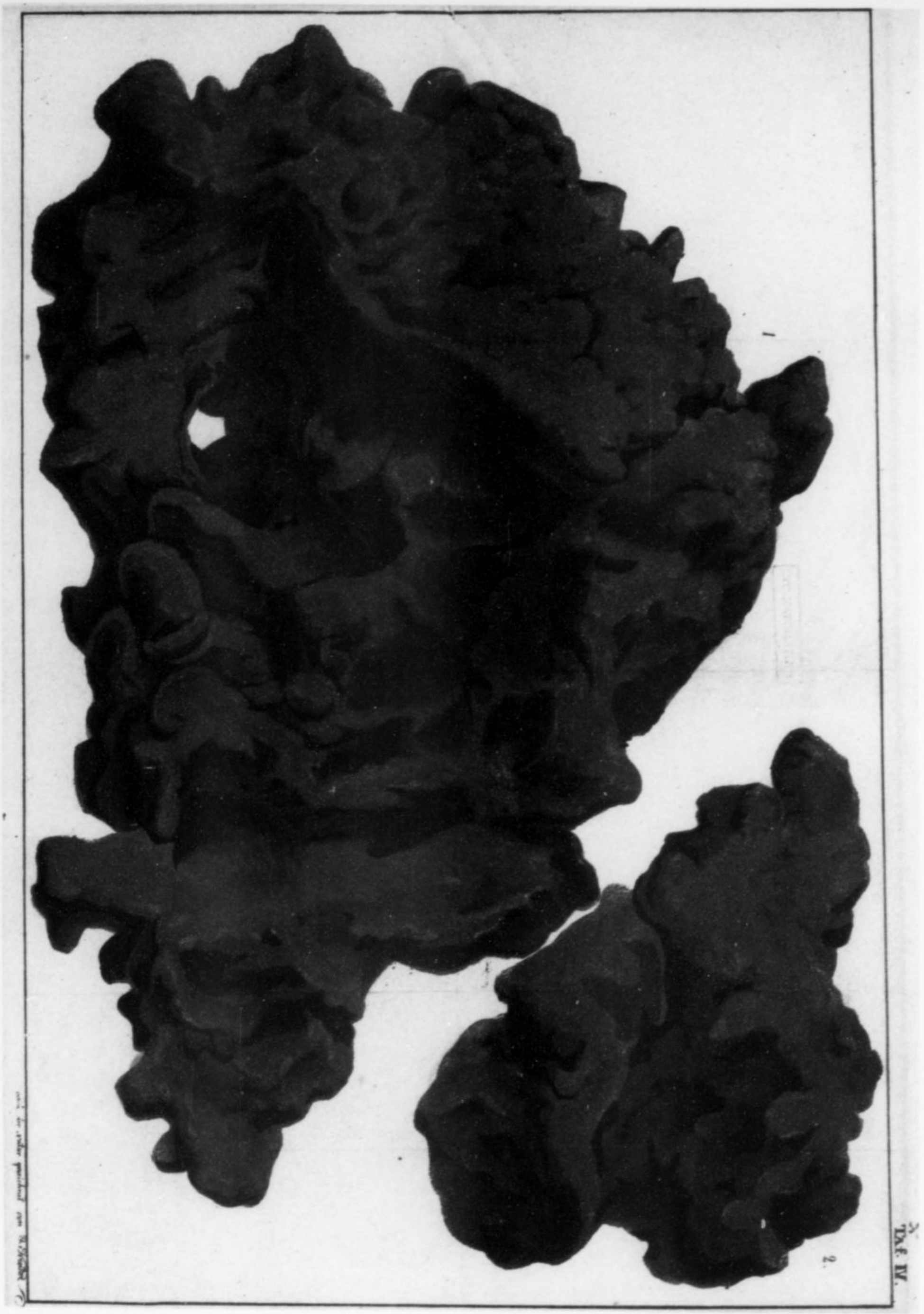


The largest gold nugget ever found in the Ural Mountains, recovered October 26, 1842, in the Zarevo-Alexandrovsk mine, Slatoust Region, Russia. It measured 38 cm and weighed 36 kg. The smaller nugget shown was found in the same mine on March 26, 1824; it measured 20.4 cm and weighed 13.3 kg. (From Verhandlungen der Russisch-Kaiserlichen Mineralogischen Gesellschaft zu St. Petersberg, *1843.)*

NICKOLAY IVANOVITCH KOKSHAROV AND HIS *MINERALOGIE RUSSLANDS* (1853–1891)

Wendell E. Wilson
4631 Paseo Tubutama
Tucson, Arizona 85715

Koksharov was one of Russia's most renowned mineralogists and crystallographers, and a tireless documenter of the mineralogy of his vast homeland. His monumental work, Materialien zur Mineralogie Russlands *("Information on the Mineralogy of Russia"), in eleven volumes plus an atlas of crystal drawings, is a rare and still much sought-after classic of topographical mineralogy.*

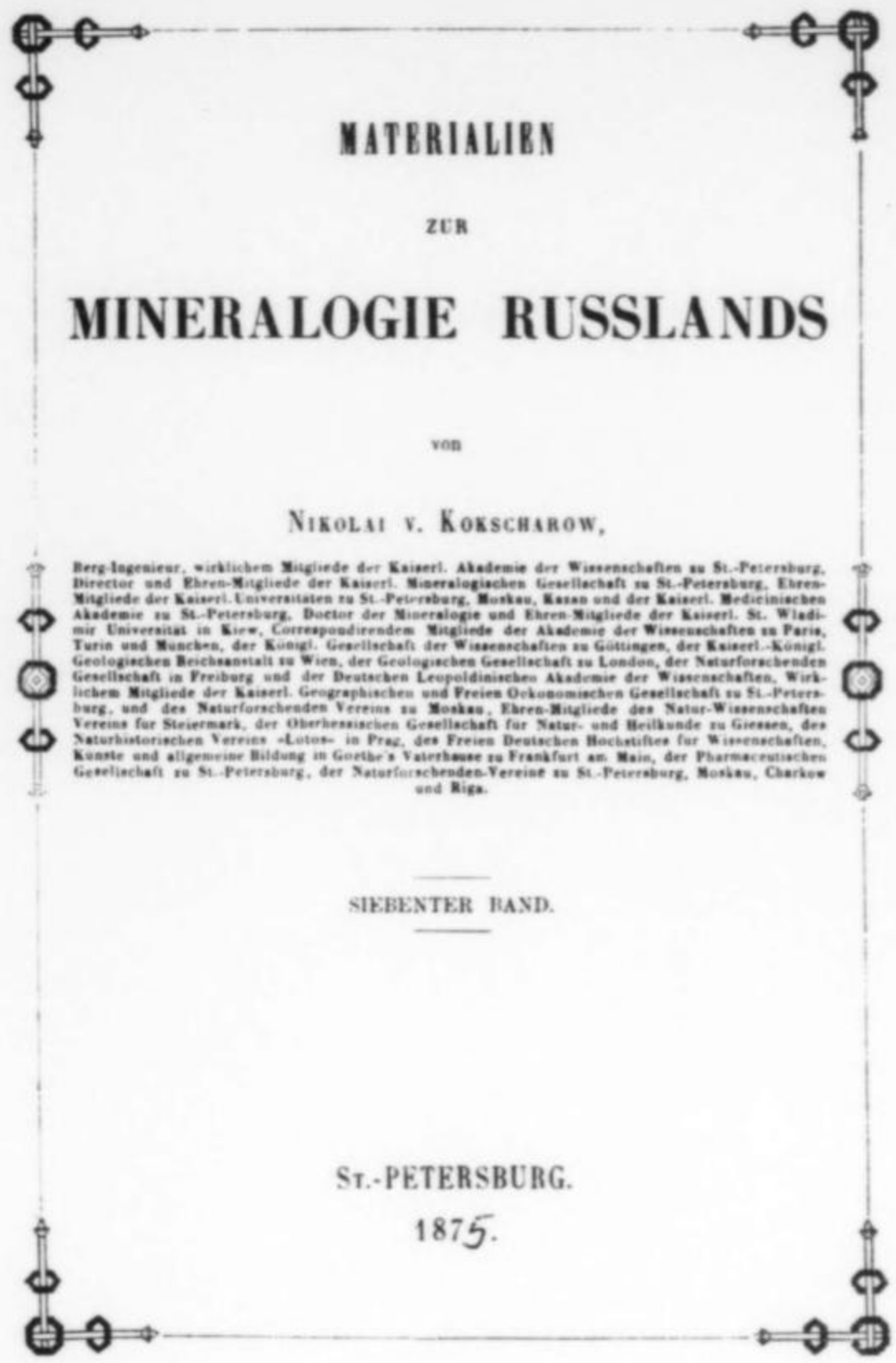
Nickolay Ivanovitch Koksharov was born on the 23rd of November, 1818, not far from the city of Ustkamenogorsk in the Semipalatinsk District, Russia. He was the son of Ivan Konstantinovitch Koksharov, and in the Russian tradition took his father's first name as his middle name ("Ivanovitch" meaning "son of Ivan"). Nickolay's grandfather, Konstantine, had served as commandant to Prince Eristoff, an important position which surely aided Ivan in obtaining a good education as a mining engineer. Ivan Konstantinovitch served first in the Altai region, and later was appointed director of the Berezov gold mines in the Ural Mountains. It was at Berezov that Nickolay Ivanovitch spent his childhood, up until the day that he was accepted into the St. Petersburg Military School of Mines (today the St. Petersburg Mining Academy).

Koksharov had barely completed his studies at the Academy (in 1840) when a fortunate opportunity came his way. The famous British geologist, Sir Roderick Impey Murchison (1792–1871), and the French paleontologist, Philippe de Verneuil (1805–1873), had decided to undertake the first geological research expedition through Russia. Koksharov was assigned to serve as Murchison's aide-de-camp. During the next two and a half months the party covered over 4,000 km, contributing substantially toward a broad understanding of the geology of Russia. And the close contact with such distinguished scientists increased Koksharov's own natural inclination to scientific research. Koksharov's report, published in the *Mining Journal,* was entitled "Geognostic observations in several districts of European Russia."

Murchison himself always attributed Koksharov's later success in mineralogy to his own influence during their travels together. At the time, however, Murchison was not much impressed by the young Koksharov; he described him as "a very good natured, flabby lad, forever asking questions, but, not understanding one word of French out of four, he is therefore of little use." Murchison nevertheless ac-

Николай Иванович Кокшаров

Nickolay Ivanovitch Koksharov


MATERIALIEN

ZUR

MINERALOGIE RUSSLANDS

VON

NIKOLAI V. KOKSCHAROW,

Berg-Ingenieur, wirklichem Mitgliede der Kaiserl. Akademie der Wissenschaften zu St.-Petersburg, Director und Ehren-Mitgliede der Kaiserl. Mineralogischen Gesellschaft zu St.-Petersburg, Ehren-Mitgliede der Kaiserl. Universitäten zu St.-Petersburg, Moskau, Kazan und der Kaiserl. Medicinischen Akademie zu St.-Petersburg, Doctor der Mineralogie und Ehren-Mitgliede der Kaiserl. St. Wladimir Universität in Kiew, Correspondirendem Mitgliede der Akademie der Wissenschaften zu Paris, Turin und München, der Königl. Gesellschaft der Wissenschaften zu Göttingen, der Kaiserl.-Königl. Geologischen Reichsanstalt zu Wien, der Geologischen Gesellschaft zu London, der Naturforschenden Gesellschaft in Freiburg und der Deutschen Leopoldinischen Akademie der Wissenschaften, Wirklichem Mitgliede der Kaiserl. Geographischen und Freien Oekonomischen Gesellschaft zu St.-Petersburg, und des Naturforschenden Vereins zu Moskau, Ehren-Mitgliede des Natur-Wissenschaften Vereins für Steiermark, der Oberhessischen Gesellschaft für Natur- und Heilkunde zu Giessen, des Naturhistorischen Vereins »Lotos« in Prag, des Freien Deutschen Hochstiftes für Wissenschaften, Künste und allgemeine Bildung in Goethe's Vaterhause zu Frankfurt am Main, der Pharmaceutischen Gesellschaft zu St.-Petersburg, der Naturforschenden-Vereine zu St.-Petersburg, Moskau, Charkow und Riga.

SIEBENTER BAND.

ST.-PETERSBURG.

1875.

cepted Koksharov's services again for a similar expedition the following year.

Although Koksharov's academic advisor, Professor Tchevkin, wanted him to concentrate on the study of geology, Koksharov's interests even as a student focused on minerals. Given the exposure during his childhood in the mineral-rich Urals, this is not surprising. In addition to the secondary ores of copper, lead and silver, and the abundance of native gold, his father's station at Berezov was also the discovery site of the beautiful lead chromate, crocoite.

In 1842, at the recommendation of Murchison, Koksharov was sent abroad by the Russian government for three years of study. In Paris he had the opportunity to work under Jean Élie de Beaumont (1798–1878), the prominent mineralogist and crystallographer, and Ours Dufrénoy (1792–1857), the well-known geologist and mineralogist (who, with Élie de Beaumont, had just published their geologic map of France in 1841). Moving on to Berlin, Koksharov was decisively influenced by his studies under the German crystallographer Christian Samuel Weiss (1780–1856) and the mineralogist Gustav Rose (1798–1873).

Koksharov returned to St. Petersburg in 1846 and was appointed as a tutor at the Mining Academy. A year later he published one of his first works on crystallography in the *Mining Journal,* studies on magnetite and bagrationite (= allanite). (He had earlier published an article on perovskite crystallography in the same journal.) There followed a long series of outstanding monographs in various Russian and European journals.

Koksharov's most important contribution was his massive series, *Materialien zur Mineralogie Russlands;* the first volume appeared in 1853 and the series continued through 11 volumes until his death 40 years later. It appeared initially in simultaneous Russian and German-language editions, although the Russian editions ceased after volume five.

The first volume was extremely well received, being awarded the Demidoff Prize. It is important to realize that up until this time the practice of mineralogy in Russia centered entirely on general physical appearance, external characteristics and chemical composition. Koksharov's work changed all that at a single stroke by introducing rigorous crystallographic measurements as the basis of all mineral descriptions. "Only repeated and extremely exact goniometric determinations," he wrote, "can form the basis of an understanding of crystal formation."

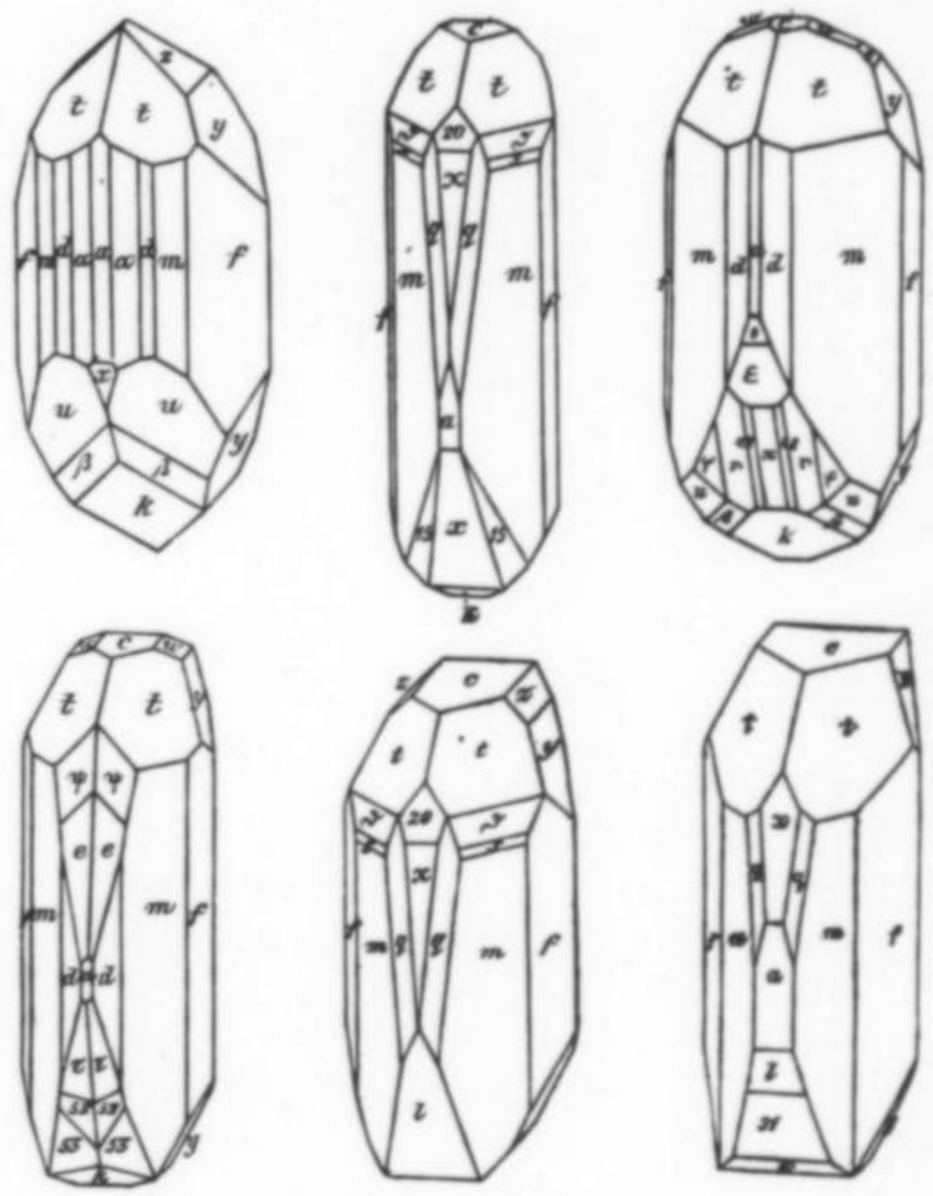
Over the course of 11 volumes Koksharov described the morphology of over 200 mineral species from Russia in exacting detail, many of them first discovered by him in Russia (e.g. euclase, brookite and wollastonite), and some of them entirely new to science at that time (e.g. ilmenorutile and clinochlore). The dates of issue and pagination of the various volumes are as follows:

Vol. 1	1853	[5], 226, [3] p.
Vol. 2	1854–1857	377, [3], [2 blank] p.
Vol. 3	1858	394, [5] p.
Vol. 4	1862	400, [4] p.
Vol. 5	1866	397, [4] p.
Vol. 6	1870	407, [1] p.
Vol. 7	1875	384, [1] p.
Vol. 8	1878	432, [2] p.
Vol. 9	1884	365, [3] p.
Vol. 10	1888	350, [2] p.
Vol. 11	1891 (–1893)	137, [1] + index [2], 11 p.
Atlas	1853–1893?	(87 plates)

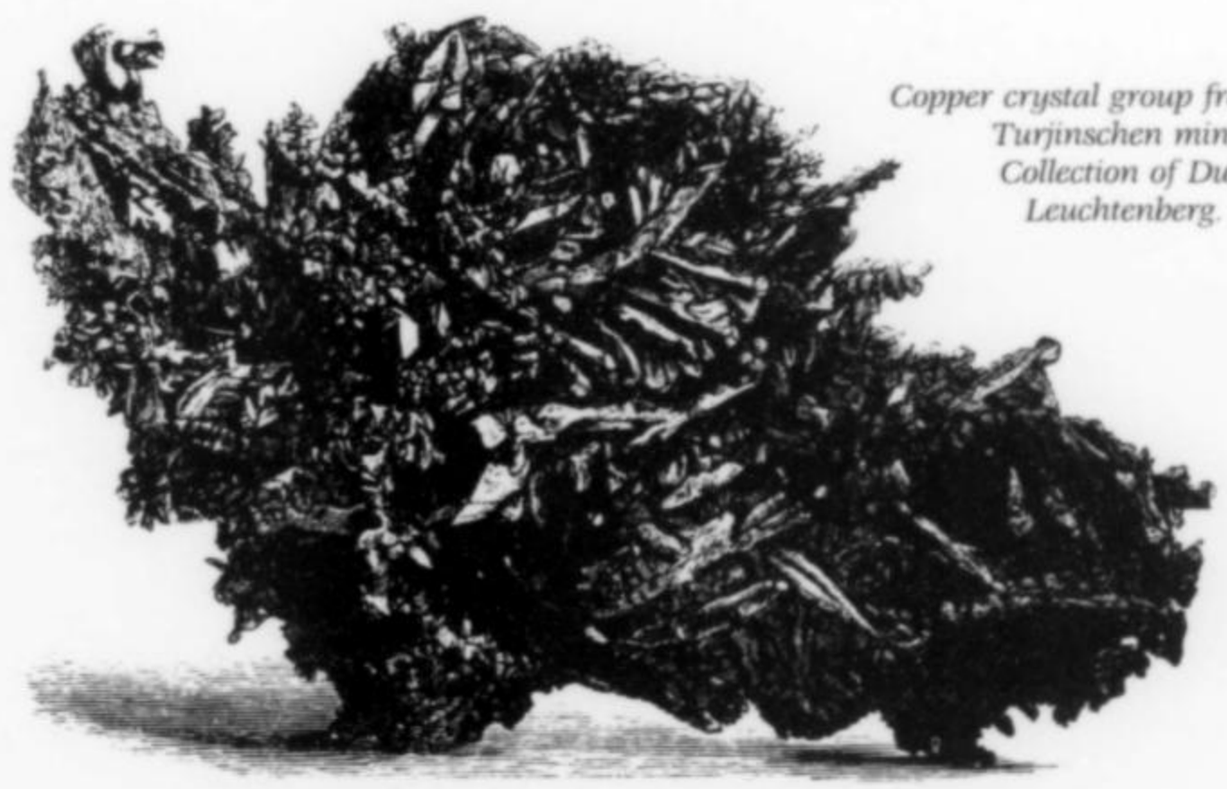
The *Mineralogy of Russia* was his *magnum opus* and the consuming effort of his professional career. However, it was far from his only work. He also found time to publish many of his lectures on mineralogy (in Russian and German); a textbook on crystallography utilizing Naumann's system, which remained a popular college text for many decades; and also a *Catalog of Russian Topazes in the Collection of the Mining Academy.*

Mineral collecting became a passion with Koksharov, and by 1865 he had accumulated 3,250 specimens including many from Siberia. In that year, however, he decided to sell his collection. Possibly at the suggestion of his chief British correspondent, the crystallographer William Hallowes Miller (1801–1880), he ultimately sold it to the British Museum (Natural History) in London, where it is still preserved today.

At various times in his career, Koksharov worked for the Department of Mines, the Corps of Highway and Hydrological Engineers, the Russian Forest Service, the Constantine Corps, the Page Corps and the Cadet Corps. In 1848 he replaced Professor Hoffman at St. Petersburg University, after having taught mining and metallurgy at the Technological Institute for a year. From 1849 to 1852 he served as curator of the Central Physics Observatory. In 1857 he became a member of the Mining Commission. In 1855 he was accepted as an adjunct member of the Imperial Academy of Science; three years later he was promoted to "Academic Ordinaire," and in 1866 to "Academic Extraordinaire." In 1858 the Imperial Russian Mineralogical Society made him its Director, and in later years struck a commemorative medal in his likeness. He served as a member of the Institute of Mines from 1872 until 1881, when he retired from teaching. He was a Knight of the Order of Alexander Nevsky with Diamonds, and was repeatedly honored with decorations from foreign governments. He was a member of eight foreign scientific academies, in addition to 11 foreign and 19 Russian learned societies. After a lifetime of achievements and honors, he died quietly in 1893, enjoying his work in crystallography right up to the day of his death.

