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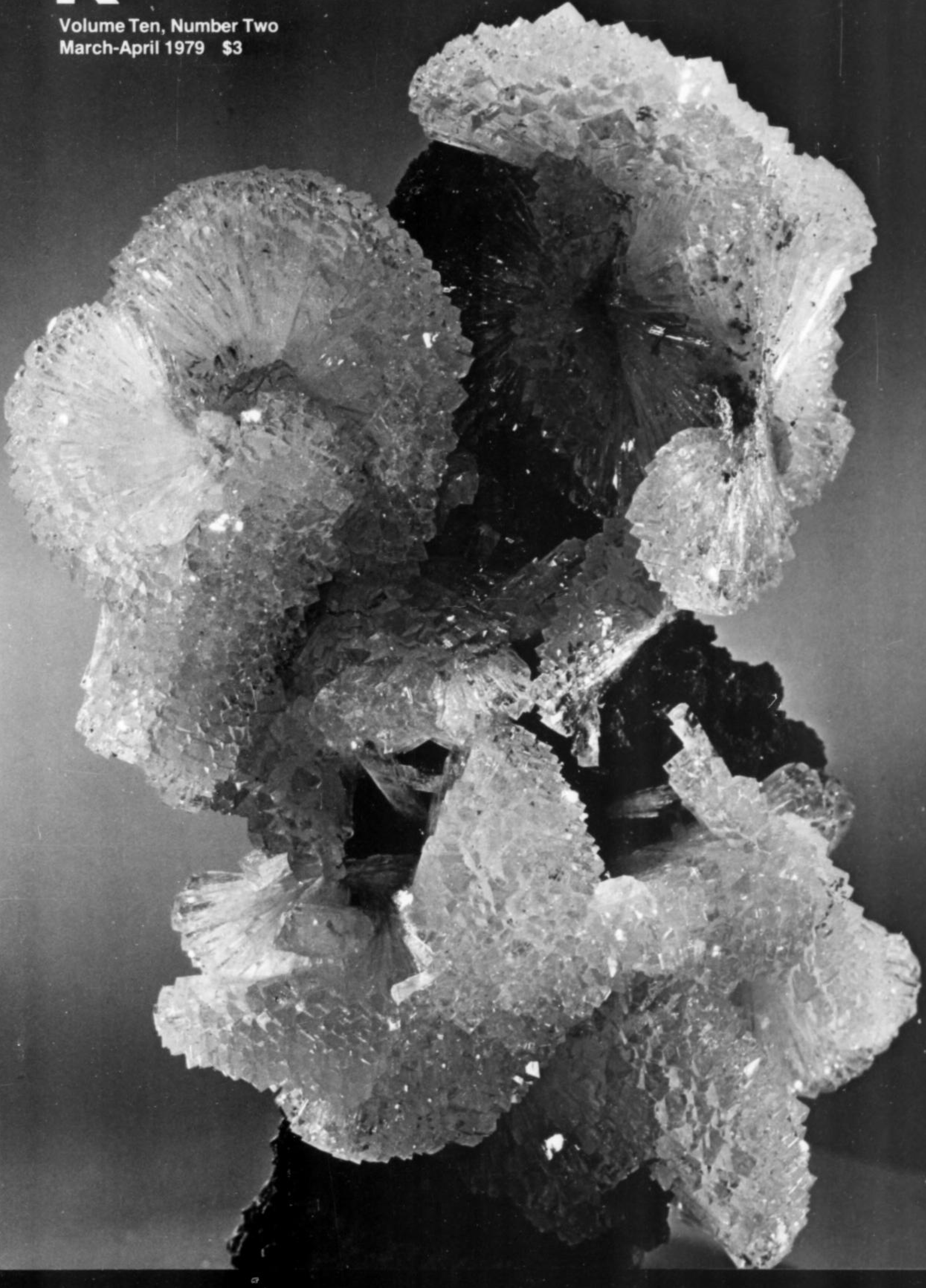