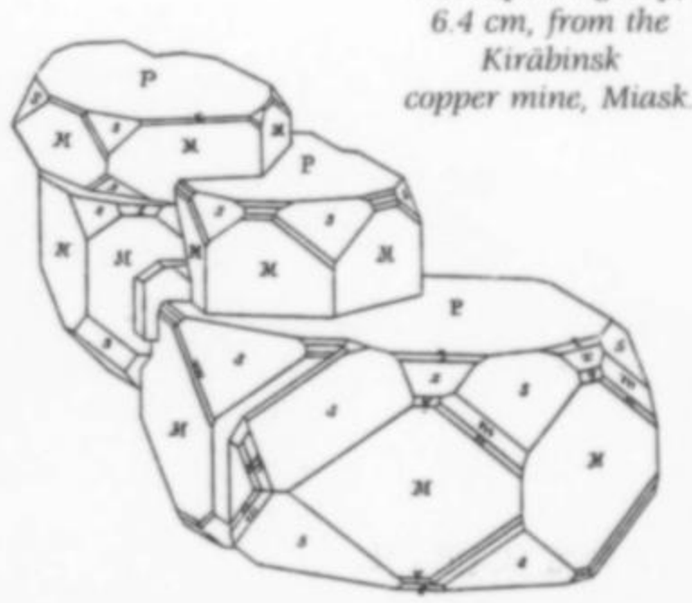


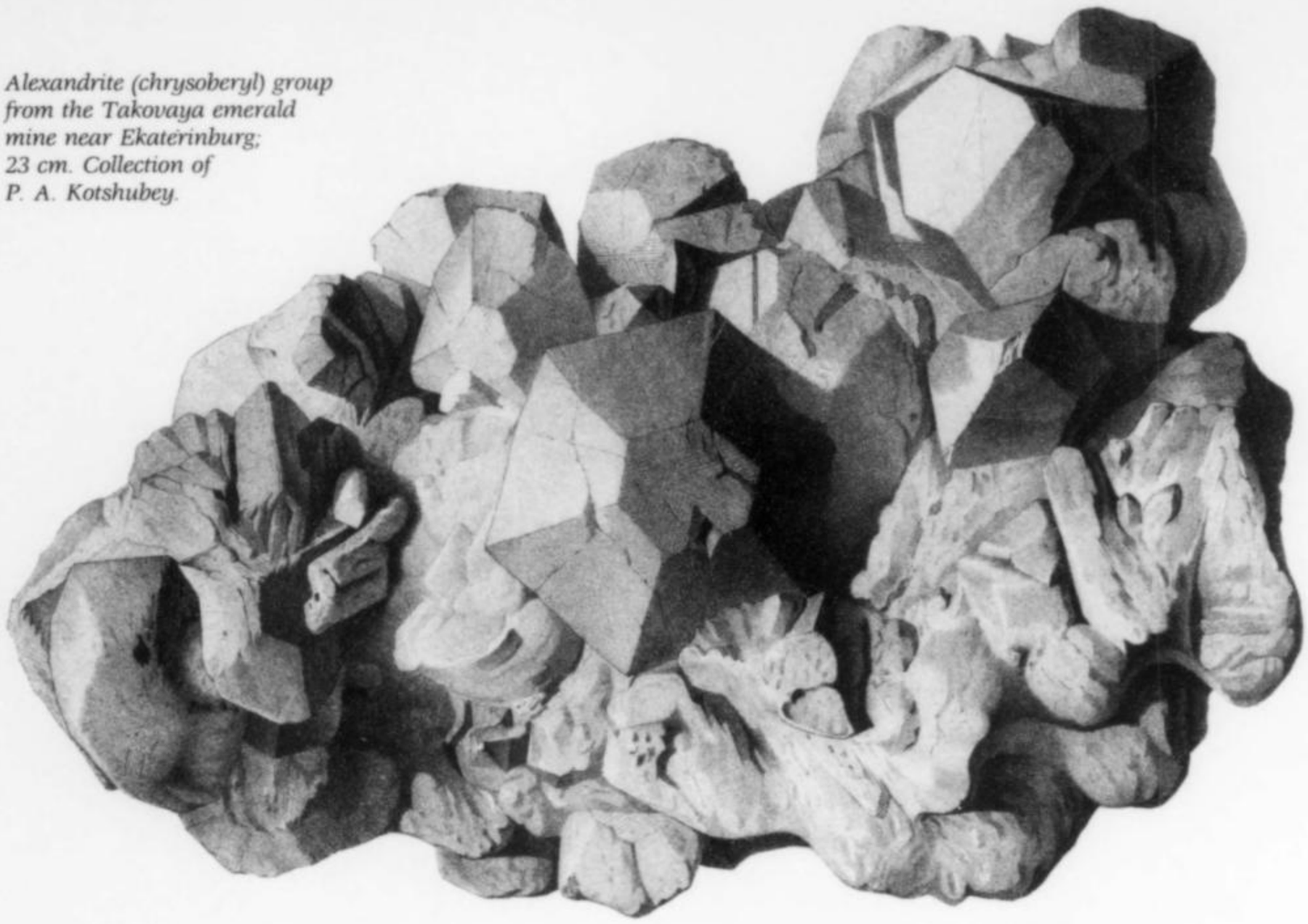
Crocoite crystals from Berezovsk, Urals.



Copper crystal group from the Turjinschen mine, Urals; 23 cm. Collection of Duke N. M. Leuchtenberg.

Fluorapatite group, 6.4 cm, from the Kirabinsk copper mine, Miask.





Alexandrite (chrysoberyl) group from the Takovaya emerald mine near Ekaterinburg; 23 cm. Collection of P. A. Kotshubey.

In personality Koksharov was admired as a man of extraordinary good will and forbearance. He was a kindly administrator, always ready to help; and whenever he felt that he might have done someone an injustice, however slight, he moved quickly to make things right. Those who knew him best found him lovable, eager and stimulating as a friend.

In addition to his scientific endeavors, Koksharov enjoyed art as an artist, a connoisseur and a collector, and relished the company of other artists. He composed poetry and songs (though only for a narrow circle of friends). And a few years before his death he published some of his memoirs, covering the years up to 1859, under the title of *Russian Stories* (1890), giving lively descriptions of the great personalities and learned men he had worked with.

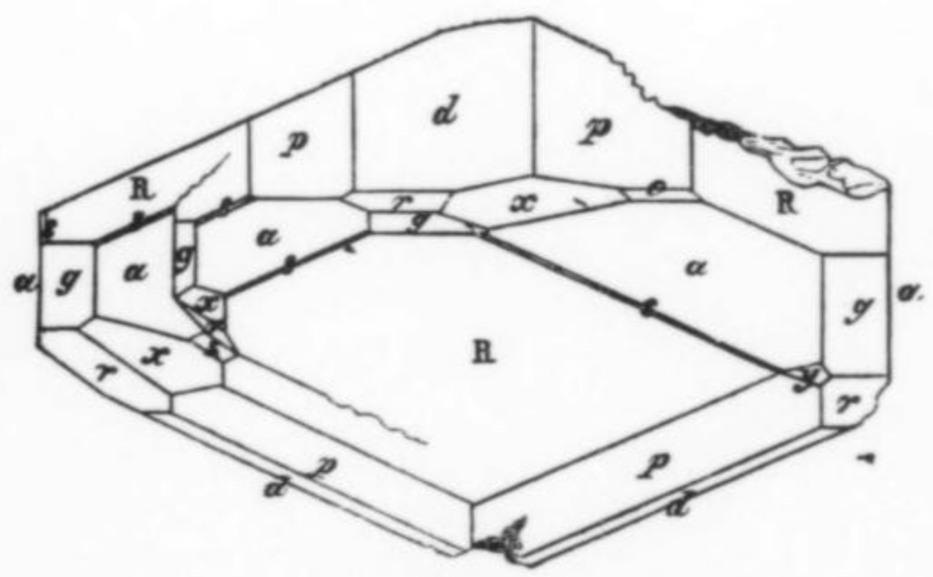
The French geologist Gabriel Daubrée (1814–1896) eulogized him fondly:

All of those who knew him were struck by his charm, and beneath this charm was a rare kindness that was reflected in his face. He was a sincere friend, always ready to help under any circumstances.

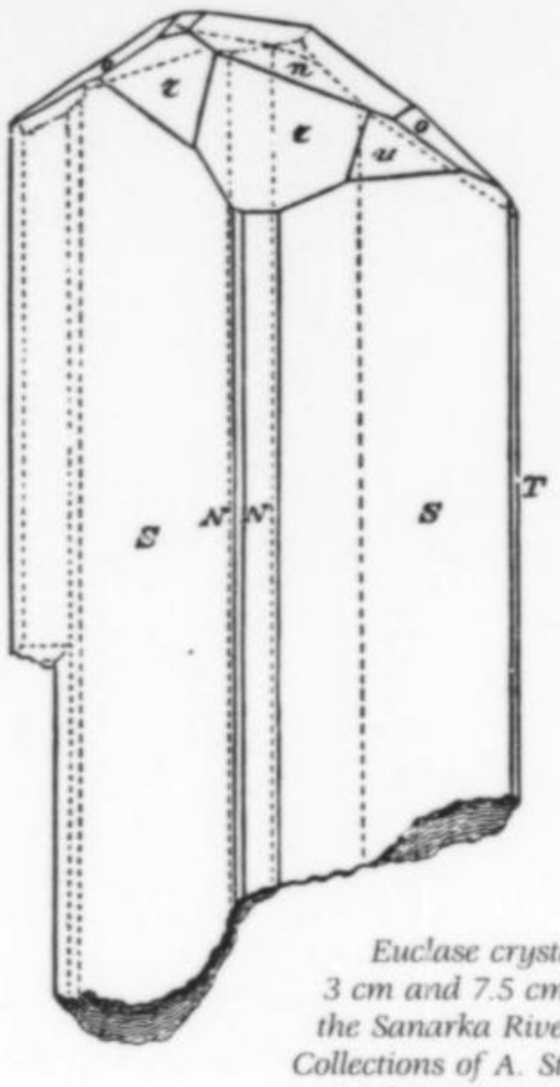
The precision of his angular measurements and the conscientiousness and care which he accorded to them make his work in crystallography a veritable monument. Any treatise on mineralogy bears witness to the place of honor accorded the researches of this Russian savant among crystallographers of all lands.

The Mining Engineer S. Kulibin, who wrote the obituary from which most of the foregoing has been drawn, concluded by saying:

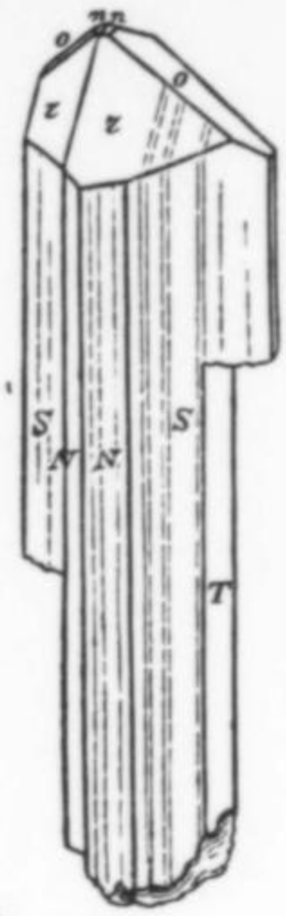
Wire gold from Berezovsk, Urals; 8 cm; collection of Duke N.M. Leuchtenberg.

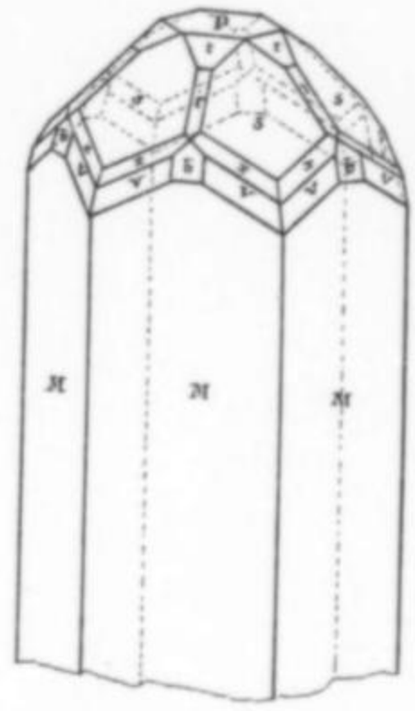


Phenakite crystal, 1.2 cm, from the Ilmengebirge. Collection of K. V. Romanovsky.

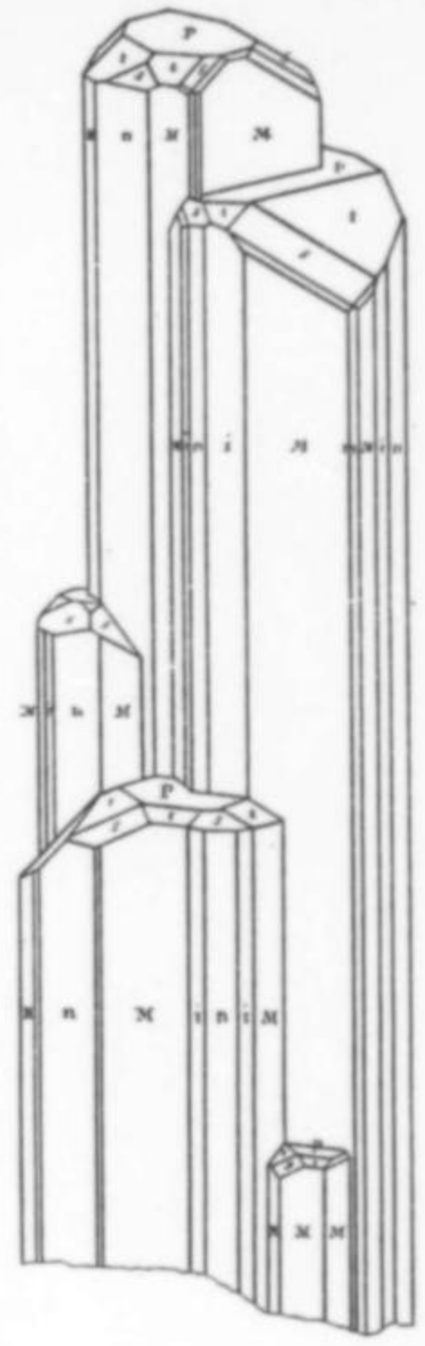


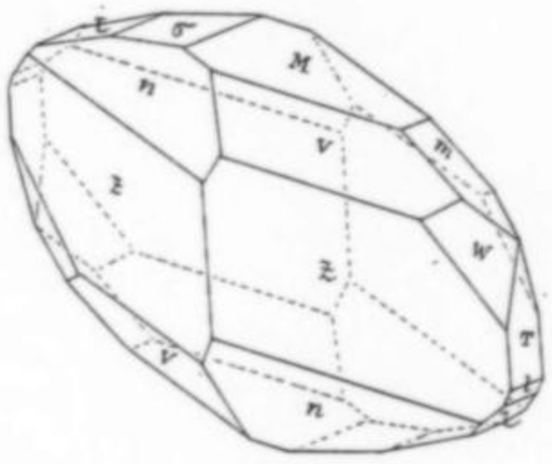
Euclase crystals, 3 cm and 7.5 cm, from the Sanarka River area. Collections of A. Strolmann and K. Romanovsky.



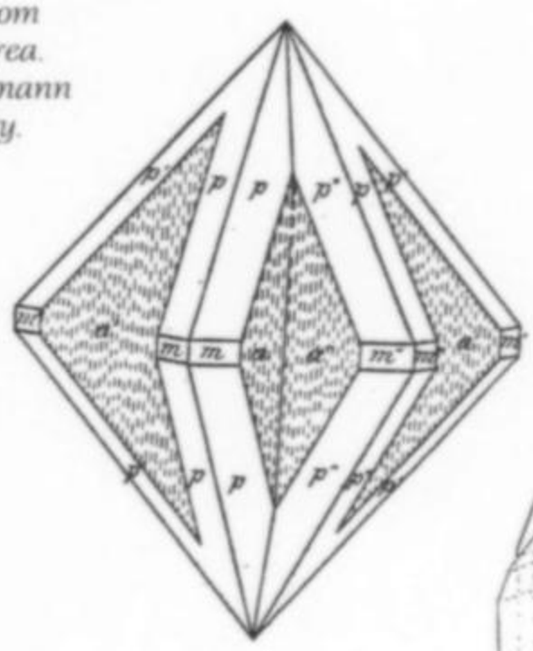


Beryl, Mursinka, 6 cm and 11.2 cm.

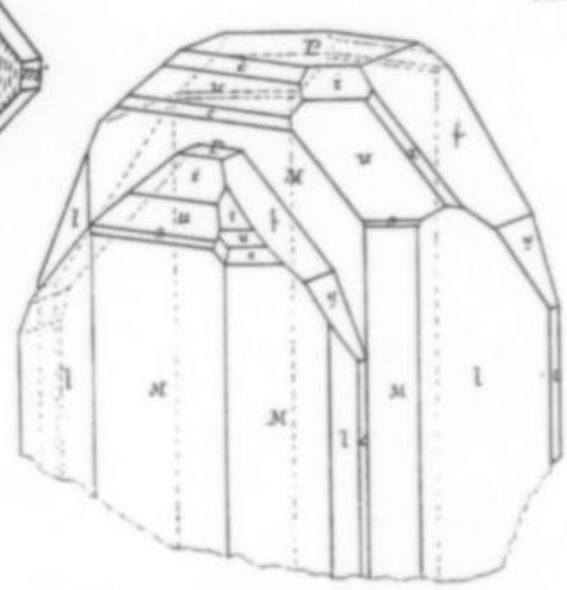




Orthite from the Akmatovsk mine, Urals.



Cerussite twin from the Nertchinsk district, Transbaikalia.



Topaz crystal from Alabashka.

The memorial to Nickolay Ivanovitch Koksharov, to all of us who knew him personally, is that he created himself in his works and achievements, which coming generations will also view with reverence and awe.

ACKNOWLEDGMENTS

My thanks to book dealer Ed Rogers, who helped the Mineralogical Record Library complete its set of Koksharov's *Materialien zur Mineralogie Russlands*. This is a very rare work in complete form, and it is only the last and rarest volume which contains the biographical information I have drawn on so freely. The crystal illustrations reproduced here (except for p. 106) are all taken from this set. My thanks also to Lawrence Conklin for critically reviewing the manuscript.

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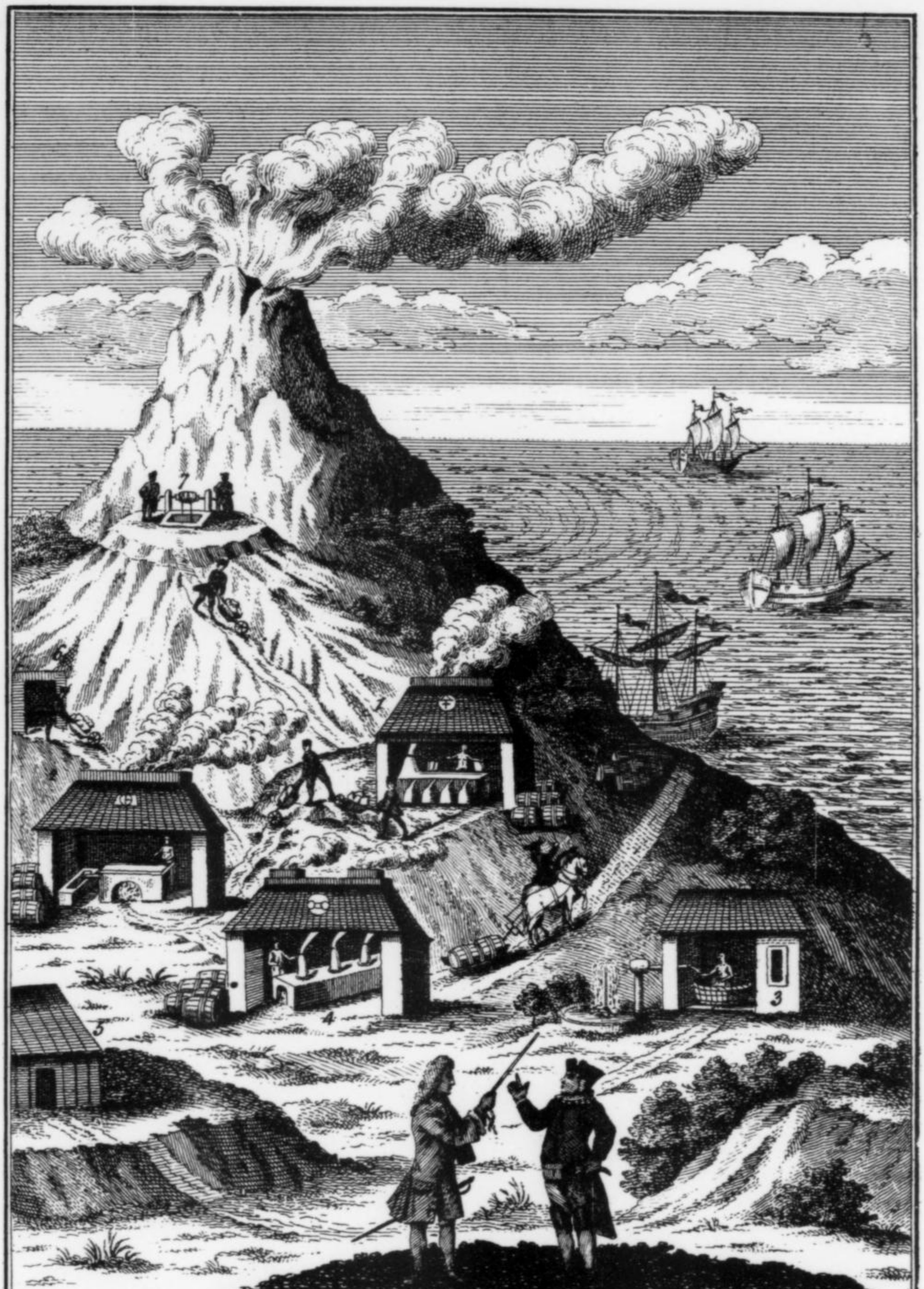

from Henckel's Pyritologia *(1757)*

Regional Mineralogies of the World

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Collecting topographic or regional literature on mineralogy is among the most practical of specialties for the mineral collector. Such materials in a personal library can directly illuminate specimens and can even lead to further discoveries. A wealth of titles exists, the newest and least expensive examples often being technically the most helpful, while the older works provide rich historical background.

Topographic or regional mineralogies consist of the description of all the known minerals occurring on or near the surface of a specific geologic, physiographic or most commonly national or political area of the earth. Also included with many of these topographic mineralogies are complete lists of references and descriptions of the geology which may be brief or quite extensive. In addition there may be some history, details of mining activity if there was any, petrology and petrography of the rocks and other pertinent information about the region covered. Existing regional mineralogies cover the whole gamut, from those that contain little more than a list of the minerals to those which are comprehensive mineralogical and geological studies.

For the purpose of this compilation only mineralogies of regional extent will be listed and mineralogies of specific locations or districts (mining or otherwise) will not generally be included.

Although there are relatively few modern mineralogical studies that actually fit the concept of the classical topographic mineralogy, there are many published works that include much of the same data and so are extremely useful for obtaining information on the minerals, their description, and their occurrences in many areas and countries of the world. Included in this list are some detailed collecting guides which may contain useful mineralogical information. For some areas where no regional mineralogies or comprehensive collecting guides exist; mineral resource reports or gemstone articles are the only alternative.

Geological, mining or mineralogical regional bibliographies which were included by Spencer (1948) have not been included here. They are a project in themselves and would swell this list to an unmanageable size. However, the compilation of regional mineralogies in that work has been modified and used as a starting point. Instead of his regional arrangement this compilation is alphabetical by country, colony, island or territory which eliminates the need for an index. For the United States only mineralogies considered to be the most important and generally the most recent have been included. More complete listings for the United States are given by Smith and Cook (1979) and Smith (1987).

Numerous sources were used to compile this list. The most important were Nickels *et al.* (1933–1993) and *Mineral Abstracts* (1920–1989). Periodicals consulted were the *Mineralogical Record* (1970–1994),

Rocks and Minerals (1926–1994), Lapis (1979–1994) and scattered issues of numerous other periodicals both foreign and domestic. Book catalogs that proved useful were *Peri Lithon* (Sinkankas, 1972 to 1995) and *Kristalldruse München* (1989).

This project was suggested by Wendell Wilson who contributed the initial data. Other persons who contributed information are Ronald Werner, Horst Windisch, Pete J. Dunn, Erik Garnum, Richard C. Erd and Anton Philipp. The Houston Gem and Mineral Society Library, the Rice University Library, and the Houston Public Library were consulted in the compilation of this list.

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The Saga of Mineral Digest

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It was the most extravagantly lavish mineral magazine in history, published in eight spectacular issues over an eight-year period by one of the more colorful figures in mineral dealing. Complete sets today are still actively collected, and marveled at. Here is the inside story of its life and death, by the man who created it.

Mineral Digest was born in 1970, out of a half-serious challenge to the canny Argentinean gem and mineral dealer Julio Tanjeloff (1916–1980), whose firm, Astro Minerals, Ltd., had just opened in a gallery on the East Side in New York City. The challenge was flung at him by a between-books freelance author-editor who, over the previous decade, had become an impassioned collector of gems and minerals—me.

I did not believe that "JT" (as he liked to be called) could, or would, ever meet that challenge. To publish a periodical such as I envisioned would have required, in my estimate, about $150,000 to $200,000 capital, with (at least for its first issues) very uncertain, if any, returns. No one I knew would undertake such a financial risk. It was just a dream. I had said to him in parting:

> JT, when you can show me in hand a contract you have signed with a first-rate color printer for the publication of a magazine that will contain a minimum of twenty-eight pages in color, *call* me. I will come in *tout suite,* on the next train from Philadelphia, to see that contract with my own eyes. . . . Give me that magazine and a free hand to edit it, and I will give you an advertising campaign that will sell your gems and your minerals, your necklaces, rings, bracelets, carvings and what-nots everywhere!

Big, boastful words! We had been fencing back and forth on that subject for months. Much as I was fascinated by his projected "department store for minerals," I had no interest in merely doing his advertising for him. I was comfortable living in a house and garden in Philadelphia, continuing my own writing far from New York's heady turmoil.

He gave me a broad grin and a handshake, and replied, in his own half-mocking way, "Hokay, Zara! You wait, I call you."

A bold, energetic and flamboyant individual, Julio Tanjeloff demanded action from others. But unless he momentarily chose to do otherwise, his own style was what I called *Mañana, mañana,* tomorrow, tomorrow! Don't worry about today, there's always tomorrow. At his invitation, I had prepared his brochure on minerals, but when I urged a strong retail advertising campaign to sell his wares, he became wary. No one had ever marketed minerals and semi-precious gems through retail advertising. I doubted that we would ever work together on any program of importance. I did not expect to hear from him again.