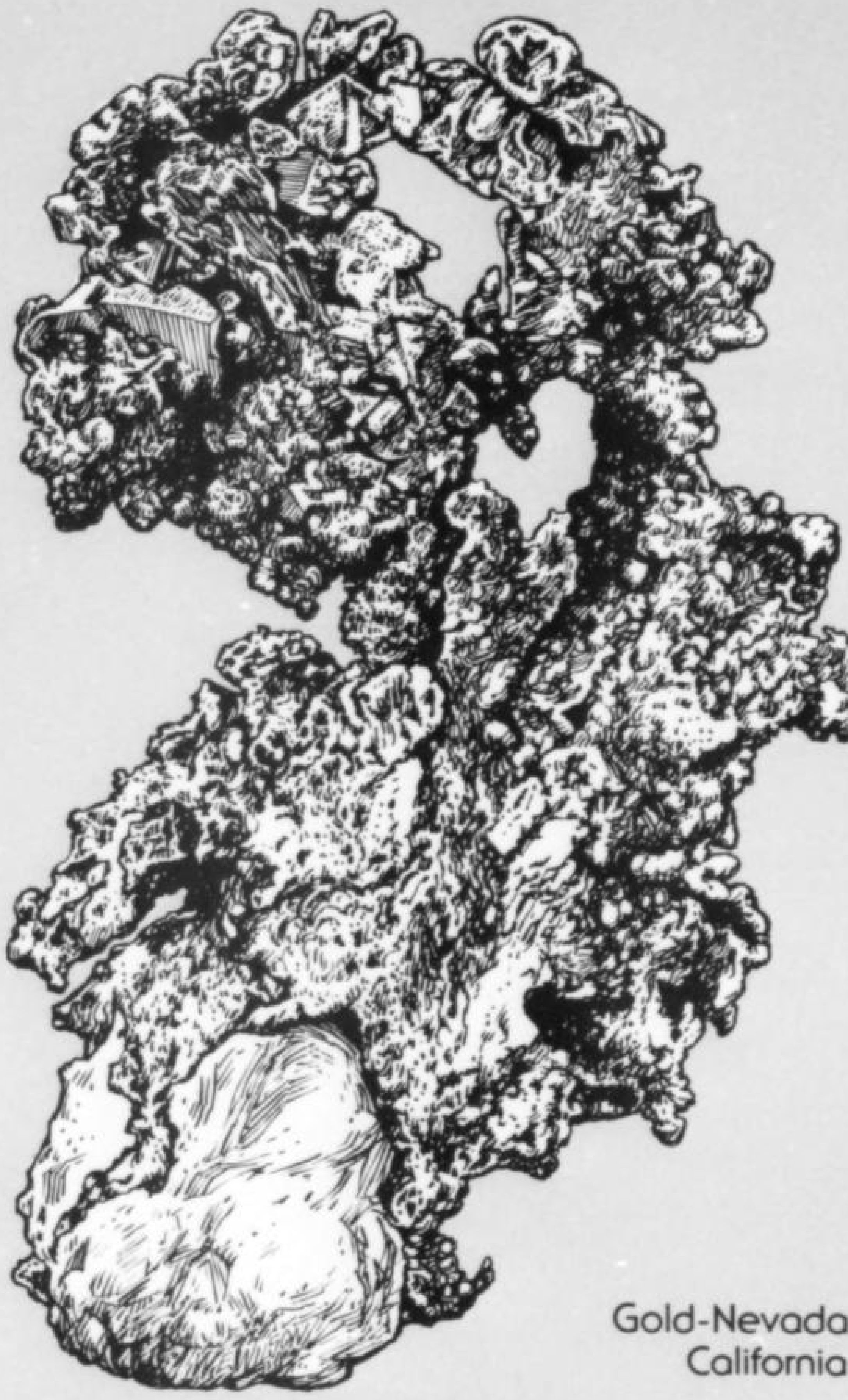

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EDITORIAL

WHEN YOU ARE ALL THROUGH COLLECTING

In the process of collecting minerals, mineral collectors also acquire a responsibility as temporary guardians for the most important and magnificent treasures of the inorganic earth. This caretaker responsibility is a very serious one and most collectors take it seriously, up to a point, by caring for their specimens, protecting them, retaining knowledge of their provenance and in other ways doing whatever is needed to safeguard these natural treasures. However, very few collectors are willing to confront the fact that they are only *temporary* guardians, and therein lies a sensitive point. We guardians are mortal.