We had met one afternoon in the spring of 1968. As I approached a large, new gallery on East 34th Street, my eyes received a pleasant visual jolt. A window dresser was setting up a pyramid of amethyst geodes, another was arranging table-tops of petrified wood around a three-foot-high vivid green torso of malachite (destined to be stolen from that very spot!). The purplish amethysts meant Rio Grande do Sul to me,

Julio Tanjeloff

and the petrified woods reminded me of the stump I had dragged from a log-strewn landscape in Arizona in 1936, while returning eastward after an assignment as a screenplay-writer at the Twentieth-Century Fox Studio in Beverly Hills.

A black-lettered sign on the white-tiled wall read: "Astro Minerals, Gallery of Gems." But the gallery was half empty. Workers were unpacking crates, clerks were puttering to fill showcases. I gazed admiringly at a huge group of quartz crystals. Beyond rose a pyramid of strawberry-streaked rhodochrosites.

Within minutes the proprietor had me in tow. A short, portly, olive-skinned man with a thin penciled mustache and a grin that reminded me of Wallace Beery in his prime, he led me, between open drumheads of agate rough, to his office. Underfoot, my soles crunched tan grossularite crystals spilling from a sack. I spied an opaque gray sapphire cabochon the size of my fist sitting on a heap of his correspondence.

Next, Julio Tanjeloff—it was he—was flashing gems and minerals from his pants pockets, his desk drawers, his shelves and the open safe behind him—beaming as he watched my eyes glow! I had become addicted studying the gems and minerals in the exhibits in the barn-like halls of the old American Museum of Natural History in New York. I had paid many visits to the beautiful specimens in the Vaux Collections at the Academy of Sciences in Philadelphia. From schooldays in Chicago, I had haunted the Gem Room and the Mineral Halls in the Field Museum on the lake front. JT did not have to "sell" me.

I bought from him that day, and continued to do so for many years thereafter. If I recall correctly, my initial acquisitions included a packet of trapiche emeralds and a clear, finger-length Mount Ida quartz crystal group in the form of a crucifix.

He talked, and I prodded. He was a self-assured, cocky character, but quick-witted, well-read and a fast learner. I took to him and, apparently, he took to me. In the fellowship of minerals, we related to each other.

"Why such a grand gallery to sell minerals? The public knows little about gems and less about minerals." He snorted, "I teach them!" He had an option to double, or triple, his space within two years. His dream was not merely to have "a department store for minerals" but to make it "a Tiffany of minerals," with a workshop in the rear for the cutting and tumbling and polishing of mineral bookends, mineral clocks, mineral boxes, and who-knows-what else. It dawned on me that, at this moment, he meant every word. He was no mineralogist, but he was shrewd enough to apply well-honed merchandising skills to the gems and minerals trade.

How had he gotten started in minerals? Julio Tanjeloff was an Argentine citizen, and a graduate lawyer. A business venture had thrust him into ownership of a lead and ornamental rhodochrosite mine in Catamarca Province. But he had left Argentina because, resisting the Peron regime, he had been warned that his life was in danger: "I did not want Evita, or her brother, for my partner!" he said grimly.

From Argentina he had emigrated to Colombia, where he had acquired a fortune in emeralds. Trying to sell them in England and in Germany taught him much about wheeling and dealing in gems and minerals. Seeking a new home, he and his wife toured the U.S. with car and chauffeur before deciding on Manhattan for their base of operations.

Louis Zara

Naturally, he quizzed me in return. Mine was a relatively simple story: a writer from adolescence, I had published about sixty short stories. My first had appeared, when I was twenty-two, in H. L. Mencken's *American Mercury*. My first novel, *Blessed is the Man*, had been "One of the Nation's Notables of 1935."

Seven or eight novels had followed, one in translation in Spanish, another in Dutch and Norwegian. Two had taken awards. I had been the vice-president of the Ziff-Davis Publishing Company, directing their book publishing division. I had written plays and radio continuities. I had been anchorman on ABC's "Stump the Authors" simulcast TV show out of Chicago's WBKB. I had been an independent consultant to several advertising agencies, including Armour & Company's public relations program.

At Ziff-Davis, in 1950, I had created the large art magazine entitled *Masterpieces.* At this point JT interrupted me. He said he planned one day to publish a magazine on minerals. I caromed back: "As I had in *Masterpieces,* I want twenty-eight pages of color in mine." In true one-upmanship, he snapped his fingers: "I will have color on *every* page!" I could not raise him; I had run out of chips.

He said he needed guidance in the American scene. I was willing. I designed an advertisement for him to launch a campaign. He ran it in July on a midweek date that he insisted on, and the results were nil. I stepped back. That was when I threw my challenge at him: "You get me a printer's contract for a magazine with color on twenty-eight pages and, if you let me, I will give you an advertising campaign that will sell your minerals! . . . Bye-bye, JT."

About a year passed. One afternoon his voice, loud and clear, was on my telephone in Philadelphia: "Zara, I have cohntract. Came! I show you." (In private, I had frequently corrected his English and he, as frequently, to twit me, repeated his old errors. He could do better.) "Okay," I responded. "Wait for me. I will be there."

Next morning, in his office, he showed me the printing "cohntract" he had signed with Ferd Harrach KG, Bad Kreuznach, Germany, for a periodical with "Color on every page!" The Harrach color samples excited me: plates with highly detailed 250-line screen! Also, a promise of unlimited color corrections. When my *Masterpieces* was on the press in Chicago I had paid the color printers, the Newman-Rudolph Company, $800 for "Stop Press!" privileges to allow me, while checking color, to halt the press and make any hue readjustments I deemed necessary.

A few additional words on creating his advertising *my style* via the pages of the *New York Times,* and we were ready to go to work. He had already interviewed for an art director. I met his choice: young, redheaded Robert Sadler. He had worked for Conde Nast Publications and the Shell Oil Company. I studied his portfolio—on the unorthodox side, but bold, fresh and dynamic. I liked his offbeat approach. I had ample experience from my book and magazine days, but Sadler possessed a flair for the unconventional that I lacked.

JT seldom interfered, but I must add that when he did, as occasionally with Sadler, the latter never failed to produce a better version of his earlier effort. (I still

Robert Sadler

regard him as one of the best typographers among the many with whom it was my good fortune to work over the years.)

First hitch: JT and I had agreed on a small *Reader's Digest*–size periodical. I suddenly realized that Harrach, a calendar printer, had presses suited best for $8^1/_2$ x $12^1/_4$" pages. Oh, well; Harrach could still print our *Reader's Digest* size. But he would not; his contract specifically stated the size to which he was committed. JT and I gazed ruefully at each other. Should we change the name? We struggled with that problem for days. After Sadler brought in his first cover design, which pleased us, we decided to stay with *Mineral Digest.* And so it remained, the world's largest digest-size periodical.[1]

Working out the editorial format was a joy for me. I had been planning it for ages, it seemed. I must have articles on gems, by authorities of course, and articles on minerals, ditto. Via long distance, I talked to John Sinkankas first, then to Fred Pough, to Richard Pearl and to Cornelius Hurlbut, later to Russell MacFall and Benjamin Shaub. All amiably agreed to contribute. JT, after a heated session with me, consented to an editorial budget so that I could pay every one of my contributors. As a longtime member of The Authors' Guild I felt obliged to do no less.

I had compiled a file of stories and essays, literature that somehow involved gems, to flesh out my

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[1]Editor's note: At this same time, John S. White at the Smithsonian Institution in Washington was also preparing to launch a new but less lavish mineral magazine for serious collectors and amateur mineralogists. Its name was to be . . . *Mineral Digest*! Upon discovering that Tanjeloff and Zara were initiating a magazine of the same name, White changed the name of his publication (before the first issue was printed) to *The Mineralogical Record.*

publication. I wanted Thomas Huxley's famous essay *On a Piece of Chalk,* Goethe's essay on granite, Conan Doyle's *Adventure of the Blue Carbuncle,* and Guy de Maupassant's *The Diamond Necklace.* Selecting stories was relatively easy, but I decided I must have them illustrated afresh in full color.

I threw that task at Sadler and he, regularly, issue after issue, discovered brilliant young artists and kept after them for the weeks and, often, months, it took them to produce the finished paintings or drawings that we three (JT, Sadler and I—there was no other staff) considered worthy of our pages. It was, however, JT who discovered the astonishing realist painter Bradford Boobis, whom he commissioned to paint the handsome portrait of Anita Tanjeloff, our co-publisher, in our second issue. For our third issue Boobis also illustrated Somerset Maugham's *Mr. Know-All* story with a triple gatefold painting. Boobis was a find. Regrettably, although a very young man, he died soon thereafter.

The first issue, 1970

It was Sadler who proposed our gatefold feature: expensive, but JT, once he caught on, approved the additional cost. Call it an "ego-trip," as his friends did, but his insistence on the best, however costly, also maneuvered us into using a beautiful, heavily enamel-coated paper. Unfortunately, while superb for Harrach's color, this paper was too heavy for the simple glued binding which held the signatures together. That distressed me, but JT would not yield. Only in our very last (the eighth) issue, with the cooperation of Reto Conzett, who printed and bound it in Zurich, did I prevail to have a linen strip reinforce that binding. However, I was endlessly grateful that, despite many rocky intervals in his fortunes, JT stayed the course as long as he did.

It was my ego-trip, too. I paid for it in a different

way: the pressure of working on two jobs. In my enthusiasm I had not calculated that I would have to put my own writing on the back-burner for years and concentrate entirely on *Mineral Digest* and the Astro Minerals advertising. I had not taken into account that I might become an on-premises associate, a factor in daily operations if I was to turn out effective copy day after day for Astro Minerals. I had not foreseen that, if I was to give Astro a proper image, I would have to teach the public much about the lore and legend of minerals, and do it in short, snappy bites and phrases, not so readily created. I was lucky to have Bob Sadler grasp my meanings quickly and, although he knew little about minerals, he created layouts and sketches that forcefully supported my concepts and my copy.

The magazine progressed all too slowly. I perceived that its existence, no matter what JT had said, depended on the success of my advertising. After the initial enthusiasm everyone waited for a miracle. If my advertising failed I might get a single issue through, but never a second. If JT had deep pockets, as he intimated, he also had a family that viewed his expenditures with unsympathetic eyes. He was a buyer, who bought lavishly, and frequently overbought. Zara was pushing him into more expenditures.

That was true. I wanted at least one ad each week, the continuity bringing the name of the firm and its location to the attention of the public. I wanted "position" in the up-front pages of the *Times.* Everything I recommended, although I started with a 35,000-line ad contract, added to the cost of the daily lineage.

Zara was under pressure to produce results. Sadler worked off-premises, but I was on-premises with little time to spend on *Mineral Digest.* I sweated evening

hours in the nearby apartment I had rented, to keep abreast of what needed to be done to keep the magazine project alive. In my office at Astro I was still trying to persuade JT to *begin* his advertising. Retail advertising was new to him. "Tomorrow!" I would schedule an ad, and he would cancel it. I threatened to leave, and he became florid: I had "promised!" I burst out: "Everything here is *Mañana y mañana y mañana! Tomorrow and tomorrow and tomorrow!*" He shrugged: so it was.

Nursing my wounded pride, it struck me that I had been on the wrong track. *Mañana*! was the key to everything here. The public should hear about that. Why not? Personalize Astro, personalize JT. Folks, step right up: this is "*Mañana*-land." I rewrote the headline boldly on my 150-line x 4 column ad:

Mañana y mañana y mañana means
Tomorrow and tomorrow and tomorrow.

I made it a three-day sale, the ad to run the next Thursday. The sale would be Thursday, Friday and Saturday. Next morning, after persuading JT, I sent it off to the *Times*.

The Thursday morning it was to run I was in Washington on a private matter. At breakfast I bought a copy of the *Times*. My ad was nowhere in the paper! Disheartened, I seized the telephone. The *Times* informed me that my ad had been *moved*, to Saturday. Moved by whom? By Julio Tanjeloff.

I confess that I raged over the phone. Mr. T was calm. He had discovered that the Saturday advertising rate was cheaper than the weekday rate. I shouted that people, understanding what *Mañana* meant, would be knocking at his door on Sunday. He jeered: "Who will come? Stores are closed on Sunday!"

This is part of Astro's legend. On Saturday, March 27, 1971—a day to be long remembered!—the sidewalks outside the store (now officially a gallery) had a winding half-block queue of customers waiting impatiently for the doors to open. What had brought them? The *Mañana* phrase, or the first ad ever in a newspaper to hawk amethyst and turquoise and coral and amber? No matter, the entire gallery soon bulged with people who were eager to buy. There were not enough salespeople to wait on them; after a while, there was not enough wrapping-paper.

Unprepared for any rush of business, JT as yet had no *cash registers* . . . Scout's honor, not one! They were "on the way!" he said. The clerks had to shove the money they collected into cigar boxes. JT himself rolled by every quarter-hour to empty the boxes and solemnly stuff the greenbacks into his pockets fore and aft. No one was prepared for this kind of success, least of all he. I, proud as Punch, patrolled the incredible sight. Twice I pitched in and sold quartz crystals and bicolored tourmaline, then ran about looking for JT. He gravely accepted the cash and gave me a two-shoulder shrug.

Trusted family friends were summoned by phone to hurry in and keep an eye on those cigar boxes. A store whose daily take normally hovered around $300 suddenly was taking in thousands of dollars. The precise total I never learned.

Exhilarated, I had one of the clerks letter a sign: "Closed—Sale continued Monday" and hung it on the

front door to greet the next day's *Mañana* customers. JT wiped his brow and predicted: "No one will came!" then added, "Who knows?"

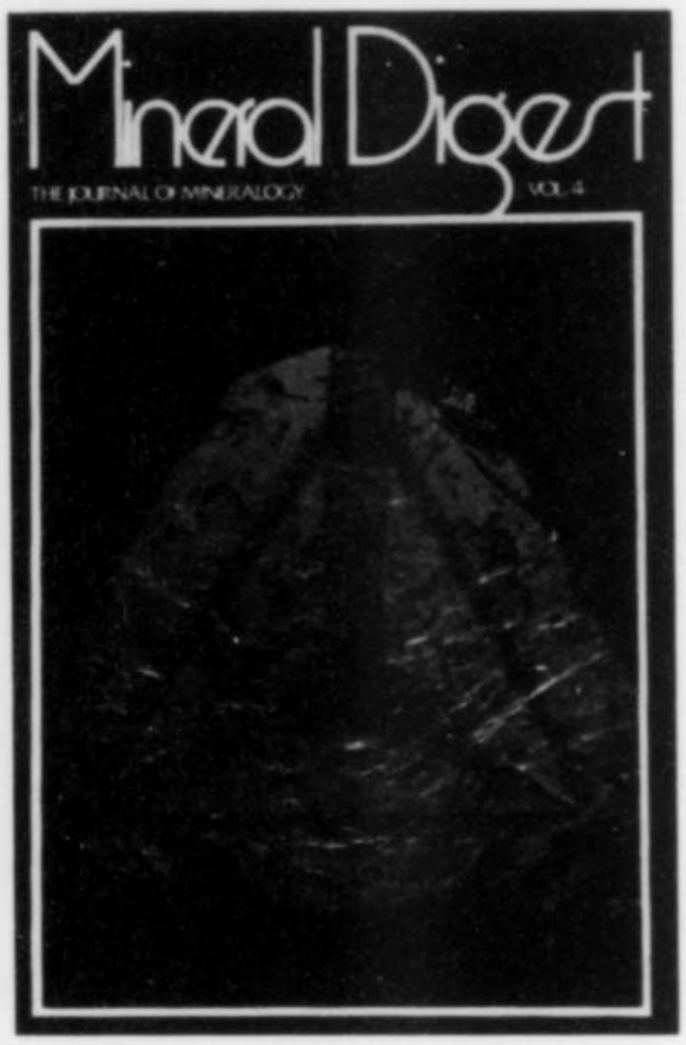
They did "came." Dozens came and hammered on the windows. Some slipped angry notes under the door. Others telephoned their complaints to the *New York Times*. As people streamed in on Monday and Tuesday, I ordered the *Mañana* ad repeated on Thursday, with a humble apology. Only a minor queue assembled, but attendance thereafter became a steady flow every day.

Important for *Mineral Digest*: my *Mañana y Mañana* ads were the apotheosis of Louis Zara. People delighted in the self-mocking, ungrammatical lingo I often tossed in. Men and boys, and women and girls, darted in, cash in their fists, holding the ads they had clipped. With blessings from the family, I began to run ads every week.

A gleaming brass cash register appeared in the gallery; then another. Finally, modern money-machines arrived to accept payments and record transactions. From April 12 through December 27, 1971, I placed forty ads in the *New York Times*, all but six with fresh copy. I nominated Julio Tanjeloff, "Mineral-General of the U.S." He beamed as a tide of customers swept into his gallery every morning and afternoon.

He and I conferred daily now. He was comparing each day's sales figures on a paper tape and I was becoming aware of the vast purchases he had made in

anticipation. One day he took me down to a sub-basement to see his "reserves": a storeroom crowded from floor to ceiling with petrified wood logs, sacks of garnets, drums of geodes, and crates of tiger-eye from Griqualand. Touring his musty cache, I realized that he was a man who took himself seriously. Although *mañana* was his style, he had established the workshop he had promised, with tumblers and diamond saws and half a dozen workers to operate them.



Mineral Digest was a minor objective. Only the success of Astro would bring it to reality. In my ads I featured the merchandise he had in quantities: amethyst ("born to the purple") in necklaces, rings, brooches and geodes; and agates, turquoise, corals, ivory, pearls, amber and lapis. Later, coming upon a sack of tektites, I promoted tektites. I capped each ad with a simple definition, description and sketch of the object ("Amber is . . . Coral is . . .")—that was my weekly educational contribution.

Every other afternoon, I met with Bob Sadler. His primary task was to turn my copy into eye-compelling ads. Together, we also reviewed the snail-like progress on *Mineral Digest,* the page layouts, the slow deliveries of art and photographs—"Where are they!" When color proofs appeared from Bad Kreuznach, we transmitted our corrections to Germany via a telex machine that Harrach had recommended and JT had promptly installed for us. At home I read galley proofs and worried over new articles.

Once when I had shut my door and was concentrating on *Mineral Digest,* JT, ever anxious for new copy, barged in. In a brainstorm, I commissioned him, as publisher, to write a "Credo" for *Mineral Digest.* He elected to dictate a polemic on the plight of the miners in the third world whose labors brought forth the minerals the world economy depended on but who were so miserably underpaid. The central thoughts and reasoning were his; I mothered his final prose. For our second issue, his topic was the controversial "Semi-precious stones do not exist." For our third issue, his Credo trumpeted for an official "Earth Survival Year," proposing an International Commission to monitor the continuing damage to our planet and its environment. In his last editorial, written in 1976, his topic was "Hunger: Specter Over the Planet." *Mineral Digest* had become his personal vehicle, which meant that he would publish it as long as he could bear the expense.

The production of periodicals, even when well-staffed, always produces heartaches. Our contributors always required more time, our artists did too, and our engravers and printers did as well. And there was never enough time to ferret out the beautiful pictures of minerals I craved. To paraphrase Wordsworth, my heart still leaps up when I view some of the pictures I did obtain. Often, I had minerals from my own collection photographed: a certain polished variscite, a mannikin of copper crystals, and a pair of animals in red almandite garnet, my little seated red bear and my open-jawed hippopotamus.

I recall many of our illustrations with deep feeling: the dozen pages of bi-colored Maine tourmalines, after the chromolithographs in A. C. Hamlin's volumes, printed by Harrach on a special buff sheet; the brilliant dozen pages of fluorescent minerals from Paul Bechberger's vivid slides for his article, "Franklin Fluorescents"; the great minerals from the Sorbonne, in Paris, photographed by Nelly Bariand.

I owe a special tribute to Leopoldo Duranano, one of the most versatile illustrators I have ever encountered, who did an extravaganza of clever scenes for "Raspe the Rascal," my article on the roguish geol-

ogist-gemmologist author of *Baron Munchausen.* Duranano also created the colorful portraits and gatefold fantasy map and camel borders for my account of the famous jewel-traveler Jean-Baptiste Tavernier. Incidentally, Duranano, too, was an Argentine, a Tanjeloff discovery.

I copy-edited most of our articles and wrote many of the unsigned pieces for *Mineral Digest.* Still it took over a year to complete our first issue. When the sample copies fresh from the bindery arrived, JT and I examined them—and emotionally embraced. "We" had made it! I had fought for it on my side, he had fought for it on his. My advertising had unquestionably eased the financing of *Mineral Digest.* Nevertheless, the money had come out of his pocket. He would not accept advertising except for his own interests, so we had no advertising revenue.

For our first issue, I did write a "puff-piece" on him and used color pictures of the gallery. But he was truly introducing gems and minerals to a new public, and deserved the praise I allotted to him. He would not allow me to date that issue, nor any other;[2] his reasoning I never fathomed. Our masthead indicated that we published "quarterly," but in reality we never did. The cost of publishing *Mineral Digest* would have broken any other man, so I kept my peace. I would hang in there as long as he would support another issue.

I was confident that he would, because I had been fortunate, in a foray into mail-order advertising for modestly priced goods, to come upon a 36-inch necklace of colorful beads which could be bought

cheaply from India, and could be sold at a handsome profit by mail. For want of a better name, I christened the necklace "beggar-beads" and the name helped sell them. I was stirred up enough about "my" beggar beads to long-distance JT, who was then in Hong Kong, for permission to proceed full speed. He said, "Go!" Within weeks I had mail-order ads in twenty-four newspapers across the country. I was told that, in my time, we sold at least 100,000 of those necklaces. Among the orders that came in were one from a distinguished Justice of the U.S. Supreme Court, and another from a Nobel Prize laureate in Chemistry.

Circumstances of which I had but the remotest inkling brought JT the acquisition of the George Jensen Company (which handled magnificent silver and crystal on Madison Avenue in Manhattan and in several suburban locations) and the local Rosenthal China store on Fifth Avenue (which offered the famous Rosenthal wares). Suddenly I was the advertising director overseeing the programs of those enterprises as well as those of Astro Minerals. I had two artists on staff, a secretary and a freer hand, but *Mineral Digest,* our showcase item, was still on the back-burner.

Sadler (who wisely would not work on premises) and I met the new challenges. The budgets for the new operations justified large ads. So we created large ads that drew attention and sales. We also carried the advertising for Astro Minerals, but admittedly not with the same energy we had given it earlier.

I was increasingly unhappy that *Mineral Digest,* even more than before, had become a "Do it when you have time!" item. I urged, I pleaded. JT was occupied with other dreams. To this day, I cannot state how many copies were printed of any of the first seven issues—5,000, 10,000 or 20,000, nor indeed how much they cost. One evening, JT told me that *Mineral*

[2]For the sake of the bibliographic record, the actual dates of publication for the eight issues of *Mineral Digest* were as follows: I: 1970, II: 1971, III: 1972, IV: 1973, V: 1974, VI: 1975, VII: 1976, VIII: 1977.

Digest had cost him between $200,000 and $250,000. I do know that the largest printing was of the eighth number, and that copies may still be available. Complete sets of *Mineral Digest* sell at a premium.

Every year, in several categories, the magazine

won awards from the Art Directors' Club, for editorial excellence, for design and, of course, for color. We strongly advertised every product in the house except, in my view, *Mineral Digest*. Mailings were sent out to lists of names rented from list-brokers; I considered the choices of these lists poor. I prepared the copy and Sadler designed them, but we heard nothing of the results. Had they been impressive, I would have been informed.

When we were on the verge of plans for the eighth issue, Sadler, as I had suspected he would sooner or later, left us for greener pastures. Then Harrach, after a difficult period, lost or sold his printing establishment. I hired Jean-Pierre Pezzella, a Montreal-born artist and a gifted painter and designer, who proved to be an imaginative art director. JT signed a printing contract with the famous firm Consett & Huber AG of Zurich, Switzerland. Reto Consett, publisher of the distinguished European art magazine *Du*, was a sympathetic and sensitive individual in command of a great color printing plant. His color work, in many respects, was superior to Harrach's.

I had given a decade to *Mineral Digest*, but now saw the handwriting on the wall. JT was awash in dreams of business expansions, which ultimately would bring him down. I had cautioned him not to believe what I called "the mythology" that I and others had planted in his public relations releases: the "Mineral-General of the United States," etc. "I don't believe, I don't believe!" he protested, but he did believe. I declared that I would be leaving; I doubt that he believed me. In January of 1977, with a long vacation coming and my "last" *Mineral Digest* on press in Zurich, I went to visit him before going on to Cairo, Abu Simbel and Istanbul.

It was not easy to break away from JT. I had no personal plans except to return to my freelance work. However, with no new *Mineral Digest* in the wind, I suddenly craved freedom so strongly that I accepted an invitation to go as far away as I could—on a slow trip across Asia by bus to Katmandu in Nepal. Further details are of no consequence here, except that I was cutting the Gordian knot. On September 29 I cabled JT from Istanbul: "Am going around! Don't wait for me."

From Katmandu I did go around the world, eastward via Bangkok, Hong Kong and Tokyo, and did not touch down in New York's Kennedy Airport again until December 19.

A few days later I called in. All hell had broken loose while I was away. JT had been ousted from the George Jensen Company premises for non-payment of rent and was back in his old headquarters at Astro Minerals. "I knew you would come back!" he crowed, and declared that he wished he could have come along with me.

He needed help now and I could not turn him down. But no more full-time. For several years I was his private advertising consultant. *Mineral Digest* was a topic neither of us could avoid. For months he sought to persuade me to "throw the dice again." It was tempting, but I had to resist him. Neither of us could afford it. His health was failing, although he kept up his old bravado and joked about falling from a skyscraper" "I am still at the 26th floor!" But he was going down.

I was grieved when he passed on. I wrote his obituary and his eulogy. I still think of him with affection. He had been a force and an influence. As the swashbuckling "Mineral-General of the U.S." he had brought gems and minerals and their by-products to a vast public that had never before known they were affordable.

I am proud of the role I played in the creation and publication of *Mineral Digest*. That it is still regarded as a landmark in popular periodical publishing pleases me, of course. However, the truth is that without JT, his dreams, his vision and his daring, it would never have happened at all.

An Introduction to Bookplates

with examples from the Earth Science Library of Herbert P. Obodda

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Bookplates, the bibliographical equivalent of mineral specimen labels, have a long and distinguished history. Book collectors today are free not only to design and use their own personalized bookplates, but also to consider collecting examples from other private libraries. Bookplates designed with earth science in mind, like historic mineral specimen labels, have their own special appeal to the collector of minerals and mineralogical literature.

Bookplates, those interesting and sometimes lovely slips of paper denoting book ownership or book giving, were originally called "ex-libris"—in some quarters they still are—and first appeared on the continent of Europe. More specifically (and most logically, it would seem), they were first used in Germany, the land of the invention of printing from movable type, around the year 1450. The earliest examples, printed in ink, were struck from woodblocks and were generally of an armorial type. (Heraldry was also born in Germany.) It is recorded that Albrecht Dürer engraved at least one bookplate before the year 1503. Bookplates worked their way through France and to England in due course; the earliest English example known was executed in 1520. By the 18th century they were in general use. Samuel Pepys, the English diarist, recorded the ordering of one from his plate-maker in 1688. A book-*label* exists of probable American workmanship that is dated 1679, but the first signed and dated native American bookplate known to have survived was executed by Nathaniel Hurd in Boston

The earliest known bookplate, ca.1450.

Bookplate engraved by Albrecht Dürer before 1503.

in 1749.

Occasionally the contents of entire libraries, or small groups of significant books are presented to a college, a library or any institution for that matter, and a special *gift-bookplate* is designed and printed to commemorate the event.

For the purposes of this discussion, a "bookplate" will be considered to be a slip of paper, denoting ownership of a book, that was printed from a *plate,* and not from printers' devices and/or type. This definition would exclude the book-*labels* of Parker Cleaveland and Matthew Boulton, for instance, which were produced by printers, and not engravers. The Cleaveland label is included with the Obodda selection, however, because not only is it quite important in its own right, but it is also one of the few early American book-labels (or book*plates* for that matter), if not the only one, which is seen affixed to books about mineralogy with some regularity—Parker Cleaveland had a large library. The Boulton example is included for similar reasons.

By the 19th century bookplates had become quite venerable, after more than three hundred years of usage, and were considered as collectible objects in their own right. The very first collection of record was formed around the year 1820 by a Miss Jenkins of Bath, England. By the year 1850 an American gentleman, James Eddy Mauran of Newport, Rhode Island, was assembling a large, general collection that at his death in 1888 (the beginning of the golden age of American bookplate design and collecting) numbered some 3,500 examples.

Since then the collecting of bookplates, produced with just about every art medium known, including woodcut, wood-engraving, copper-engraving (known as chalcography; why does that word seem so familiar?), steel-engraving, etching, lithography, photography, etc., has thrived to the point that today a collection of bookplates exists, the property of a law professor at the University of London, William E. Butler, of more than *200,000* examples. Professor Butler knows of several collections that are even larger than his, including one of more than 600,000 examples in Italy! A good private contemporary collection of a general nature and mostly modern specimens, might consist of 20,000 pieces more or less. A bookseller of my acquaintance currently holds an inventory of 25,000 bookplates, most of which are available for sale individually, but some are held in small related collections such as the lifetime production of a single bookplate-artist or groups with a common theme (who among us does not remember topical stamp-collecting?) such as those depicting maps, windmills or stacks of books, to name just a few.

Societies for the furthering of bookplate collecting, study and design exist today, and over the years numerous books on the subject have been published. It is estimated that perhaps *two million* different bookplates (not prints, but the plates themselves) have been created to date, and yet certain bookplates, especially the early American examples, perhaps due to very short press-runs ordered for small private libraries, are not easy to find. In 1784 the very wealthy Boston merchant Perez Morton (1750–1837) ordered 100 bookplates from engraver Paul Revere. Today examples of that bookplate are, not surprisingly, excessively rare. Collectors of such items must

A bookplate by Paul Revere.

pursue them quite vigorously and be willing to put out substantial sums occasionally, in order to achieve any measure of success.

Paul Revere, the American silversmith-patriot, also engraved a bookplate for Isaiah Thomas, the famous printer-publisher of Worcester, Massachusetts, around the year 1795, examples of which regularly turn up on the market in an unused state—they had never been pasted into Thomas' books.

Early American bookplates of the Revolutionary War period and, of course, bookplates related to the earth-sciences are of special interest to your writer. Early examples of the latter type are, indeed, rare and are *very* hard to find, even scarcer (but not as expensive) as those in the former category. The single most desirable, and therefore most valuable, early American bookplate is the one used by George Washington, so, *naturally,* a forgery and several reproductions altered to fool the unwary are known to exist. It has recently been estimated by the experts at Sotheby's that if an authentic George Washington bookplate came on the auction block now it could reach a significant *five-figure sum!* I am not sure if I agree with that evaluation, but that is another matter. The last auction price recorded for a book from Washington's library, the highly important two-volume *Federalist Papers* (New York, 1788, with Washington's bookplate and signature in each volume) brought $1,300,000 at Sotheby's in New York on January 31, 1990. A 19th century restrike from the original copperplate seems to be priced these days, when available, at around $350. The closest comparison to the original G.W. bookplate in the world of American earth science, at least as far as desirability (but certainly not value) is concerned might, perhaps, be the bookplates of the Danas, James Freeman (1793–1827) and Samuel Luther (1795–1868), co-authors of *Outlines of the Mineralogy and Geology of Boston and Its Vicinity with a Geological Map* (Boston, 1818). The bookplates of each of these gentlemen, who were doctors of medicine and amateur mineralogists, are recorded, but I have yet to see one. Illustrated here, however, is the original plate of their ancestor, Francis Dana (1743–1811), engraved and signed-in-the-plate by Nathaniel Hurd (1730–1778). The J. F. and S. L. Dana bookplates are merely *later impressions of this plate* with the name Francis removed and their first names written in by hand. These examples would, of course, also fit nicely into a collection of early American bookplates.

Most bookplates are routinely sold and collected loose, that is, not mounted in the books that should normally contain them. Sadly, until about 50 years ago it was considered acceptable to remove a desired bookplate from a book. Today that action is thought of as vandalism. Yet, even today some booksellers routinely remove large or obtrusive bookplates (if no resultant ugly stains are revealed thereby) to improve a book's aesthetics and consequently to increase the

chances of a sale. The rule to remember is that if a bookplate is desirable in the first place, it is only more so if it is still in a book, the combination of the two adding up to what then would be considered an "association copy."

Many bookplates that are collected loose today were, happily, *never* affixed to books. Book collectors, it is theorized, always order from their printers more bookplates than they normally consume in their lifetimes. And, of course, modern collectors routinely exchange bookplates with each other, perhaps to a greater extent than they use them in their books. It is claimed that modern continental European collectors commission more bookplate varieties than they have books to put them in.

Standards of quality for collectible bookplates, especially for the early ones, naturally exist. Since they were sometimes printed many examples to the sheet and then cut apart by hand, "wide margins" are particularly desirable. This is especially true when the bookplate is a large one, because large examples were often trimmed very close, occasionally even into the design, to make them fit into small-size volumes. Early and late strikes (that is, bolder and weaker) from the same metal plate are possible variables, and "platemarks" (those indentations left in the paper by the edge of the plate) are important too, as evidence of the bookplate's being "struck." Of course, the general condition and cleanliness of the paper itself are significant, although, due to their small nature, bookplates lend themselves easily to washing.

The *râison d'etre* for the bookplate has changed considerably over the centuries. Originally, it was mostly for one very practical reason that a gentleman

affixed them to his books—so that he might have the reasonable expectation that books he loaned out would eventually be returned to him. The armorial bookplate, sometimes executed without a name inscribed, was a very natural, immediately recognizable iconographic symbol that was constantly in the eye of the borrower as a reminder of who owned the book, and it could further serve its owner should the book fall into the hands of an illiterate person.

Attempting to imitate their English counterparts, coats-of-arms became very popular among upper-class early American families, whether they were technically entitled to use one or not; most families are non-armigerous! It is known that a typical colonial engraver, after finding a coat-of-arms that pleased his eye and after offering false assurances to his unarmed client that its usage was correct, would simply appropriate it. Indeed, the venerable Thomas Jefferson's desire to own a coat-of-arms was so great that he instructed his London agent to locate his family's arms and, failing that, to order a new one to be created! The most popular printed source of such designs in use at the time was Guillim's *Display of Heraldry* (London, 1724). In England such matters were controlled by the College of Heralds, but in the American colonies these activities were not supervised. Coats-of-arms were painted on coaches, engraved on household silver, cut into personal seals and finger-rings, carved in wood for display over doorways, painted on wooden panels for framing, etc., mostly by native craftsmen. Often, armorial bookplates were engraved, usually on copper, by these same artisans. This was especially true in early New England, but in Virginia, where there was a larger population of "gentlemen" with closer ties to England, their bookplates, which, it seems, are generally of a more professional execution, were, for the most part, ordered from London. New York City was also somewhat more closely tied to England. It is assumed that the George Washington plate was engraved in London but, curiously, it is inferior to the best American work of the period.

The usage of bookplates mentioned previously implies, and apparently correctly, that there was much book-lending and book-borrowing in early society when printed works and private libraries containing them were much scarcer (and books were significantly more expensive) than they are today. Apparently it was considered a matter of *noblesse oblige* for gentlemen of that period to share their libraries with other literate but less affluent citizens.

The message offered by the Gilbert W. Withers bookplate shown here is a modern descendant of a very long line of similarly expressed sentiments found inscribed on bookplates over the centuries, such as:

This book was bought and paid for by D.C. Colesworthy. Borrowing neighbors are recommended to supply themselves in the same manner. Price seventy-five cents.

Stolen from J.W. Houx;—Read Slowly, Pause frequently, Think seriously, Return duly with the corners of the leaves not turned down.

Any one may borrow, But a gentleman returns.

Never open a book farther than to bring both sides of the cover on to the same plane. Never lend a borrowed book, but return it as soon as you are through with it, so that the owner may not be deprived of its use. You may think this is a strange request, but I find that although my friends are poor arithmeticians, they are nearly all of them good book-keepers.

Of course, quotations from the Old Testament were not neglected, and Matthew, Chapter XXV, verse 9 supplied the following:

Go ye rather to them that will sell and buy for yourselves.

And finally my personal favorite, originally from Germany (again) and of 17th century origin—

By him who bought me for his own
I'm lent for reading leaf by leaf;
If honest you'll return the loan,
If you retain me you're a thief.

There are also inscriptions placed on bookplates that are much harsher than the statements quoted above. They are known as *book-curses,* and two examples are quoted here—

May whoever steals me cease,
ever to have a moment's peace.

This book belongs to none but me,
For there's my name inside to see.
To steal this book, if you should try,
It's by the throat that you'll hang high.

It is hard to believe it today, but the theft of a single book in early England, and in colonial America too, was often prosecuted as a *capital crime.*

Today almost no collector, at least none of my acquaintance, would consider lending his or her treasured volumes to anyone for any reason, although most will allow on-premises consultation. The two notable exceptions to this rule are bibliophiles Carl Krotki of New York City and Richard Hauck of Franklin, New Jersey, who trusted me with the loan of many significant and valuable books from their important libraries over the years, including one of the most precious, their copies of Sowerby's *Exotic Mineralogy.* Hauck's mineral and gem books have

been sold and are now scattered; sadly, neither man added bookplates to his books to denote his tenure for future owners of his volumes to ponder. Today the use of a bookplate can be a mark of personal satisfaction for the book-owner much in the same way that a mineral collector uses a personal label for his minerals. Have we not all, at least once, experienced the thrill of finding an old-time mineral specimen that retained three or four (or more) labels, each identifying a different previous owner of the piece—and would the specimen be as desirable to us if some collector separated these labels from the specimen and added them to his files? This is precisely the kind of information, history and romance that bookplates impart to books, and why they should remain *in* the books.

Clarence Sweet Bement (1843–1923), who was among the greatest of all mineral collectors, used a personal bookplate. (See illustration.) Bement had a highly important private library of a general nature which has been discussed in several places, but apparently he did not collect mineral books. In a sales-resistant letter to George F. Kunz (dated 1896, and published in my book, *Notes and Commentaries on Letters to George F. Kunz*), he wrote that his resources were limited "with not a cent of income except from sales of my books. This week I expected a dealer from New York who wanted to buy an expensive volume . . . ." As part of an earlier letter, published in the book quoted above, Bement encouraged Kunz' book-collecting—"I presume you are adding steadily to your gem library, and must now have an immense accumulation of material interesting to mineralogist and gem admirers. It is an interesting hobby and I think your library will prove a good investment in every way."

In 1923 the American Art Association sold at public auction those of Bement's books that survived his death. The 1,178 lots included only three books of a mineralogical or gemological nature. They were the 1677 edition of Tavernier's *Travels* and copies of Kunz' *Gems and Precious Stones of North America* in both the first and second editions, the latter an autographed presentation copy from the author. The general books in the auction catalog are certainly interesting, but no rare treasures are present. It can be safely assumed that the legendary bookseller Dr. Abraham Simon Wolf Rosenbach, who considered himself, and perhaps rightly so, to be the world's foremost bookman, sold (many on a consignment basis) all of Bement's best books many years previously. Whether or not Bement had other gem and mineral books that Dr. R. (as he was known) or others sold for him can only be speculated upon, but one would think he surely had a mineral collector's working library.

For more information about Bement's activities as a book collector consult "Clarence S. Bement: The Consummate Collector" (1990) by Joseph J. Peters and Charles L. Pearson (*Mineralogical Record,* **21**, 47–62), and *Rosenbach, A Biography,* by Edwin Wolf, II with John Fleming (London, 1960). Bement's bookplate, of a pseudo-heraldic style, is one that was photographically produced and does not match the very high quality, hand-engraved, custom-designed examples used by many of his contemporaries, especially his fellows in The Grolier Club.

Whereas the main purpose of this article is to discuss bookplates in general and to exhibit and describe in particular those earth-science-oriented examples in the Obodda library, the intention (if the cat has not already slipped out of the bag) is also to encourage mineral-book collectors to have designed (or to personally design, if they are so capable) and to use a personal bookplate in their books. I myself practice what I preach and am very happy with my little bookplate, which was designed only for the books in my geoscience library. I like it so much, in fact, that I am considering extending its use to my general library.

The bookplate, commissioned with the help and advice of William Hallam Webber, noted antiquary of Gaithersburg, Maryland, was hand-engraved and embossed on steel by Stanley E. Scantlin, of Springfield, Virginia, a master-engraver formerly with the United States Bureau of Engraving and Printing, and it was, of necessity, quite expensive. (A fine bookplate need not be hand-engraved, however and can be produced quite inexpensively.) It copies and replaces the less accomplished example, pictured in the Obodda library as Number 22, which was executed for me as a gift from a friend around 1975. One wealthy book collector of the past half-century had between 250 and 300 bookplates made for her over her lifetime.

The artwork in the early example of my bookplate was photo-reproduced from a pen and ink drawing

done to my specifications, which was fine, but each bookplate was supplied with factory-applied, self-sticking, stain-producing adhesive, and this type of adhesive is to be avoided at all costs.

The guiding factors in bookplate design should be that the bookplate be executed in a *small* size and tastefully; within those guidelines, much is possible. It should be remembered that a small bookplate will fit in *all* sizes of books, while a large example (unless it is drastically trimmed-to-fit a smaller book) harms the aesthetics of the small volume that it overwhelms.

Once it is decided to place a bookplate in a book, it should be done in an archivally safe, but permanent, manner with a paste adhesive such as rice glue. The most traditional spot to affix a bookplate is in the exact center of the inside front (sometimes called the upper) cover. If the book is an old one and that spot is occupied, then any place on that cover (sometimes also called the front paste-down) is fair game. If the cover is fully occupied then a collector can move on to the front free-endpaper, the inside back (or lower) cover, and finally to the back free-endpaper or to the rear paste-down. If they are *all* full, as is the case in one 17th-century work in my own library, then a bookplate can be *tipped-in* on top of one of the older ones. This involves just a bit of mounting tape applied at the top of the new bookplate so that it is hinged and can then be lifted to reveal the earlier bookplate beneath it. In any case an old bookplate should *never* be covered. The only possible exception that comes to mind (and I am not sure if it is valid) is, as in the case of one little volume in my library, when the owner covered his *own* bookplate with a new and slightly larger example.

Bookplates are lovely and fascinating little items. At their best they can be miniature *tours-de-force* of the engraver's art that put us in touch with an age long gone. In the case of the early American examples, they represent the only affordable area of collecting 18th-century American engraving left to persons of ordinary means. At their worst (tastelessness excepted), bookplates simply offer information about their owners that may not be available anywhere else. Since early earth-science-oriented examples are rare (rarer by far than the early American ones), their pursuit, pleasant and inexpensive as it is, can be never-ending. But, unlike mineral specimens or even books, a lifetime collection will never present a storage problem, and owning but a few such bookplates (which is, realistically, what most of us, if we specialize, must expect) can be very satisfying too, or so it has been for me.

After this story had been substantially written, I was shown a two-page article from the publication *K, The Magazine for Amateurs in Minerals and the Lapidary Arts,* Moscow, written in the Russian language and published sometime in 1993. On the first page is a foreword in English as follows:

> Yu Borodayev [author], Geologist's Book-plates [title of the article]. The geologist lecturing at the Moscow university has a *peculiar* hobby: [italics added] he collects book-plates that belong to the people of geological professions. The author narrates of a number of book-plates from the library of prominent mineralogists and geologists of past and present times.

The article illustrates 14 bookplates and book-labels, mostly of Russian origin. Four of them (including the author's own) depict groups of *quartz* crystals, one displays what seems to be a *fluorite* crystal group of penetration-twins held in a human hand, and one bookplate includes several *trilobites.* Two of the 14 belong to women and, interestingly, alongside the Cyrillic lettering, some of them use the universal term *ex-libris.* A. E. Fersmann's very simple book-label is included in the selection.

THE HERBERT P. OBODDA LIBRARY OF THE EARTH SCIENCES

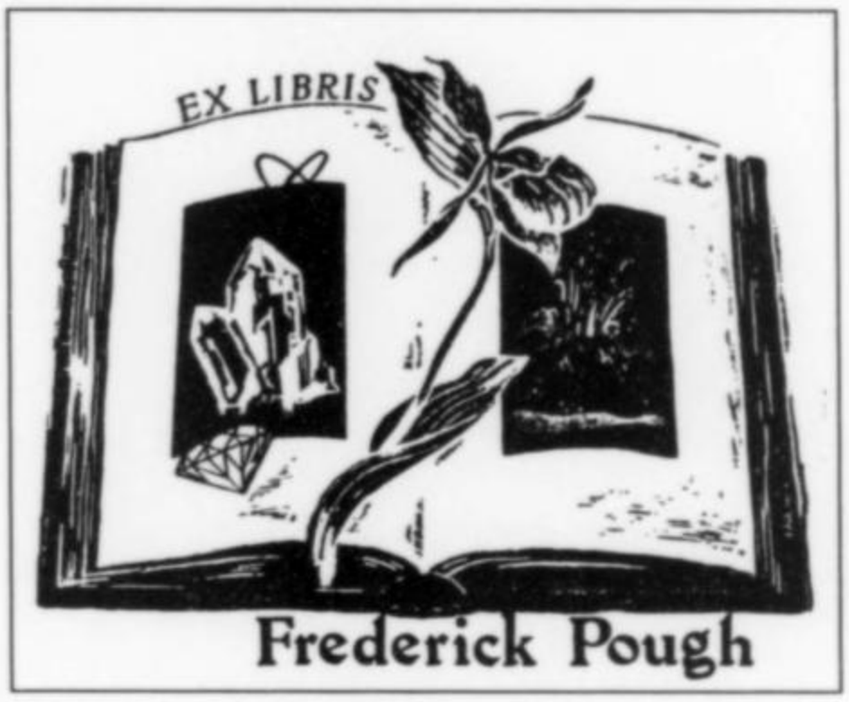
The Obodda Library (the term *earth-science* is used here to include works on mineralogy, mining, geology and gemology but almost no paleontology) was begun in the early 1960's when such books were much easier to find in the marketplace than they are today. It has been enlarged ever since then, but especially since 1979. Today this assemblage must be considered as one of the very finest libraries of its kind in the world, public or private, and *surely* the most comprehensive in this hemisphere. It contains more than 10,000 separate works (!), a most impressive number for any single-theme library!

One day I thought it might be most informative (and fun, too) to learn what bookplates accompanied the Obodda books, and to that end Herbert Obodda examined each and every book in his library and supplied me with a photocopy of each bookplate, a number that approached two hundred, not including duplicates. Those reproduced here are, of course, only a fraction of the whole, but are the most interesting ones.

One criterion that had to be met in order for a bookplate (if it was not obviously of a geoscience nature) to be included in this article was that it was present in a book that had been part of a library with significant earth-science holdings (actual or apparent), and was not merely a bookplate inserted in an odd mineralogical or geological work that was part of a general library. This problem manifests itself often in mineralogies. One good example would be the mineralogical works of James Sowerby, which were once required accessions for the vast "gentlemen's libraries" assembled in the great English houses in the 18th and 19th centuries. Many of these libraries still survive, are sold off occasionally; they are regular sources of a few fine geoscience books each, that may then enter the marketplace. In the Obodda library are

many books with handsome early bookplates, especially of the armorial type, presumably from sources similar to those mentioned above and other places too, but little or nothing can be traced regarding their owners. Only their names, titles (if any are listed or symbolized) and the fact that they were "gentlemen" and "ladies " have survived.

BOOKPLATES IN THE OBODDA LIBRARY



Frederick H. Pough (1906–)

American mineralogist, gem expert, author of the almost legendary *Field Guide To Rocks and Minerals,* writer of numerous gem and mineral-oriented articles, etc., etc. . . . Pough, who was once curator of minerals at the American Museum of Natural History, had an extensive and important library on minerals and gems, especially books with colorplates, which was dispersed by catalog sale several years ago. He also had a large mineral collection. The mineral *poughite* was named in his honor.

Affixed to *La Science Des Pierres Precieuses* by Antoine Caire, Paris, 1833.

Louis C[omfort]. Tiffany (1848–1932)

Son of Charles L. Tiffany, founder of Tiffany & Co., he designed many jewels using gemstones and, of course, achieved fame with his iridescent "Tiffany glass." Louis Tiffany (or LCT as the world knew him), along with the author Oscar Wilde, himself a gem collector, spread George Kunz's "revolutionary theory" about the importance of "semi-precious" stones (which were largely neglected up until that time) to a world then embracing the principles of Art Nouveau. In the year 1902 he inherited from his father an estate of more than thirteen million dollars! This is a good example of an armorial bookplate.

Affixed to *The Cullinan Diamond,* no place, no date, but probably produced by Tiffany & Co. even though it is not so stated.