Most of our mineral specimens existed millions of years before *we* appeared as a species and, barring the destruction of our planet, will likely survive us both as species and individually. It is not usually apparent from our perspective, but the cherishing of mineral specimens is a very recent phenomenon. Some specimens have existed for 4,500,000,000 years; the consciousness of what we call civilization for less than 5000; and true collections, as we know them today, only in the last few hundred years.

Unlike zoos, aquaria, botanical gardens and aviaries which house very temporal living things, the places where mineral specimens repose are but way-stations on the specimens' long journey to a succession of many resting places. Indeed, the human-assisted migrations of some specimens are already legendary!

Such migrations have many causes: changes, transitions, death and others. For these causes, mineral collections may change hands and places of rest quite frequently. As a collector, you have a responsibility to see to it that such transitions in the ownership of specimens are beneficial to yourself, the specimens themselves, and the science that studies them. Such transitions, however, are seldom well-planned, orderly, or done as one would have chosen. Problems frequently develop which interfere with an orderly transferral of collections.

Most mineral collectors love specimens and wish to be surrounded by them during their lives. This is a quite natural and delightful experience and a very basic aspiration, but it leads frequently to a basic and recurring problem for their survivors: *"What to do with John Doe's minerals?"* Unless you have given serious thought to providing a home for your collection sometime in advance of your passing on, or left detailed instructions, or a carefully detailed will prepared, the disposal of your collection must be done by a family in grief, or good-intentioned friends, at a time when they are least prepared mentally or emotionally to cope with it. Is the decision that they might make likely to be in good agreement with what would have been your wishes? All collectors should take enough time to deliberate on this problem and then take some action to ensure that what they have assembled and cherished is safeguarded or used as they would desire.

Many alternatives are open to the collector. One might choose to give one's collection to another collector of similar inclination. Another collector might decide to use his collection to provide a nucleus or particular strength for a young collector, many of whom have trouble getting started in the high-priced contemporary mineral market. Others might choose to do other things; the possibilities are limited only by the imagination and foresight of the collector. However, two alternatives seem to be most dominant; to either liquidate the collection for financial return, or to donate it to a museum or institution.

Considering the liquidation aspect first, if you choose to have your collection sold after you have gone, there are many considerations you should ponder in advance. For example: Is your likely survivor (spouse, siblings, relatives) competent to handle the business aspects of the matter? Will the collection have to be appraised? By whom? To whom will it be sold? Should it be broken up or sold as a unit? Will a broker be necessary? How will the heirs be protected against unscrupulous merchants or collectors? Try to look at these problems as your heirs will face them. Although you might not like to see your collection broken-up, might it be best for your heirs if this is done? Financial matters can become very difficult for a family after an unexpected death, and they might not be well-prepared to cope with the responsibility, or the demands of business negotiations. These things you can ponder in advance, and perhaps leave detailed instructions.

If donation is part or all of your plan, consider two major components of the matter: the nature of your collection and the nature of the intended recipient.

A very localized collection might not be of as much use to a major museum as it might be to a local group, library, nature center or historical society. A scientific collection would be best utilized by a research-oriented museum. A comprehensive and large species collection would be a very valuable addition to a large national museum but would be likely wasted in a more parochial repository. If a collection is designated to be sold, with only the proceeds donated, then value is a consideration. Hence, the very nature of the collected specimens might point the way to maximum utilization of the collection.

If you choose to take time to ponder these matters, take time also to inquire at the institution of your choice about the matters which concern you. Your own concerns will dictate the course of any such inquiry, but some thoughts you might keep in mind are: is there a curator who really cares about mineral specimens, and who is competent and experienced? Or is there simply a person called "*curator*" who looks in once a month to see if everything is intact? How good is the security on existing collections? What are the policies on gifts and bequests? Will the collection be used? Will the collection be open to view? What other matters concern you? Take the time to really see how things are cared for; lip service is cheap, but good curation takes hard work and diligence. Ask to see some drawers, selected at random from the mineral cabinets.

As a collector, you are a small-scale curator. Like those of us who curate large collections, you too have a curatorial responsibility to your collections. Mineral curators like to think of preserving everything mineralogical, and it is a sad, sad and bitter moment when we see good mineral collections (or even non-good ones) irresponsibly broken-up, dispersed, or thrown in the trash (Yes! it really does happen!).