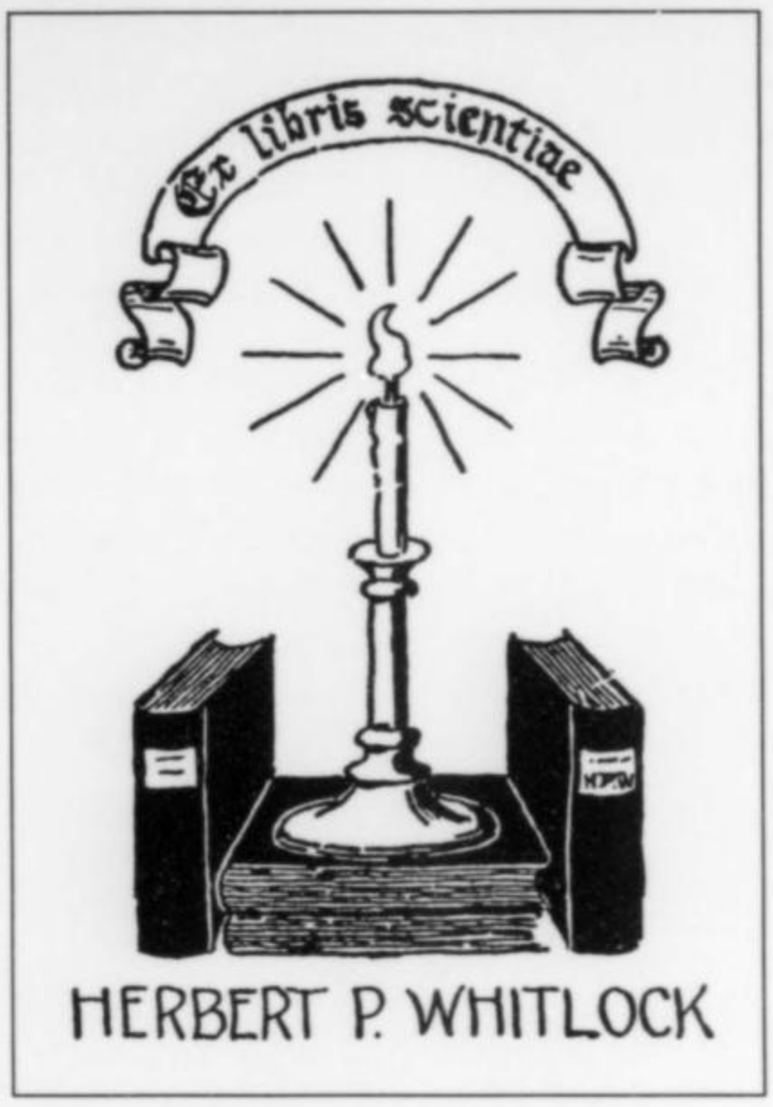
Nathanael G. Leske (1751–1786)

Leske was one of the most distinguished pupils of Abraham Gotlob Werner (1750–1817), later becoming a professor of Natural History at Marburg University. He assembled a very significant mineral collection of more than 7,000 specimens. It was known as the *Leskean Museum,* and it was purchased from his heirs in 1792 by the Dublin Society, a predecessor of the National Museum of Ireland. This collection was the subject of a separate work by Dietrich L. G. Karsten, himself a disciple of Werner, and was translated into English in two volumes by George Mitchell as, *A Description of the Minerals in the Leskean Museum* (Dublin, 1789). The book is very rare today, and there are only two copies in private hands known to the writer, one of which is in the Obodda Library and was formerly the property of Matthew Boulton. The Dublin Museum today possesses about 7,500 mineral specimens, but only about 2% of them are on display.

Affixed to *Kleine Minerologische* [sic] *und Chymische Schriften* by Johann Friedrich Henkels, Vienna, 1769.

Herbert P[ercy] Whitlock (1868–1948)

American mineralogist, after whom *whitlockite* was named, he was once curator of mineralogy at the American Museum of Natural History and wrote



several books on minerals and gems, including the classic monograph *Calcites of New York* (Albany, 1910). In 1949, with the noted gem and mineral dealer Martin L. Ehrmann as junior author, he produced *The Story of Jade* (Sheridan House, New York). This book described many specimens of jade in the collection of the American Museum which included the famed Drummond Collection given to the museum in 1934 as well as specimens from the senior author's private collection which he later donated to the Museum.

Affixed to Louis Pope Gratacap's *A Popular Guide To Minerals* (New York, 1912), which is a presentation copy signed to Whitlock from the author. It would be hard to imagine a more desirable copy of this work, as Whitlock was Gratacap's successor at the Museum. The book, with its numerous photographs of mineral specimens, is one of my favorites. It was, up until the recent writings on Clarence S. Bement in the *Mineralogical Record* and *MATRIX* by Joseph Peters and Charles Pearson, the best reference in print about the Bement Collection at the American Museum, and it is still the most comprehensive.

Dr. Carl Hlawatsch

Hlawatsch's is one of the few obviously mineralogical bookplates and a handsome example too, but little, so far, has been uncovered about Dr. Hlawatsch.

Affixed to *Physikalisch-Chemische Mineralogie* by Dr. C. Doelter (Leipzig, 1905). There are many letters in the George F. Kunz file at the American Museum of Natural History Library from Doelter to Kunz. In one such letter of 1926 (written in German) and still in my files, Doelter tells Kunz that he "has fitted up a small crystallographic laboratory . . . and every afternoon I am busy there measuring crystals for the chemists. In the forenoon, I occupy myself at the Natural History Museum [of Vienna] but have no official connection with the museum." Another interesting quotation from this letter is—"In addition I have written the article on Sulphates for the *Handbook of Mineral Chemistry* by Dr. E. Zeitmeyer."

Sidney Melmore

Melmore's bookplate is a superbly executed (mineral?) crystallographic example, but at this time we can find nothing about Mr. Melmore. Perhaps a reader can help with information on this and the preceding example.

Affixed to *Memoire Sur Les Systemes Formes Des Points* by A[uguste]. Bravais (Paris, 1850). Bravais' work *Études Cristallographiques* (Paris, 1866) is cited in the bibliographies of *Dana's System of Mineralogy,* editions 6 and 7.

George Frederick Kunz (1856–1932)

Kunz was an author, mineral and gem collector and dealer, authority and expert (perhaps the world's greatest) on gems, for Tiffany & Co., etc., etc., after whom *kunzite,* the pink gem variety of the mineral species *spodumene,* was named. His is one of the very few bookplates known to me to have been executed in color. After his death Kunz's legendary library (including this volume?) went, apparently as a gift, to the United States Geological Survey Library where it still exists today, albeit in somewhat reduced form. This was done in spite of the fact that Kunz, in his will, had instructed his executors to keep intact his library of books, magazines and newspaper clippings on minerals, precious stones, etc. "pending an advantageous sale." Kunz considered it, and probably justifiably, to be the most complete library on those subjects in existence.

Affixed to *Popular Mineralogy* by Henry Sowerby (London, 1850). The author of this work (1825–1891), was a grandson of James Sowerby and was the last of the dynasty to produce a mineral book, this work. It is a small but lovely volume with numerous printed colorplates of minerals.

George F. Kunz (See previous entry)

Kunz was *also* an expert, perhaps the greatest in his day, on the *literature* of gems, jewelry and minerals. In November, 1927 he gave an in-depth lecture on that subject to The Grolier Club, of which he was a member, and supplied from his library a comprehensive display of such books as a background to the talk. At this time it has not been determined whether Kunz had other (non-gem-and-mineral) books in his library that gentlemen collectors of his time considered to be *de rigueur.* This bookplate is a typical (probably pseudo-) armorial example of the 1890's, not engraved, but nonetheless, quite handsome.

Affixed to *A Descriptive Catalogue of Diamonds in the Cabinet of Sir Abraham Hume* by the Count De Bournon (London, 1815). Of this work, which is very rare, James Sowerby, in *Exotic Mineralogy* (London, 1811–1817), made the following comment: "The crystallization [of diamond] was but little known until Bournon's *Catalogue* of Sir Abraham Hume's collection was published. . . ."

Duncan Andrews (1935–)

Andrews is a contemporary American book collector and one-time member of The Grolier Club who

now collects the works of the illustrator Stephen Gooden (in which this bookplate is also used) and has assembled what is surely the *finest* Gooden collection. This is an excellent and well-designed (Scottish theme) bookplate that was originally used in a very important and comprehensive gem-library. It was the disposition of the Andrews gem-book library that was referred to by me, without name, in *Mineralogical Record* (vol. 22, no. 6, p. 466). This bookplate was designed by Andrews in 1966 and was executed for him on copper by the English master-engraver (now deceased) Kenneth Hobson, who was affiliated at the time with the venerable London bookbinding firm of Sangorski & Sutcliffe. After a short while in use it was *steel-faced,* an electroplating process that coats the surface of the plate with the harder metal, to make larger numbers of impressions possible. There is some detail lost by this action, however. Andrews designed another lovely bookplate (not shown), done by the same engraver, that was used in his "sporting-books" and is replete with riding accessories and the required fox-head. At the bottom of this bookplate, in a small and subtle display, is a tiny thistle as in the example illustrated. Both of the original engraved plates cannot now be located and are assumed lost.

Affixed to *Les Merveilles des Indes Orientales et Occidentales* by Robert De Berquen (Paris, 1661). The book is a very rare little volume of early descriptive gemology and is considered important. The author was a Parisian jeweler.

De Witt Clinton (1769–1828)

Clinton was twice Governor of New York and earlier, Mayor of New York City. He was also President of the Literary and Philosophical Society of New York. This example is signed in the plate by the famous New York City engraver Peter Rushton Maverick (1755–1807) and was probably engraved in the year 1789. Maverick, who was born in England and emigrated to America about 1774, was the most prolific of our early bookplate engravers, with a total of more than 72 different examples attributed to him. (I have eleven Maverick bookplates in my collection so far, including Clinton's, which is considered rare.) This is one of the *very* few bookplates, surely the only one in the Obodda library, that fits into *both* of my bookplate collections. It has been assigned the Allen number 171 (*American Book-Plates. A Guide to their Study with Examples* by Charles Dexter Allen, New York. 1894). It is not known for certain if De Witt Clinton owned a significant number of earth-science

books, but it is probable that he did, as there are four entries of a geological nature to his credit in Hazen & Hazen's *American Geological Literature, 1669–1850* (Stroudsburg, 1980), and the mineral *clintonite* was named for him in 1828.

Affixed to *Outlines of the Mineralogy and Geology of Boston and its Vicinity with a Geological Map,* by J. Freeman Dana, M.D. and Samuel L. Dana, M.D. (Boston, 1818), This book, to the best of my knowledge, is the earliest work that can lay claim to being an American regional mineralogy even though, in spite of its title, it is not really a work of mineralogy alone, but treats mostly the geology of the area. Both of the Danas, J.F. and S.L., used personal bookplates.

Parker Cleaveland (1780–1858)

Cleaveland was author of *An Elementary Treatise on Mineralogy and Geology, Being an Introduction to the Study of These Sciences, and Designed for the Use of Pupils,—For Persons, Attending Lectures on these Subjects* . . . (Boston, 1816), the first substantive mineralogy written by a native-born American and therefore a highly collectible volume completely aside from the importance of its contents. The book is dedicated to Benjamin Vaughan (1751–1853) of Maine, one of early

America's most prominent citizens. Vaughan was a leading patriot in the Revolutionary War and did important work on the Anglo-American Peace Treaty after the war. He personally purchased, and was responsible for, *many* copies of Cleaveland's book being given to institutions and prominent individuals including President James Monroe, but the books were *always* presented in the name of the author. Benjamin Vaughan himself used a particularly handsome armorial bookplate. Cleaveland is called by the *Dictionary of American Biography*—"The Father of American Mineralogy," and the mineral variety *cleavelandite* was named for him. He had an extensive earth-science library, including at least one volume that had previously been in the library of the early New York City mineralogist and editor of *The American Mineralogical Journal* (New York, 1814), Archibald Bruce, M.D. (1777–1818). Cleaveland's library survived essentially intact in the hands of his descendants until it was purchased and dispersed by a bookseller in Maine in the 1950's. The photograph shows a *book-label* rather than a bookplate since it was created by type and printers' devices and was not engraved as a *plate*.

Affixed to *A Manual of Mineralogy* by Arthur Aikin (London, 1815). This work, which only halfheartedly uses the then-current Linnaean system of classification of minerals, was quite popular in its day. A Philadelphia edition of the same year exists, and is therefore one of the earliest mineralogies printed in the United States.

Horace Parker Chandler

Not too much has been uncovered about Mr. Chandler except for the fact that he was the *grandson of Parker Cleaveland,* and that the volume carrying his bookplate was once the property of his grandfather. What is interesting here is that Mr. Chandler has reused (with minor changes in lettering) the bookplate of *another* ancestor, Gardiner Chandler (1723–1782) of Massachusetts, which was engraved, probably in the 1760's, and signed-in-the-plate, by *Paul Revere,* one of only *four* signed examples known to have been engraved by Revere (see p. 144). Several years ago I owned a copy of the second edition of Cleaveland's *Elementary Treatise* . . . which had been presented to Horace Parker Chandler with appropriate genealogical inscription by his mother, if I recall correctly. The book had been enhanced by a superb original photograph of Parker Cleaveland in old age.

Affixed to *Principia Rerum Naturalium* by Emanuel Swedenborg (Dresden, 1734).

Daniel Tilas (1712–1772)

Swedish scientist and an early (probably the first) owner of this volume. He wrote extensively about Swedish mineralogy and geology and was a founder and president of the Royal Swedish Academy of Sciences. *Tilasite* was named in his honor. According to the *Dictionary of Scientific Biography* (Vol. XIII, p. 409)—"[He] was greatly interested in the inspection of mines and took part in the work at mines and smelting plants. He discovered the need for exact mapping of the mineral veins in the mines, in order to form rational plans, and soon extended this work to mapping the geology of the surrounding areas to facilitate prospecting for new mines." It would seem that Tilas was an early economic geologist.

Affixed to the same book as the previous bookplate.

M[atthew] Boulton (1728–1809)

Boulton, because of his technological activities,

especially those accomplished in association with James Watt and the exploitation of the steam engine, epitomizes the English Industrial Revolution. In the 1790's he completely revolutionized the minting of coins. American coin collectors are probably already aware that Boulton & Watt, through their Soho Mint at Birmingham, England, supplied many coin blanks (planchets) for the minting of American coins during the early Federal period, and that they actually struck the Myddelton pattern coins, used in Kentucky, in 1796. Boulton had a vast library of science and technology which survived essentially intact until it was sold at auction by Christie's in December of 1986. It was reasonably rich in mineralogies, and contained around 30 earth-science-related books. One of these works was once part of my own library, *Elements of Mineralogy* by Richard Kirwan (London, 1794). Sadly, this two-volume work lacks Boulton's *book-labels.* The enterprising auction house however, created their own little reproduction of the original label, added their name (of course) and the auction date, and pasted one into each volume. Boulton also had a private mineral collection.

Affixed to *A General Natural History: Or New and Accurate Descriptions of the Animals, Vegetables, and Minerals . . .* by John Hill (London, 1748).

Herbert [Clark] Hoover (1874–1964)

Hoover is best known as the 31st President of the United States. Very early in his life he became extremely successful and affluent due to his mining engineering activities and was able, in the year 1912, along with his wife, Lou Henry Hoover, to devote the enormous time necessary to produce the first English-language translation of Agricola's *De Re Metallica* (Basle, 1556). In the introduction to the bibliography of the Hoovers' library, *The Hoover Collection of Mining & Metallurgy* (Claremont, 1980), author Cyril Stanley Smith tells us that:

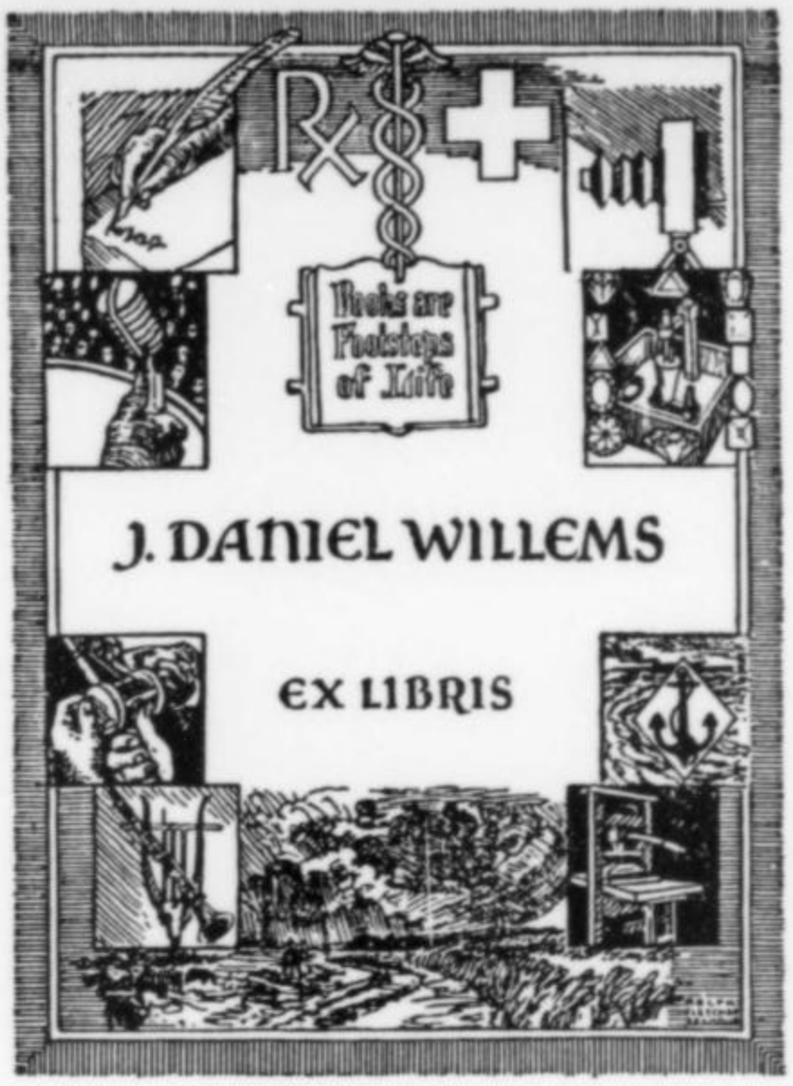
> The translation [of *De Re Metallica*] may have been done as a pleasant extension of Hoover's work as a professional engineer, but there can be no doubt as to the magnitude of its contribution to history. The work is of the highest quality and it could only have been produced by someone with far more than a casual interest in technical history. *It is astonishing that Hoover wrote nothing else in the field* [italics added] and that he never participated in meetings of any historical [or scientific?] society.

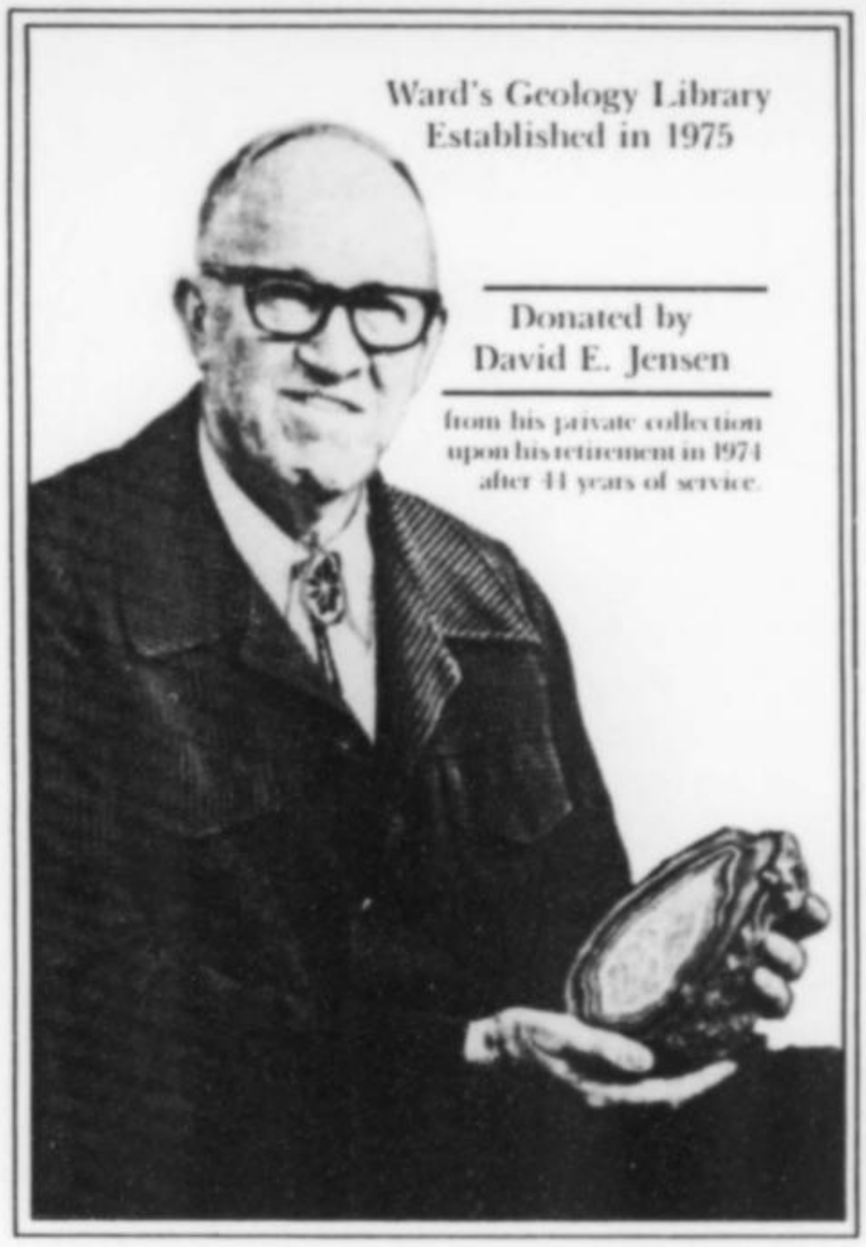
The Hoovers' extensive De Re Metallica Library was assembled at first to help in the translation project, but it is apparent that they became authentic bibliophiles. They purchased their first books in 1908 and by 1912 (the year of the publication of the translation) they had a library of 275 volumes. They continued purchasing, however, and by 1914, the last year of any acquisitions, the library had more than doubled in size to 573 works. The books are all now at the Honnold Library at Claremont College, near Los Angeles, California.

Affixed to *Transactions of the Institution of Mining and Metallurgy,* Vol. VIII (London, 1900).

J. Daniel Willems, [M.D.] (1888–1971)

Willems was a Chicago, Illinois, surgeon, and also an amateur gem cutter (he wrote a very fine manual, *Gem Cutting,* Peoria, 1948) who assembled an important gem and mineral library and, in semi-retirement, became a part-time dealer in such books. He was a source of gem and mineral books for me for many years, and until recently I owned his copy of John Mawe's *Travels in Brazil* (Philadelphia, 1816) *with his bookplate.* His private library was sold at auction by Swann Galleries, New York, in 1971. He once wrote an interesting article entitled "Cameos: An ancient gem-carving art revived for modern tastes," in *Mineral Digest* (vol. 2, p. 42, New York, no date). According to Louis Zara, Editor-In-Chief of *Mineral Digest,* "The result was probably the most lavishly illustrated





article on cameos in full color ever to appear in a periodical." It was based on Willems' private collection which later went to The Lizzadro Museum of the Lapidary Arts. During most of his life Willems assembled a "massive compilation" of gem- and mineral-literature bibliographical information, but even with the help of his friend, Louis Zara, it was impossible at that time to find a publisher for it. Willems sold it, just before he died, to another gem-bibliographer, who, adding it to his own work, published it recently. Zara, who supplied the Willems information quoted above and who acted as something of a mediator in the sale of the bibliography, assumed that the new author "would make appropriate acknowledgement to Willems." As I write these Willems notes I have been given a copy of his publication, "Books on Gems, Catalogue No. 10, Fall 1958," and find it to be a thoroughly professional production, with photographs, very careful descriptions and far superior to virtually all gem-book catalogs that I have seen of that time (they are usually merely mimeographed listings) or any time for that matter. A quick peek inside reveals a *British Mineralogy* by Sowerby, complete in five volumes, for $100; A "Hope" catalog of 1839 for $10, and, curious for its high price, a copy of Hamlin's *History of Mount Mica* at $25.

Affixed to *Scottish Gem Stones* by W. J. McCallien (London, 1937).