The choices are all yours and there will be no rebuttal of your decision. Be sure that your action, whatever it is, will be a wise one. If you fail to provide for the eventual sensible disposition of your collection, you will surely deserve the curses of those of us who love minerals. *Please do something!*

by
Pete J. Dunn
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notes from the EDITOR

PLAN "B"

For the benefit of recent subscribers, let me explain that the *Mineralogical Record* has been blessed for several years now by two benefactors who each contribute funds to allow us 16 pages of color annually. This has meant that two of our six issues per year have carried 16 pages of color photography of minerals which we could not have otherwise afforded. This issue was planned originally to be one of those two color issues but, due to circumstances beyond editorial control, not all of the color articles scheduled were ready on time. Consequently I was forced to turn to Plan "B" (editorial rule #1: always have a Plan "B" ready).

Magazines are printed in "signatures," large sheets of paper with several pages printed on each side. When these large sheets are folded down to 1-page size and the three outside edges are trimmed off you have a tidy portion of the magazine. In the case of the *Record,* 16-page signatures are used: a large sheet of paper with 8 pages printed on each side. Normally a color issue in the *Record* would contain one of the 16-page signatures in color. However it is hardly more expensive to print *two* 16-page signatures, each having eight pages of color on one side and eight pages of black and white on the other. And there you have Plan "B": one of those 16-page signatures with eight pages of color is in this issue, the other one will be in a subsequent issue this year when those color articles are finally ready.

The reason I explain this is so that readers already familiar with our normal procedure will not look at the reduced number of color pages in this issue and worry that something is wrong or that they have been short-changed. Furthermore, after reflecting upon the idea of splitting the 16 pages of color between two issues, I decided there might be advantages . . . it does, after all, put at least some color into more issues per year. So (unless negative feedback is received) don't be surprised to see Plan "B" occasionally become Plan "A".

COLLECTING THE *RECORD*

By now everyone is well aware that many past issues of the *Record* are "out-of-print," i.e. the publisher's stocks are sold out and reprints are not anticipated. Many people still wish to fill out their collection of the *Record,* however, hoping someday to have what every collector of anything dreams of . . . a complete set. Consequently, demand for out-of-print back issues has driven prices up in the case of the rarer or more popular issues. Whereas a collector may be able to tell which issues are more popular, it is very difficult to tell in such a restricted market which are actually rarer. So, for the sake of getting it into print before the files are lost or misplaced, I thought it might be helpful to publish a tabulation showing exactly how many copies of each issue were produced. In case anyone, now or in the future, is interested, the figures are given in Table 1. Volume 1, number 1, incidentally, is rarer than the figure would seem to indicate because it was used in a promotion campaign in which about 1000 copies were mailed out to gem and mineral clubs all over the U.S. with a suggestion that the sample copy be shown around to club members who might be interested in subscribing. The campaign was a dismal failure in gaining new subscribers, and most of the copies mailed out were probably discarded by the recipients.

GLOSSARY SOLD OUT

The *Glossary of Mineral Species* by Michael Fleischer was first published by the *Record* in 1971. That first edition became a collector's standby, the only readily available, recently published compilation of mineral species available to Americans except for the heavier and more expensive *Chemical Index of Minerals* by Max Hey. Annual updates to the first edition of 1971 were published in the *Record,* but it soon became obvious that a second edition was needed. And so, in 1975, the *Glossary of Mineral Species 1975* was published, and has since become known among collectors as the "green bible." More varietal terms and synonyms were included in the second edition, and the spine was spiral bound (thus eliminating two complaints about the first edition, namely that it did not lie flat, and that the pages tended to fall out). Annual updates to the second edition have also appeared in the *Record,* the most recent containing 100 new mineral species and scores of modifications in previous data. Demand for the *Glossary* has been steady, and orders have been received regularly from all over the world.

I must announce that, although dealers may still have copies for sale, the *Record's* stock of Glossaries is finally gone, and the second edition is now officially out of print.