David E. Jensen (1910–1983)

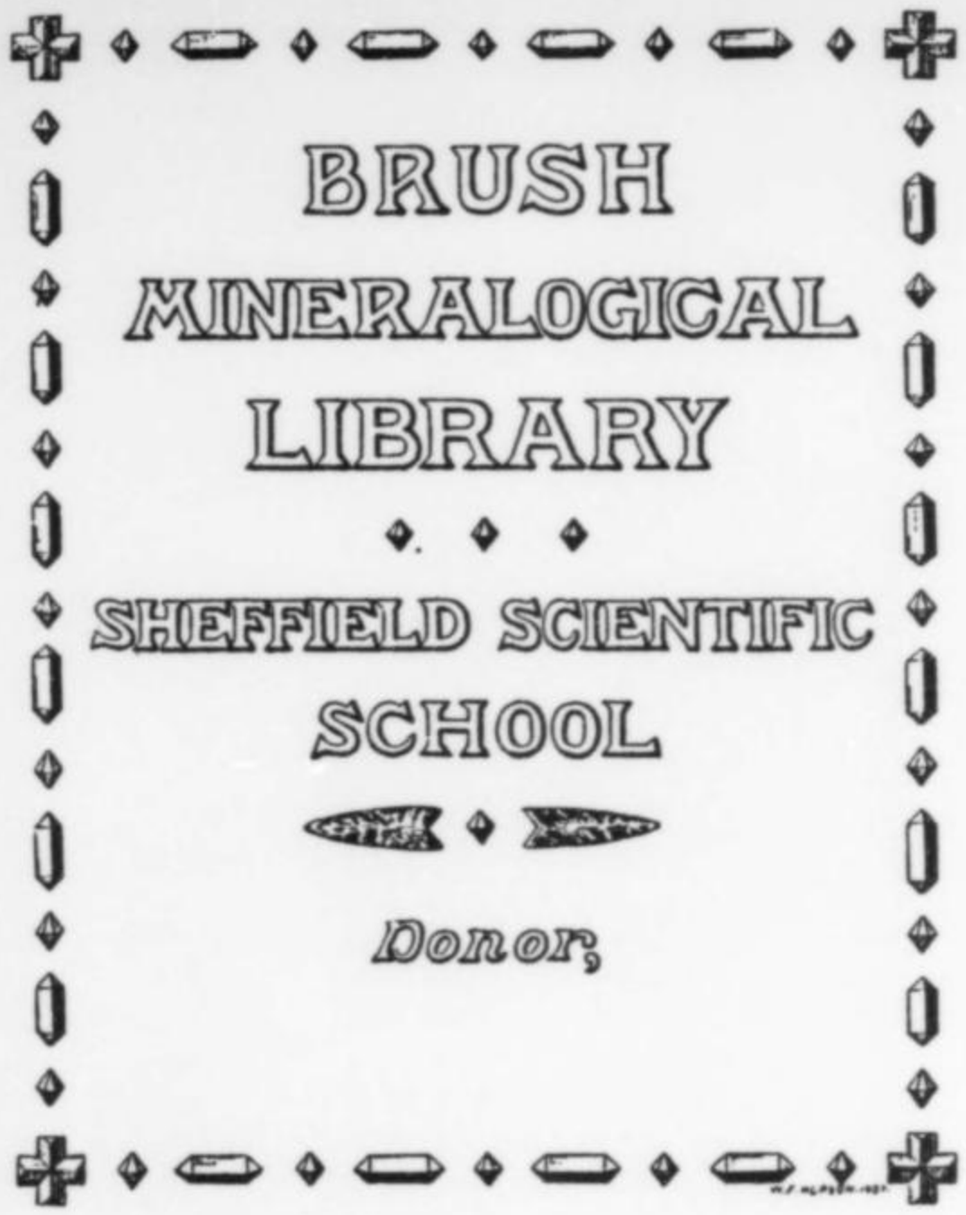
Jensen was born in Penn Yan, New York, and was a mineralogist with Ward's Natural Science Establishment of Rochester, New York, for most of his life. He succeeded Robert Vance in 1948 and retired in 1974, ending his career as vice-president. It was Jensen who put together collections of rocks and minerals that were used to teach the lunar astronauts what to search for and bring back to Earth from the Moon. He wrote a new and revised edition of George L. English's classic work *Getting Acquainted with Minerals.* A memorial appears in the July-August, 1983 issue of *Rocks and Minerals.* His geoscience library of more than 3,000 titles (including professional papers, monographs, etc.) was presented to Ward's. They sold the more important titles at retail and donated most of the remainder to the University of Rochester, who in turn sold some of the volumes to dealers.

Affixed to *The Building of the Alps* by T. G. Bonney (New York, 1912).

[George J.] Brush Mineralogical Library, Sheffield Scientific School [Yale University]

This example was executed in 1907 by William Fowler Hopson (1849–1935), who is called, by William E. Butler, in his work *The Golden Era of American Bookplate Design: 1890–1940,* one of five "Acknowledged Masters" of bookplate creation. It displays an absolutely delightful border of tiny crystal forms. Hopson was born in Watertown, Connecticut and spent most of his life in New Haven. George J. Brush (1831–1912) was born in Brooklyn, New York. In 1864 he became chairman of the mineralogy department at Yale. He had a very important personal mineral collection that was particularly rich in type specimens, and in 1904 he presented it to Yale. Probably, the gift of books was made around this same time. *Brushite* was named in his honor.

Affixed to *Allgemeine Chemische Mineralogie* by Dr. C. Doelter (Leipzig, 1890).



Lawrence H. Conklin (1933–)

I would describe myself as a mineralogist and bibliophile. This was my first bookplate, which was of the "peel-off" variety. Its factory-applied glue generates, over a period of time, stains that bleed through light-colored paper and makes this type of bookplate (or, at least, this type of adhesive) something to be avoided. It is a punning bookplate because one ancient spelling variant of the name (Conckelein) meant *little shell*; the name became Concklyne by the early 17th century in Nottingham, England, and finally, the modern spelling was used in Salem, Massachusetts, after 1640. This plate was used in my geoscience books *only,* from around 1975 until 1991, when the

similar but hand-engraved example (see below) replaced it. I was pleased that the old bookplate could be easily and cleanly peeled off in most cases, and that the new bookplate, which was purposefully designed slightly larger than the old one, entirely covered any "stain."

Affixed to *An Introduction to Chemical Crystallography* by P. Groth (New York, 1906). This volume was part of the mineralogical library that I sold in 1979, and it survived the great fire at the Byer Museum in Evanston, Illinois. I have collected books, geoscience and general books, since the 1950's, and find that my bibliophilism only becomes stronger each year.

Lawrence H. Conklin (See above)

This, my second and permanent geoscience bookplate, was hand-engraved and embossed for me on steel after the design of my original (see above), and is printed in wine-colored ink. It is in what was until recently my copy of a very rare book which I exchanged with Herbert Obodda in 1992.

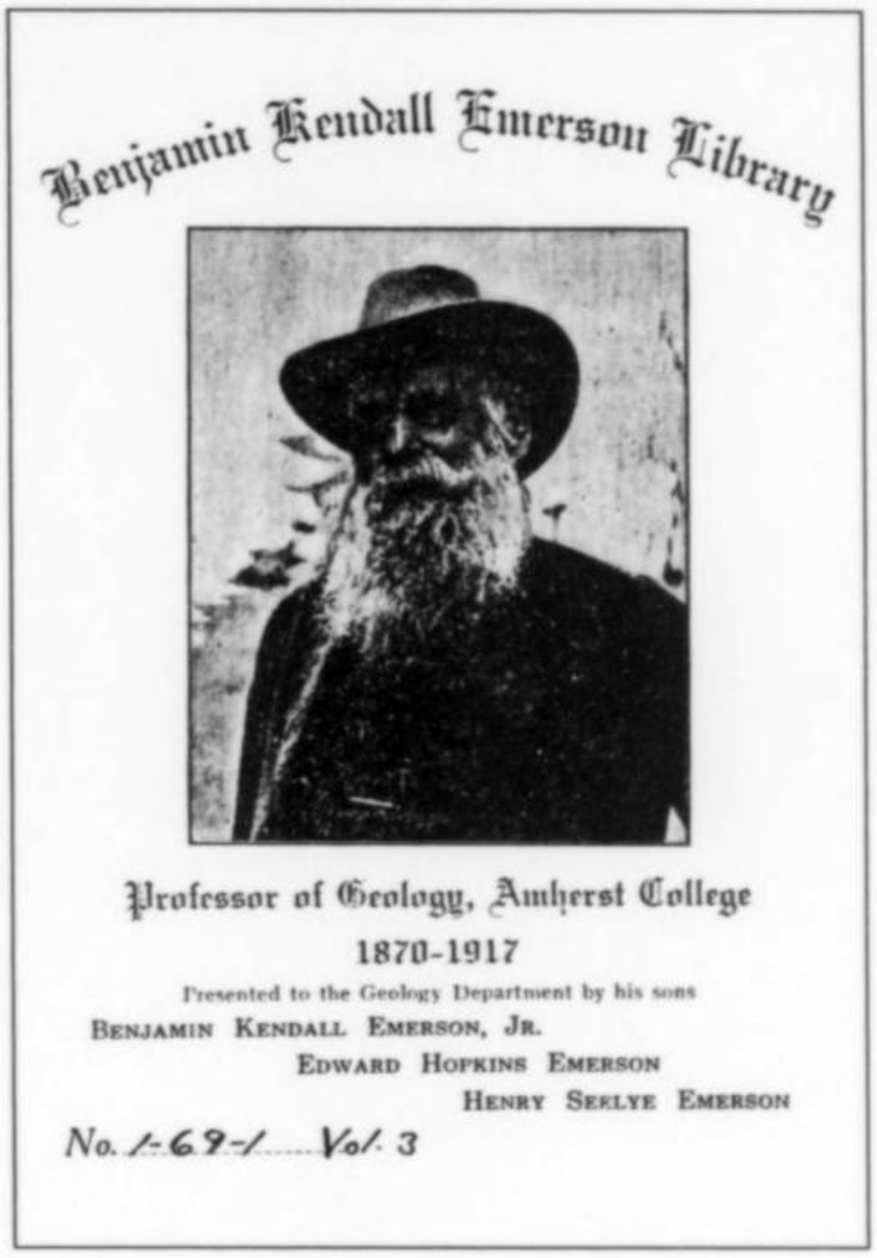
Affixed to William Babington's *A New System of Mineralogy, in the Form of Catalogue, After the Manner of Baron Born's Systematic Catalogue of the Collection of Fossils of Mlle Éléonore De Raab* (London, 1799). This book is, apparently, quite rare. The only two copies that I have ever known about in private hands were both in my library until recently, and surprisingly, at the same time! This work is particularly interesting to me because of the several specimens it lists from American localities.

Henry S. Washington (1867–1934)

Washington was a geologist and graduate of Yale who wrote articles on American gems. He was an associate of, and occasional co-author with, George F. Kunz. In my library is an *American Journal of Science* offprint of 1887 by W. E. Hidden and Washington discussing the gem minerals of Alexander County, North Carolina, that is an authors' presentation to

Kunz. *The Dictionary of Scientific Biography* states that Henry S. was a descendant of George Washington. A delightful and most tasteful bookplate.

Affixed to *Memoria Sullo Incendio Vesuviano* by G. Guarini . . . (Naples, 1855).



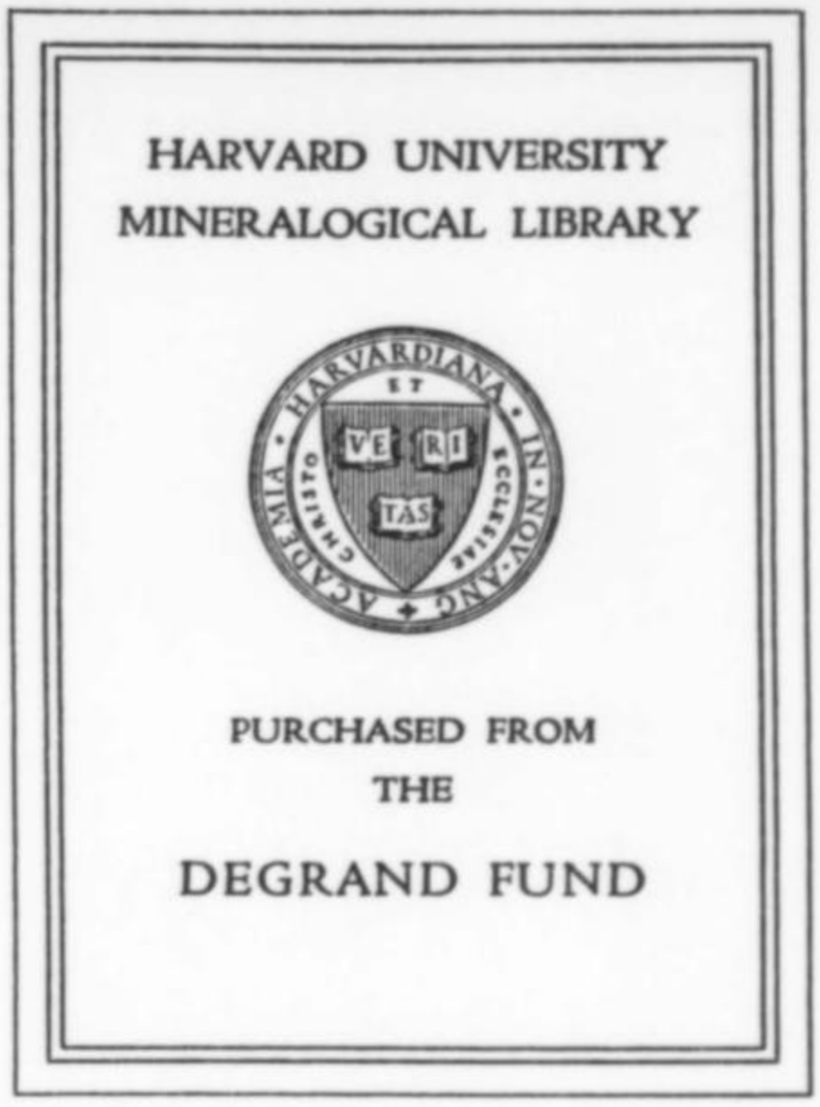
Benjamin Kendall Emerson, Library of Amherst College

Benjamin Kendall Emerson or BKE, as he sometimes signed letters that he sent to George F. Kunz, was born in 1843. He was one of Kunz's many respondents to inquiries about U.S. gem production for inclusion in the annual publications by the United States Geological Survey, and in a letter of 1891 Emerson promised Kunz that he would soon have minerals to sell to him. He was a professor of geology at Amherst College. Emerson is credited with 52 entries for writings of a geological nature in *Geological Literature on North America, 1785–1913* by John M. Nickles (Washington, 1923) and these were accomplished between the years of 1879 and 1918. His most important work is probably *Mineralogical Lexicon of Franklin, Hampshire and Hampden Counties, Massachusetts* (Washington, 1895).

Affixed to *Die Eruptivgesteine de Kristianiagebietes* by Dr. W. C. Brögger (Kristiania, 1898).

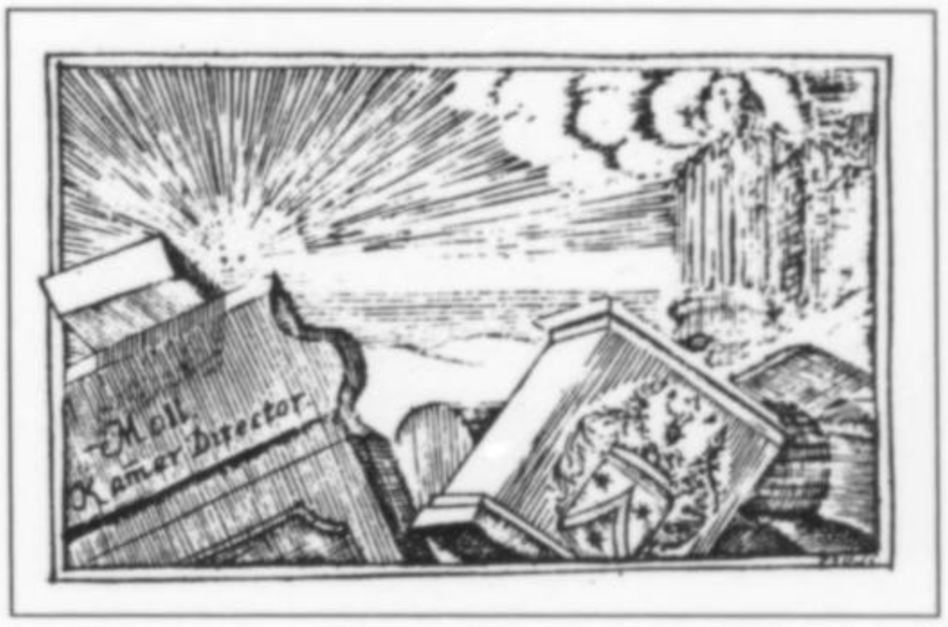
Harvard University Mineralogical Library

According to Dr. Carl Francis of the Harvard Mineralogical Museum, this library, which is quite extensive, was begun about 1895 and was rather informally held until the 1920's. In 1985 it was separated from the Department of Mineralogy and came under the



direction of the general Harvard library. Today it is quite vital and is still housed in the museum building, one floor above the mineral halls.

Affixed to *Materiaux pour la Carte Geologique de la Suisse* by Dr. Em. Gogarten and Dr. Walt. Hauswirth (Berne, 1913).



Karl Marie Ehrenbert Freiherr (Baron) von Moll (1760–1838)

Von Moll was an earth scientist, founding editor of the important journal *Jahrbücher der Berg und Hüttenkunde,* vice-president of the Bavarian Academy of Sciences and a serious mineral collector. In 1791 he was placed in charge of mining administration of the Salzburg, Austria, district, and before the year 1805 he assembled and gave to the city of Salzburg a magnificent natural history cabinet. He was an exceptionally devoted book collector too, owning, at one time, a library of more than 80,000 works. In 1815 he sold about 20,000 of them to the British Museum and then sold 50,000 more to the University of Moscow. It

should be noted that almost all of the books in his library were in immaculate condition, and he continued buying books up until the end of his life. He died owning a collection of 70,000 engravings.

Affixed to *Allgemeines Repertoriurn der Mineralogischen, Bergwerks . . . Literatur,* by D. Christoph W. J. Gatterer (Giessen, 1798). For information on this work, see "Collecting Mineral Books: An Introduction," elsewhere in this issue.

Joseph Neeld (1789–1856)

Neeld assembled a fine and extensive mineral collection (more than 3,600 specimens) around the year 1830 that apparently remained intact until it was dispersed by Brian Lloyd of London in recent times. Neeld's specimens are present in many of the major collections of today. Two examples are pyrargyrite and argentite specimens that were illustrated in Sowerby's *Exotic Mineralogy* that are now in the Stephen Smale collection and are discussed elsewhere in this issue. The Neeld information is courtesy of Brian Lloyd. The bookplate is a fine engraved example of the armorial jacobean style; its style predates Neeld.

Affixed to *Select Minerals. A Catalogue of a Very Splendid Collection of Minerals. The Property of Mr. Heuland, Including a Number of Specimens from his Private Cabinet. Which will be sold by Auction by Mr. Thomas . . . on Monday, May 4th, 1829 and Five Following Days.* Mineral specimen dealer Henry Heuland (1778–1856) employed the auction sale format as a regular means of selling his wares and may have used the time-honored marketing ploy "from his private cabinet" to generate extra interest. It is recorded that Neeld purchased some of the specimens from this sale.

ACKNOWLEDGMENTS

Special thanks to Herbert Obodda, Robert T. Curran, Jr., Louis Zara, Stephan E. Pober, Joseph Freilich, Carl Krotki, Thomas G. Boss, W. Hallam Webber and Stephen Smale. All bookplates illustrated, other than the Obodda examples, are from the library of the author.

Author's request—I should like to follow up on this article with another, listing and depicting all available, appropriate geoscience bookplates not discussed this time, and to that end I request the readers to send me a photocopy of any interesting candidate for such an article, along with a photocopy of the titlepage of the book that contains it. Please review the requirements for inclusion as described in the final paragraph of this article (before the descriptions of the Obodda bookplates). At the time of sending, please indicate whether you wish the ownership of the bookplates and books to be credited to you or if you wish them to be listed anonymously.

RECOMMENDED READING

ALLEN, C. D. (1894) *American Book-Plates. A Guide to their Study with Examples.* New York.

ALLEN, C. D. (1896) *Ex Libris. Essays of a Collector.* Boston.

BAER, C. S. (1962) *The Values of Certain Early American Bookplates.* American Society of Bookplate Collectors and Designers.

BUTLER, W. E., and BUTLER, D. J. (1986) The Golden Era of American Bookplate Design, 1890–1940. London

CASTLE, E. (1892) *English Book-Plates. An Illustrated Handbook For Students Of Ex-Libris.* London.

FRENCH, H. (1939) *Jacob Hurd And His Sons Nathaniel & Benjamin, Silversmiths, 1702–1781* (p. 82–137 on Nathaniel's bookplates). Cambridge.

LEE, B. N. (1988) *Some Recollections of a Bookplate Collector.* N.P.

STEPHENS, S. D. (1950) *The Mavericks. American Engravers.* New Brunswick.

BOOK REVIEW:

GEMOLOGY, AN ANNOTATED BIBLIOGRAPHY

Stephen E. Pober
35 Stratford Road
Staten Island, New York 10301

Considering that gemstones have always held a particular fascination for man, and further, that he has been writing about them from at least the time of Pliny in the first century, and earlier in the purported works of Aristotle, it must come as a surprise to learn that *Gemology, An Annotated Bibliography* by John Sinkankas is the first comprehensive, fully annotated bibliography of gem literature.

The history of the bibliography of gem and mineral books begins in 1548. In that year Conrad Gesner published the second volume of his enormous *Bibliotheca Universalis,* entitled *Pandectae.* One of its chapters, *De naturali Philosophia* (Natural Philosophy), is Gesner's subject bibliography of the physical sciences. Here in sections VI–VIII are found references to inanimate physical objects, especially stones, gems and minerals. Among the glossaries in these sections Gesner includes a list of names of stones and gems from agate to topaz.

Gemology, An Annotated Bibliography is both the record of a private library (Sinkankas's, now part of the Gemological Institute of America Library) and a detailed bibliographical guide to the vast literature of gems. The 7,458 entries in this work document the author's career as a book collector and dealer, and bear witness to an intimate knowledge accumulated over a 40-year period. The bibliography records all important books and articles in the field of gemology. These works have been described, collated and assessed in terms of content, accuracy and significance. What was once the private research tool of an individual now becomes, thanks to the careful notes and descriptions Sinkankas made as each item was either acquired or inspected, a work useful to all gem book collectors.

Before the publication of these two stout volumes (1,200 pages!) the bibliography of gem literature had been served by few useful guides. With the exception of Gill's *Index* (1978), a work which while useful is difficult to use, there were no book-length bibliographies of gemology. Rather, there were only reference lists of varying length and value. Most of these lists were to be found as appendices to gemological treatises. Included in this group we may note the following: There is a simple list of 299 items published in Harry Emanuel's *Diamonds and Precious Stones* (1865). Sinkankas calls this "no more than a list of authors and titles" (Sinkankas, no. 1886), some of which he says are ghosts, i.e., non-existent. An important feature of the 1914 edition of *Les Pierres Precieuses* by Jean Escard is the bibliography, which has in excess of 1,200 entries, and "which even today is unmatched in many gemological publications" (Sinkankas, no. 1945). Sinkankas notes that Escard had made the mistake of translating many titles into French which should have been left in their original languages. The large bibliography of 400 odd items on 22 pages in Kunz's *The Book of the Pearl* (1908) contains items related to the pearl and other gems. It is still a "useful place for the commencement of a literature search" (Sinkankas, no. 3690) on the pearl. Like Sinkankas's bibliography, many of the books of Kunz's list were from his personal library.

As a mere handlist Sinkankas's *Gemology* would have proven invaluable as a record of one collector's perseverance, but Sinkankas has gone further and annotated almost every one of the nearly 7,500 works recorded. In selecting works for inclusion in this bibliography Sinkankas applied two criteria: size and pertinence of the subject matter. The first criterion restricted material to works of at least 15 pages, and "allowed the author to ignore an enormous amount of trivial articles found in journals that do little more than parrot better information found in standard works" ("Preface," p. ix–x). The second criterion limited works included to a broad spectrum of works on gemology and related subjects. Thus only a few of the works found in the bibliography in Dana's *System of Mineralogy* (7th edition), a standard checklist for collectors of mineralogy books, will be found in *Gemology, An Annotated Bibliography.* This is also true for the bibliography of the Hoover collection of works on mining and metallurgy, *Bibliotheca De Re Metallica* (1980). Thus collectors of mineral books will still have to count on these other two invaluable resources.

Few of the items cataloged in *Gemology* have previously received the detailed examination given them here. The careful browser will find works from the 15th to the 20th centuries. Besides works on gems and gem materials, there are works on jewels and jewelry making as well as many aspects of lapidary work, including the engraving of gems and their study, works on collections of gemstones, biographies, and numerous subjects ancillary to gemology.

Gemology, compiled by a professional user of bibliographies, was obviously planned for maximum ease

of use. All books are arranged in a single alphabetical sequence by author's last name. Careful attention has been paid to bibliographical variants and states, in most cases indicating useful issue points. Annotations remark upon bindings, which are fully described as to cloth type, color, stamping, ornamentation, endpapers, etc. Works have been included in English, Italian, French, German, Spanish, Portuguese, Russian, Sanskrit, Hindi (Tagore's *Mani Mala,* Sinkankas, no. 6475), etc.

In addition to author and title, entries include a biographical sketch of the author, year of publication, entry number, collation, content and annotation. Descriptions are unusually full and annotations are of a length appropriate to a book's importance. There is also a subject index at the rear of volume two. While this subject index will be of relatively little use to mineral book collectors and dealers, it should serve researchers interested in finding information sources on specific subjects of gemology, such as amber, coral, and the curious lore of gems.

As with all works of this size, the second edition will surely correct typographical errors and errors of fact. One such error appears under entry 2694, where referring to the illustrations in the book *The Tourmaline,* Sinkankas states: "a large collection of the originals may be seen, framed, in the Harvard University Mineralogical Museum, Cambridge, Massachusetts." Actually the illustrations referred to are those for Hamlin's *The History of Mount Mica* (Sinkankas 2697).

Sinkankas entry numbers have already begun appearing in the catalogs of bookdealers and auctioneers. The catalog of Swann Galleries' recent auction of the mineral books of Carl Krotki cited Sinkankas numbers for some of the items in the sale. How long will it be before some book dealer proudly states that a title offered in his catalog is "not in Sinkankas"? That is, when will *Gemology* be quoted to suggest the rarity of a book on the subject of gems which is not to be found in its pages?

Gemology, An Annotated Bibliography contains much useful data on the early works pertinent to both gems and minerals. It is an ambitious work, and within its own self-imposed scope (i.e., gemology) it contains stimulating information sure to serve as a catalyst to future bibliographers who may undertake the task of writing the definitive bibliography of mineral books.

[Published (1993) by Scarecrow Press, Metuchen, New Jersey, and London, 2 vols., 1,200 pages, hardcover; price: $179.50 (regular edition) and $250 (limited collector's edition) plus postage.]

Quotations

When I get a little money
I buy books;
and If any is left,
I buy food and clothes
Desiderius Erasmus (1465–1536)

The book that a person
is beginning to create or design,
contains within itself
half a life, and God only knows
what an expanse of futurity also.
Jean Paul Francois Richter (1763–1825)

It took me fifteen years
to discover I had no talent
for writing, but I couldn't
give it up, because by
that time I was too famous.
Robert Benchley (1889–1945)

I never read a book
before reviewing it,
it prejudices a man so.
Sydney Smith (1771–1845)

There are more books upon books
than upon all other subjects.
Michel de Montaigne (1533–1592)

All these things heer collected
are not mine,
But divers grapes make but
one sort of wine;
So, I, from many learned authors took
The various matter printed in this book.
John Taylor (1652)

It is by means of [bibliographies]
that the student comes to know
what has been written on every
part of learning; that he avoids
the hazards of encountering
difficulties which have already been cleared;
of discussing questions which have
already been decided; and of
digging in mines of literature
which have already been exhausted.
Samuel Johnson (1709–1784)

It was a book to kill time
for those who like it better dead.
Rose MacAulay (1889–1958)

There is probably no hell
for authors in the next world—
they suffer so much from
critics and publishers in this.
Christian Bovee (1820–1904)

This book is John Smith's,
My fist is another;
You touch one
Any you'll feel the other.
John Smith

I love being a writer.
What I can't stand
is the paperwork.
Peter De Vries

Books are hindrances
to persistent stupidity.
Spanish Proverb

The Mineralogical Record Library

In keeping with the topic of this special issue on mineral books and book collecting, a few words about the Mineralogical Record Library may be of interest to readers, especially in view of its vital contribution to most of the articles presented here.

Since the earliest days of the *Mineralogical Record,* books on minerals and mineral deposits have been steadily accumulating in the editorial office. Arthur Montgomery, whose generous financial support helped to establish the magazine during its first three years, saw the need for reference works and donated many useful volumes to then-editor John White. As time passed, it became increasingly clear that even the best university and public libraries often failed to contain many mineralogical works needed for editing, consultation, figure reproduction and article referencing. Consequently, increased effort was devoted to acquiring such works on our own.

The growth of the library, though modest at first, has accelerated somewhat during the last 15 years, thanks to many donations of books and of funds specifically for the purchase of books. Some of the rarer acquisitions have been reproduced in limited hand-made facsimile editions (see p. 168) in order to make their contents more widely available to collectors, and to raise additional funds for further enlargement of the collection. Subscription income is not used for library purchases, and so the price of a subscription to the *Mineralogical Record* has remained unaffected.

Currently the Mineralogical Record Library consists of about 2,500 volumes, grouped according to the following subjects or specialties: **(I) Mineralogy** (ancient, medieval, early and modern mineralogies, illustrated mineralogies, regional and topographical mineralogies, determinative mineralogies, mineralogical journals, and mineralogical glossaries, lexicons and encyclopedias), **(II) History** (History of mineralogy, mining, collecting, and general science, mineralogical biographies, travels and memoirs), **(III) Collecting** (Mineral collecting, mineral collection catalogs, museum catalogs, museology, bibliology and book collecting, and mining and scientific collectibles), **(IV) Geology subfields** (general and regional geology, economic geology, crystallography, gemology, etc.), **(V) Editing and Publishing** reference works (graphic design, style manuals, foreign-language dictionaries, bibliographies, indexes, atlases, gazetteers, etc.), and **(VI) Miscellaneous** works (specimen labels, mineral postage stamps, early mining photographs, portraits, posters and videotapes). These materials have proven extremely useful in the enrichment of the visual, historical and technical quality of the *Mineralogical Record,* and can only grow more so with future additions.

It must be specified that the Record Library is not a lending library; authors and associate editors obtain access through the editor, usually for the purpose of preparing or editing materials for publication. Personal visits to use the library can also be arranged by appointment.

The Mineralogical Record Library actively solicits donations (tax-deductible in the U.S.) as well as booksellers' catalogs and lists of items in our field available for sale.

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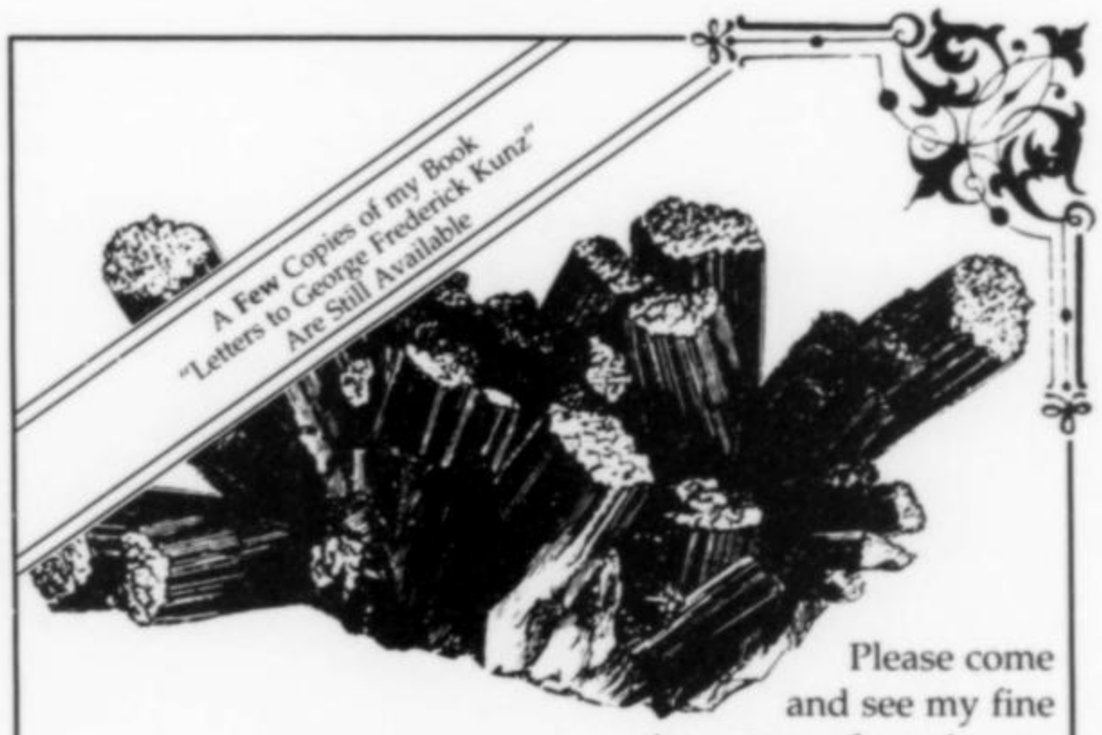

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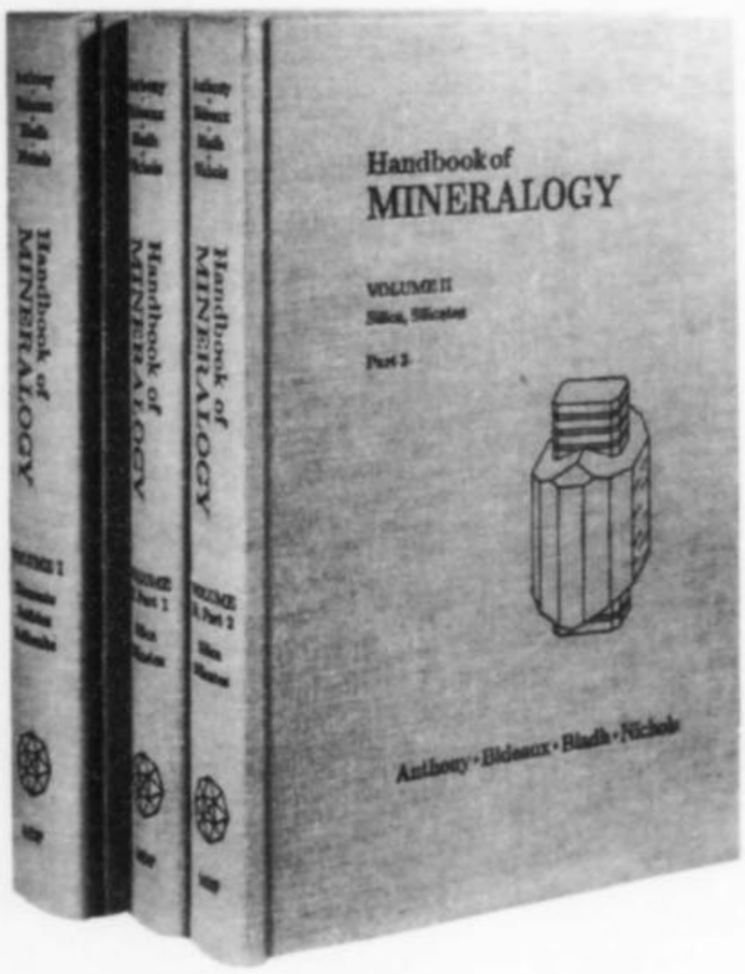

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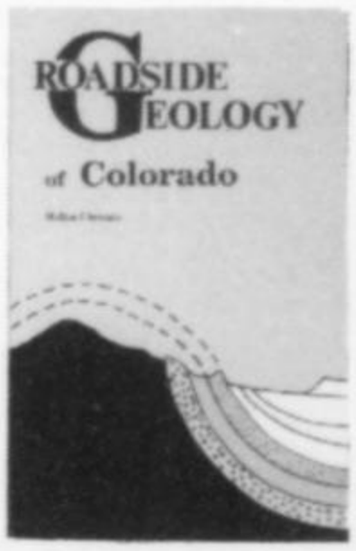

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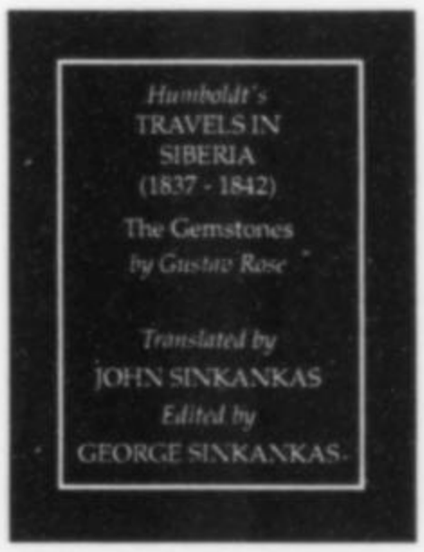

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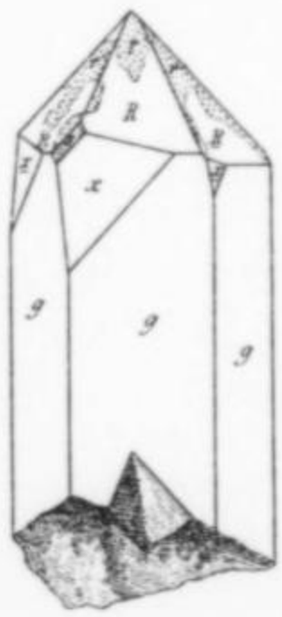

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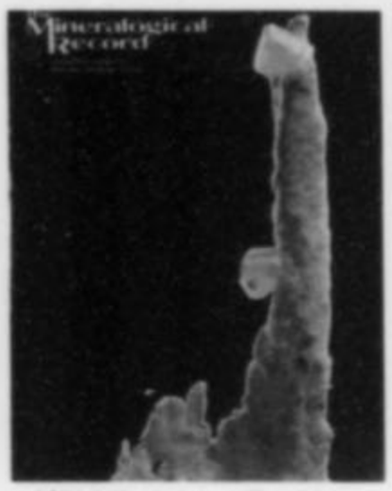

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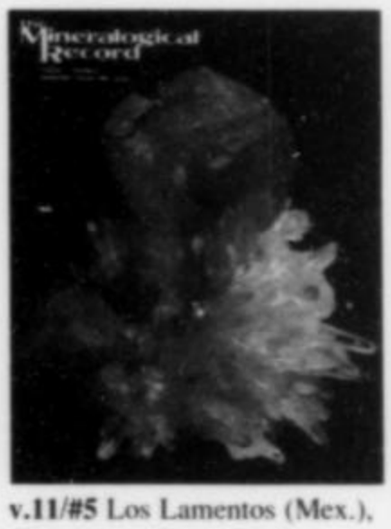

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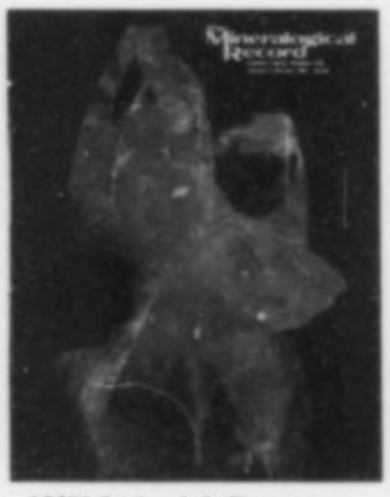

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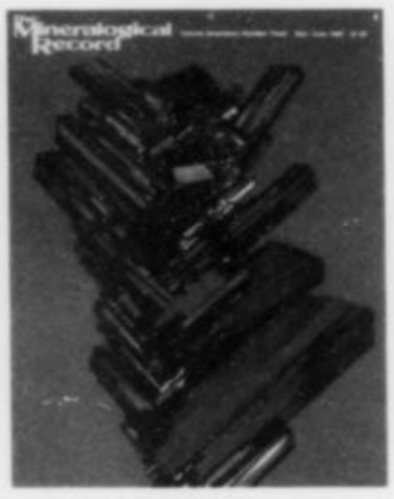

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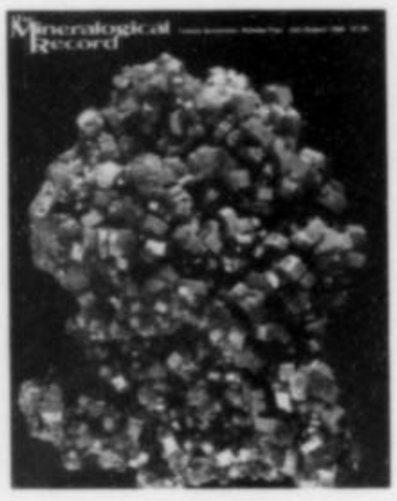

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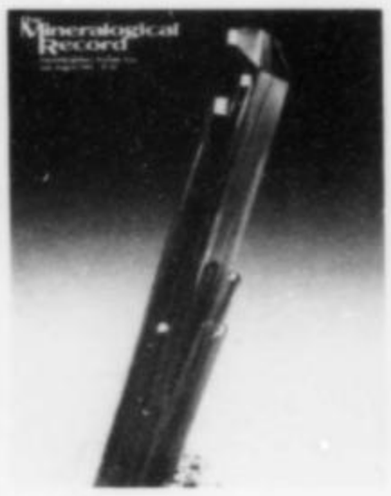

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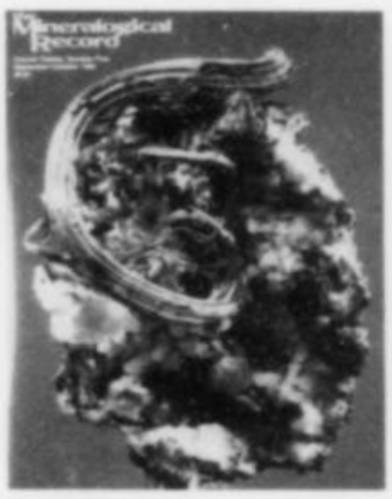

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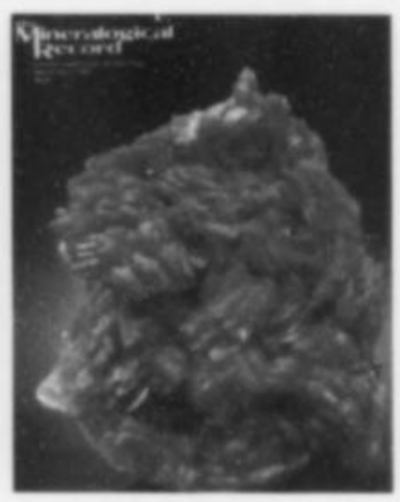

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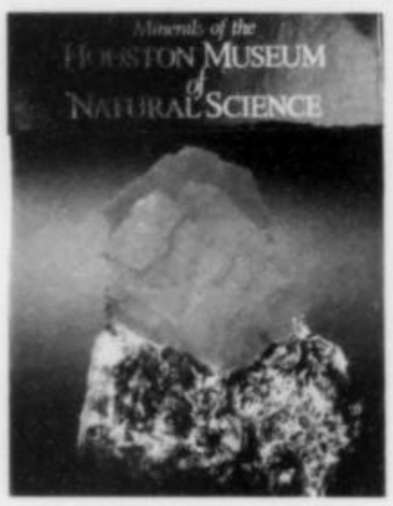

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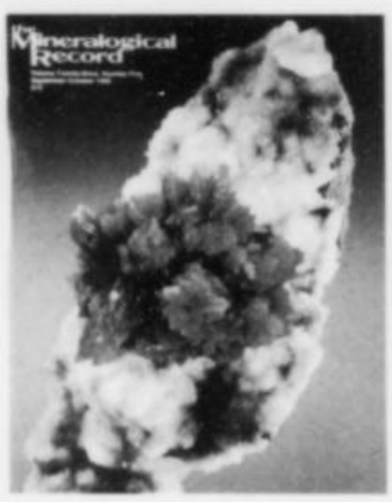

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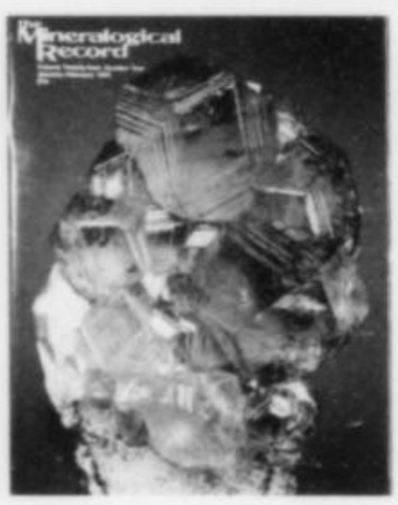

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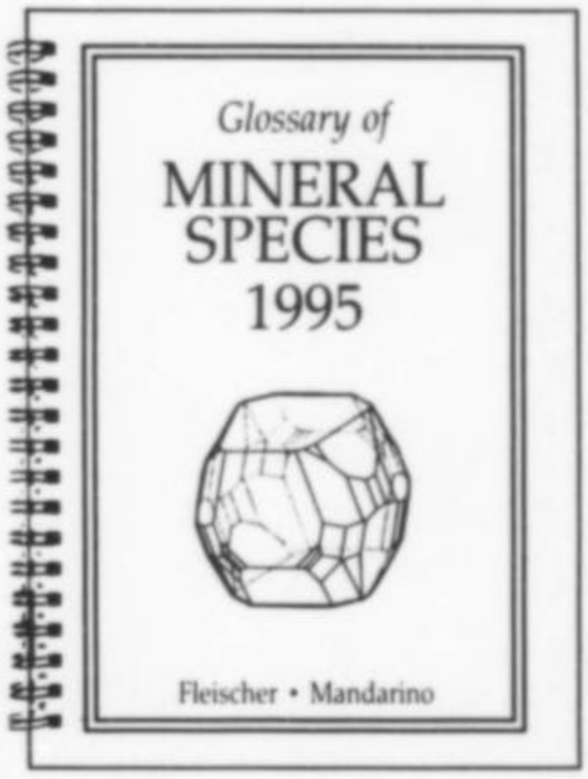

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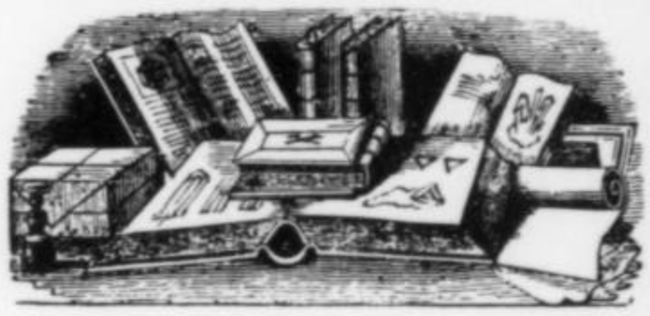

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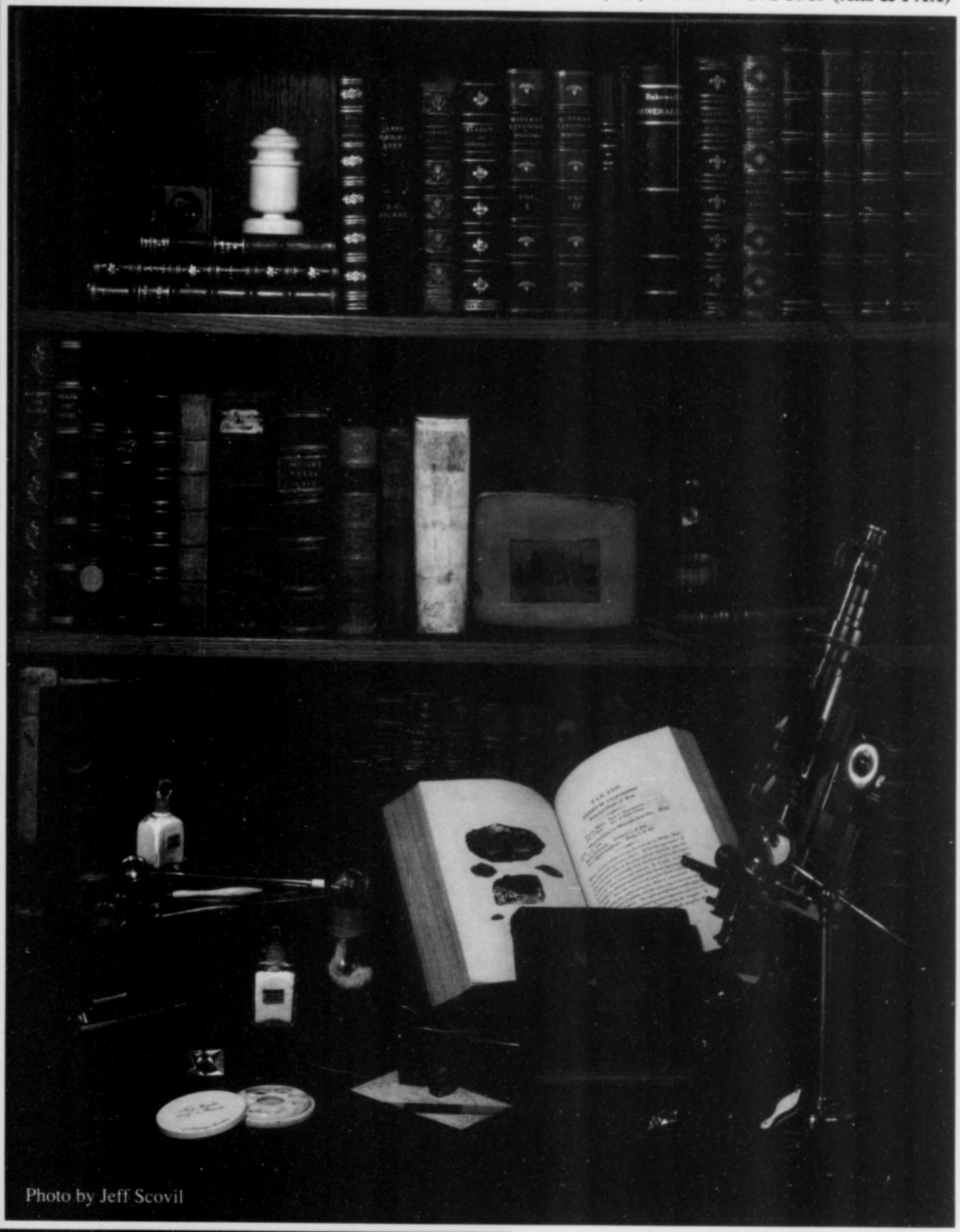

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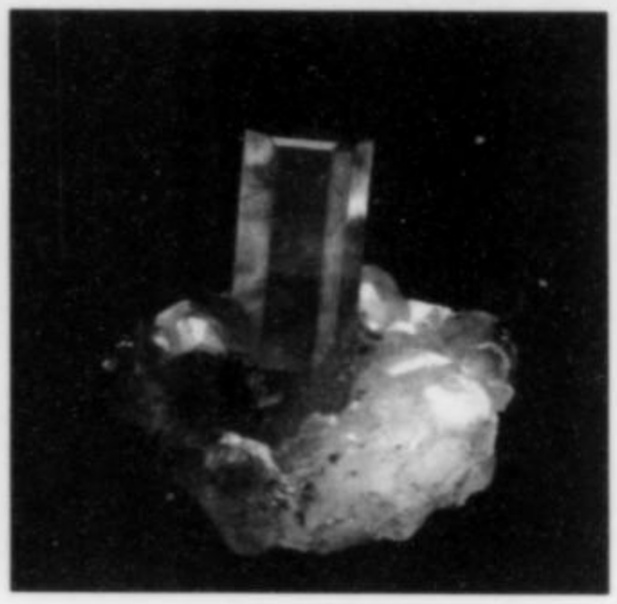

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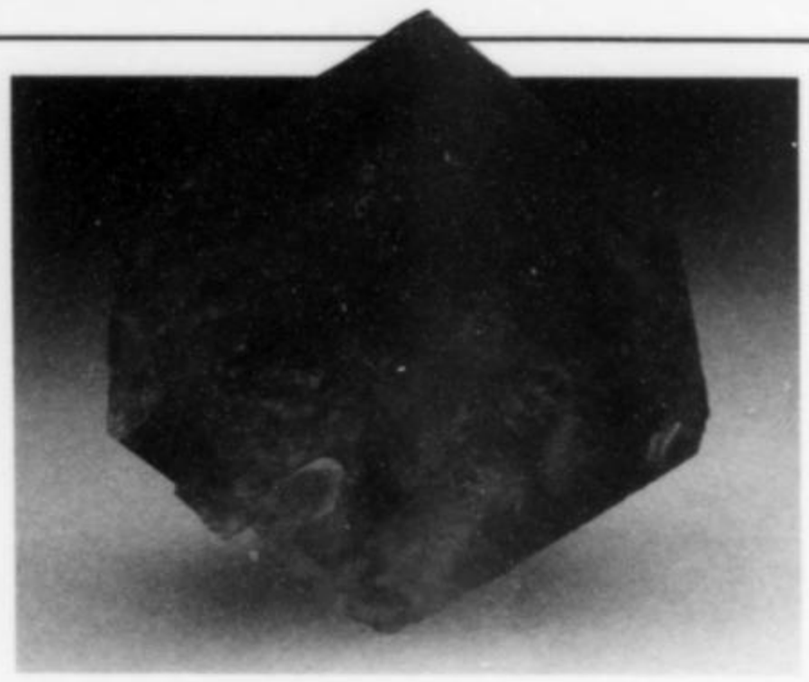

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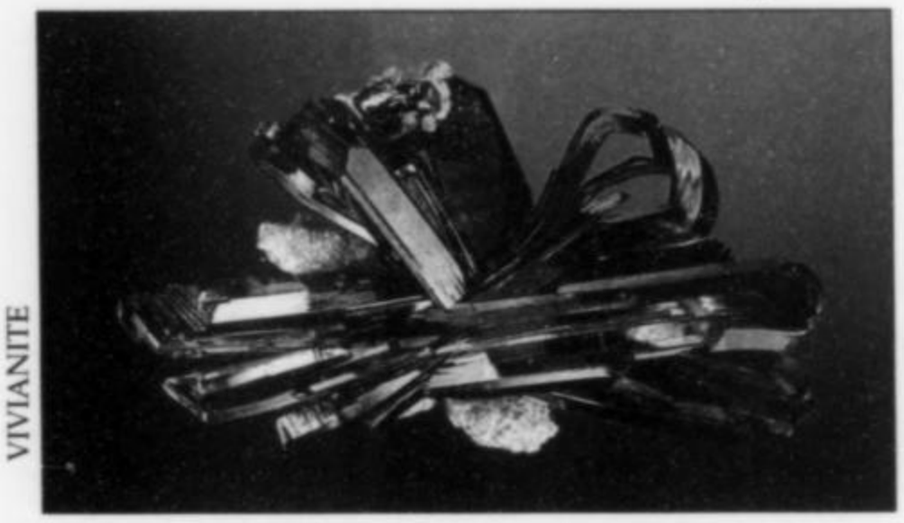

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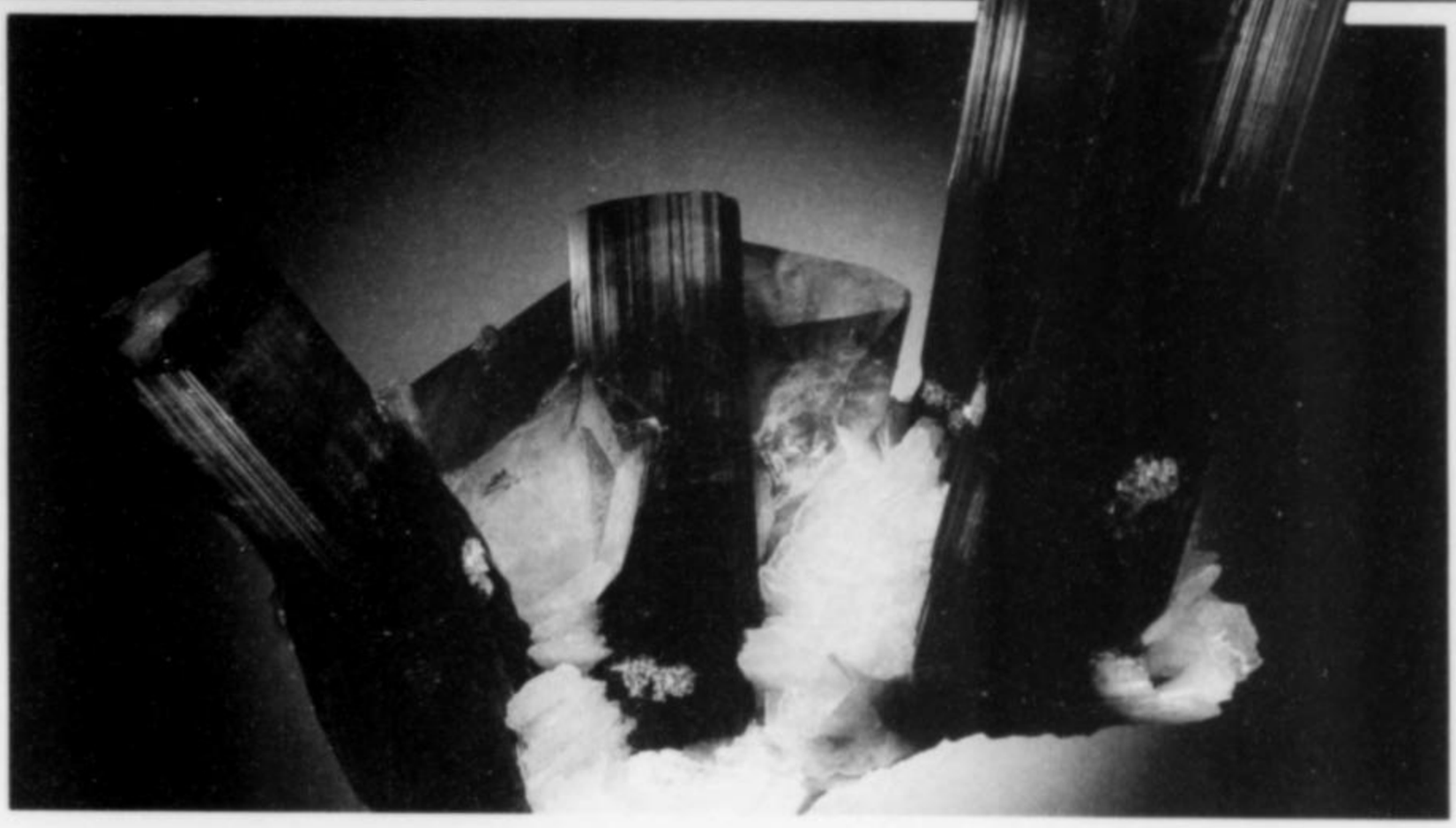

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Tel: (406) 496-4414
c/o Montana Tech
Butte, MT 59701-9981
Hours: 8–5 daily June–Labor Day; M–F & Sun afternoons Labor Day–May
Specialties: Montana & Idaho minerals; systematics

Glenbow Museum

Executive Director:
Dr. Robert Janes
Tel: (403) 268-4100
Fax: (403) 265-9769
Glenbow Alberta Institute
130 Ninth Avenue S.E.
Calgary, Alberta
Canada T2G 0P3
Hours: 10–6 Tues–Sun
Specialties: W. Canadian and worldwide minerals & gems

Harvard Mineralogical Museum

Curators:
Dr. Carl A. Francis
William Metropolis
Tel: (617) 495-4758
24 Oxford Street
Cambridge, Mass. 02138
Hours: 9–4:30 M–Sat; 1–4:30 Sun
Specialties: Systematic Mineral Collection

William Weinman Mineral Museum

Curator: Kim B. Cochran
Tel: (404) 386-0576
P.O. Box 1255
Cartersville, GA 30120
Hours: 10–4:30 Tue–Sat, 2–4:30 Sun.
Specialty: Georgia & worldwide minerals & fossils

Denver Museum of Natural History

Curator of Geology:
Jack A. Murphy
Tel: (303) 370-6445
Dept. of Earth Sciences
20001 Colorado Blvd.
Denver, CO 80205
Hours: 9–5 daily
Specialties: Colorado minerals

Geology Museum Colorado School of Mines

Curator: Virginia A. Mast
Tel: (303) 273-3823
Golden, Colorado 80401
Hours: 9–4 M–Sat, 1–4 Sun. (closed on school holidays & Sundays in the summer)
Specialties: Worldwide minerals; Colorado mining & minerals

A. E. Seaman Mineralogical Museum

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Stanley J. Dyl II
Adjunct Curator:
Dr. John A. Jaszczak
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Curator (mineralogy):
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Fax: (713) 523-4125
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Department of Geology
University of Delaware
Newark, DE 19716
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Specialty: Worldwide minerals

Sterling Hill Mining Museum
Curators: Robert Hauck
Richard Hauck
Tel: (201) 209-7212
30 Plant Street
Ogdensburg, NJ 07439
Hours: 10–5 M–Sun., Mar.–Dec.
Specialty: Local mining & minerals

Carnegie Museum of Natural History
Collection Manager:
Marc L. Wilson
Tel: (412) 622-3391
4400 Forbes Avenue
Pittsburgh, PA 15213
Hours: 10–5 Tues.–Sat.,
10–9 F, 1–5 Sun.,
closed Mon. & holidays
Specialty: Worldwide minerals & gems

Musée de géologie de l'Universite Laval
Curator: André Lévesque
Tel: (418) 656-2193
Geology Dept., 4th floor
Adrien-Pouliot Building
Québec, Que., Canada G1K 7P4
Hours: 8:30–5 M–F
Specialties: Quebec and worldwide minerals and fossils; Miguasha fishes

Museum of Geology
Director: Philip R. Bjork
Tel: (605) 394-2467
South Dakota School of Mines & Technology
501 E. St. Joseph Street
Rapid City, SD 57701-3995
Hours: 8–5 M–F, 9–4 Sat., 1–4 Sun.
Specialty: Black Hills minerals, esp. pegmatites

Penn State Earth & Mineral Sciences Museum
Curator: Andrew Sicree
Tel: (814) 865-6427
Steidle Building
University Park
State College, PA 16802
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(closed holidays)
Specialties: Mineral properties exhibits; "velvet" malachite; old Penna. minerals; mining art

M.Y. Williams Geological Museum
Curator: Joe Nagel
Tel: (604) 822-5586
University of British Columbia
6339 Stores Road
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Canada V6T 1Z4
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1:30–4:30 W (Collector Shop)
Specialty: B.C., Pacific NW, Canada; Exhibit Quality

Marshall Mint & Museum
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Virginia City, NV 89440
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Specialties: Nevada precious metals specimens

Private Museums

Hampel Mineralogical Museum
Curator: Lance T. Hampel
Tel: (414) 255-4540
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Germantown, WI 53022
Hours: by Appt.
Specialty: Midwest minerals

Museo Mineralógico M. Romero
Director: Miguel Romero
Tel: (238) 3-00-07
Fax: (238) 3-35-02
7 Norte #356
Tehuacán Puebla, México 75700
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4–6 p.m. M–F & by Appt.
Specialty: Mexican Minerals

Europe

Setesdal Mineral Park
Curator: Ole Fritjof Frigstad
Arnar Hansson
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Fax: (011) 47-38-19-90-10
N-4670 **Hornnes, Norway**
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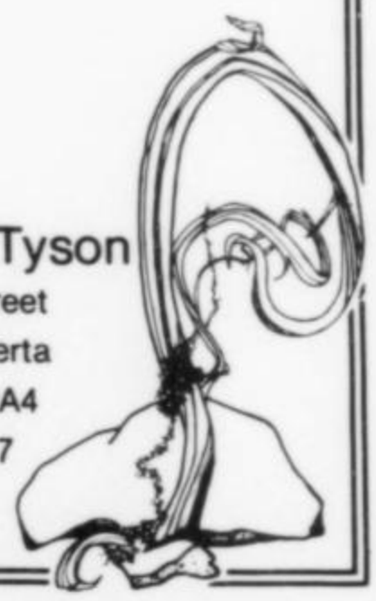

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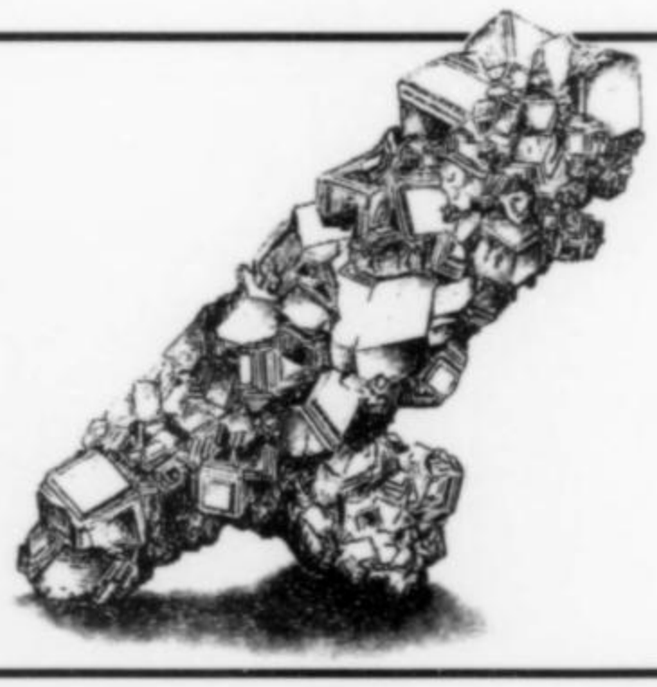

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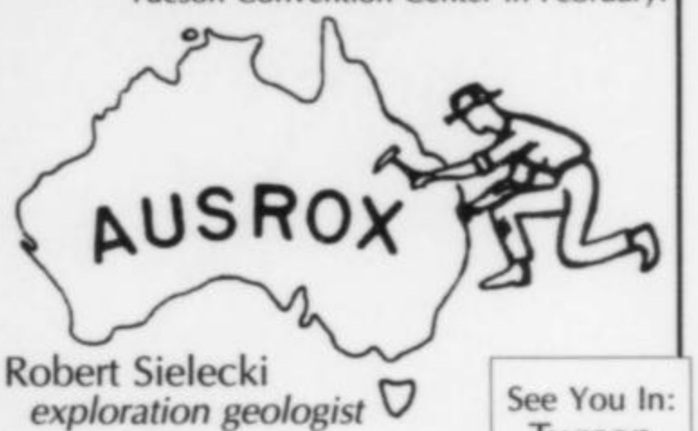

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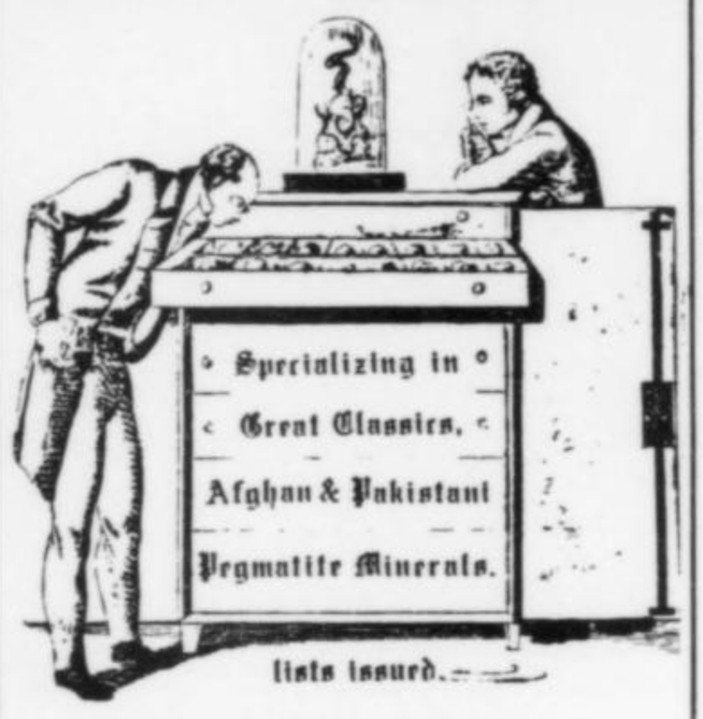

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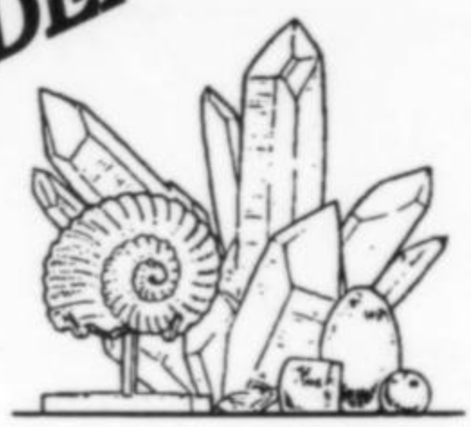

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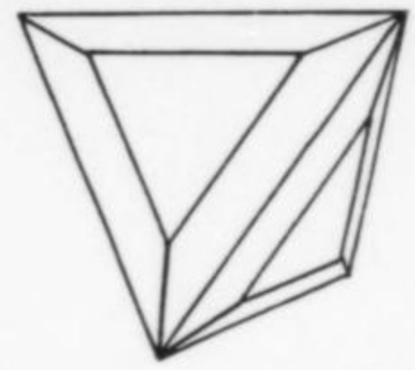

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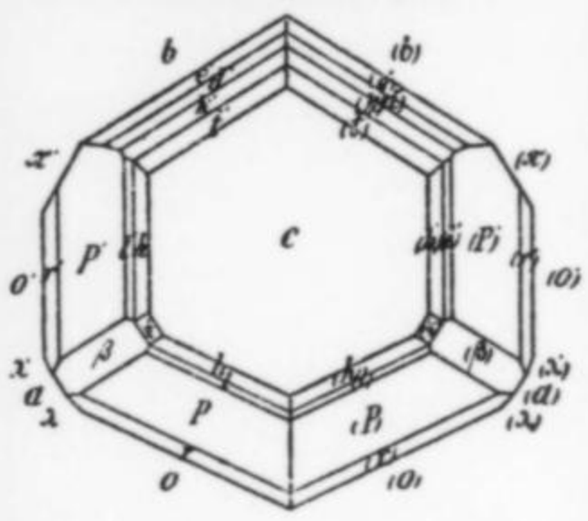

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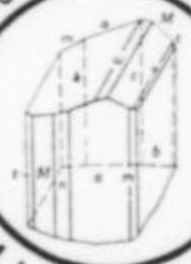

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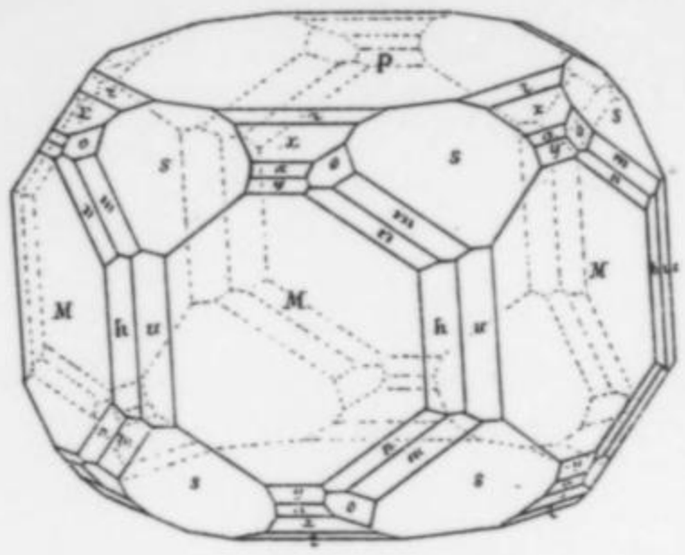

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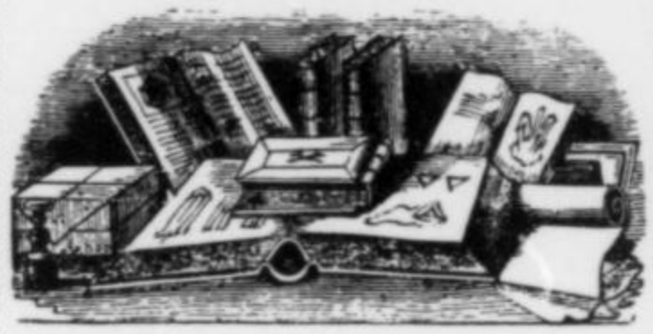

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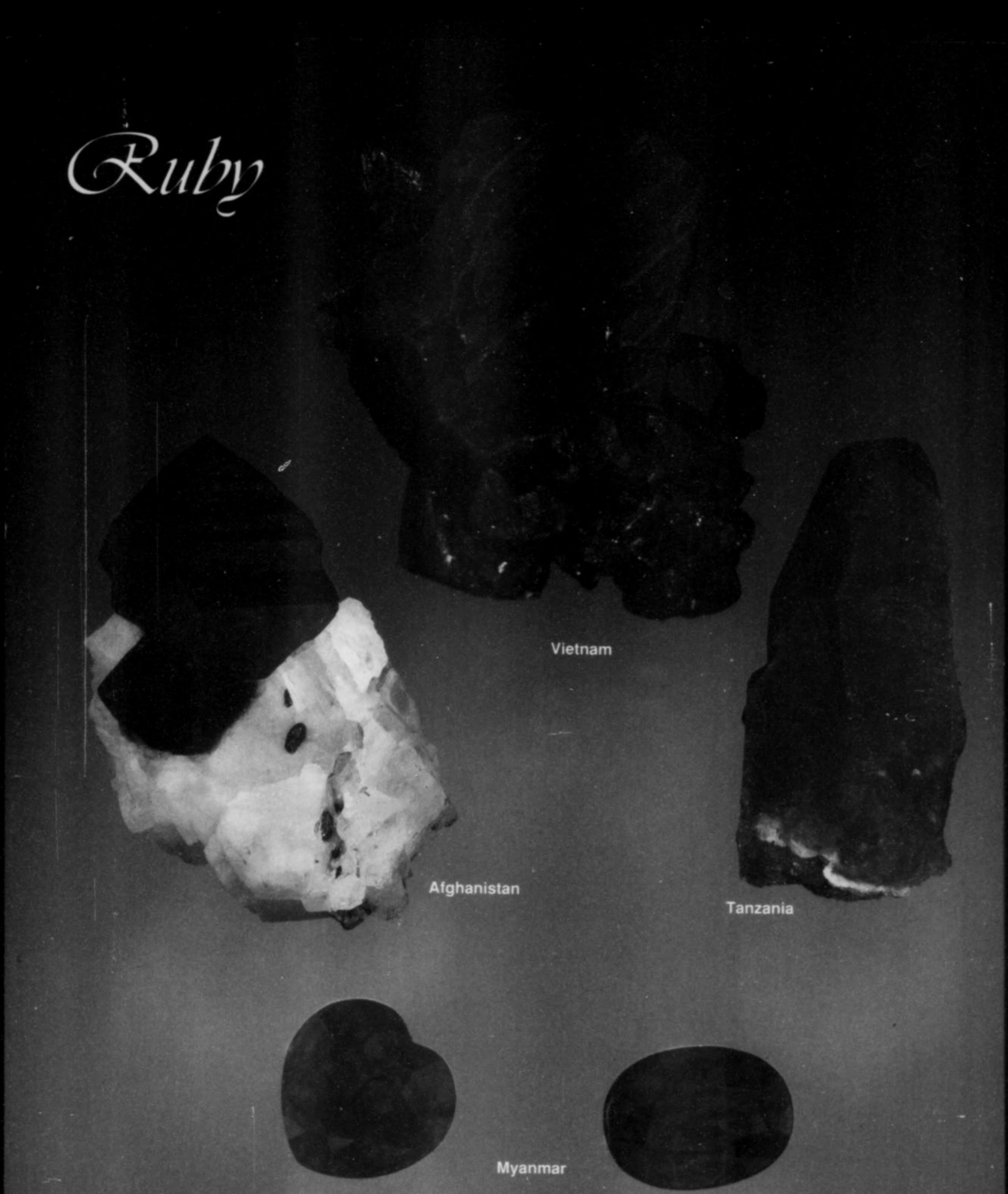

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