The first question most readers will ask (and have been asking) is, "When will a new edition of the *Glossary* come out?"The only answer we can give is, probably sometime in 1980. There will unquestionably be a third edtion, most likely containing a few new features besides, but it's still on the drawing board. So don't throw away your copies of the second edition just yet. In the meanwhile, unless you have access to the *American Mineralogist* or *Mineralogical Abstracts,* the best way to keep your *Glossary* up to date on new species is to follow the *Abstracts* column which appears in most issues of the *Record.* When the third edition is finally printed and ready, we'll run a full-page ad for it that will be certain to catch your eye.

Table 1. Number of copies printed of each issue of the *Mineralogical Record,* 1970–1979.

Vol. 1,	no.1	5600[1]	Vol. 6,	no.1	5000
	no.2	5000		no.2	5000
	no.3	4500		no.3	5000
	no.4	5000		no.4	5000
				no.5*	5000
Vol. 2,	no.1	3500[2]		no.6	5000
	no.2	4000			
	no.3	4000	Vol. 7,	no.1	5000
	no.4	4000		no.2	5000
	no.5	4000		no.3	5000
	no.6	4500		no.4	5000
				no.5*	5000
Vol. 3,	no.1	5000		no.6*	5000
	no.2	5500			
	no.3	5000	Vol. 8,	no.1	5500
	no.4	5000		no.2	5500
	no.5	5000		no.3*	9813
	no.6*	6000		no.4	6250
				no.5	9000
Vol. 4,	no.1	5000		no.6*	12000
	no.2	5000			
	no.3	5000	Vol. 9,	no.1	8300
	no.4	5000		no.2	8190
	no.5	5000		no.3*	9000
	no.6	5000		no.4	9125
				no.5*	9160
Vol. 5,	no.1*	5000		no.6	9300
	no.2	5000			
	no.3	5000	Vol. 10,	no.1	9680
	no.4	5000		no.2	9000
	no.5	5000		no.3	9000
	no.6	5000			

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[2] 3000 original copies, 500 copies reprinted with black and white cover.

famous mineral localities:

The Jeffrey Mine
Asbestos, Québec

by
J. D. Grice and **R. Williams**
The National Museums of Canada
The National Museum of Natural Sciences
Mineral Sciences Division
Ottawa, K1A OM8

Grossular crystals of exceptional quality from the Jeffrey mine at Asbestos, Québec, are to be found in collections throughout the world and have made this mine one of Canada's best known mineral localities. In addition to grossular, there are a number of other minerals that occur as fine display specimens, notably prehnite, pectolite, apophyllite, vesuvianite, diopside and aragonite. Although mineral collecting in the open pit mine is discouraged, the owner, the Canadian Johns-Manville Company Limited, provides a dump for collectors.

INTRODUCTION

The Jeffrey mine is located in Lots 9 and 10 of Ranges II and III, Shipton Township, Richmond County (Latitude 45°46′25″, Longitude 71°57′12″), about 160 km east of Montréal (Fig. 1). It operates in the second largest (after Asbest in the U.S.S.R.) asbestos deposit in the world with reserves estimated at more than 500 million tons. The Jeffrey mine produces about 13% of the world production of chrysotile asbestos, amounting to some 600,000 tons of fiber a year. As much as 40 million tons of rock and ore are removed annually from the pit, which measures over 275 m deep and 1,250 m across.

DEVELOPMENT HISTORY

Eighteenth century reports of the remote Eastern Townships of southern Québec indicate that both the Indians of the area and the early settlers were familiar with asbestos fiber. Apparently farmers' wives and families collected the peculiar, fire-resistant mineral from outcrops and rocks ploughed up in fields and knitted the silky, chrysotile fiber into socks and mittens.

It was not until 1881 (some five years after the discovery of the nearby Thetford Mines asbestos deposit) that Evan Williams, a Welsh slate miner visiting relatives, recognized the potential of the chrysotile occurrence which had been for years a local curiosity on the property of Charles Webb. Williams persuaded W. H. Jeffrey to open the mine, which operated on a royalty basis paying the farm owner $10 a ton of fiber in the summer and $5 a ton in the winter. By 1895, 2,300 tons of crude fiber were being produced annually by hand cobbing, hand drilling and black-powder blasting. The first mill in Canada to extract additional fiber from rejected rock was built in 1895, permitting the treatment of up to 200 tons of ore a day. The economy of the operation was marginal until, after a succession of insolvent operators (W. H. Jeffrey, the Danville Asbestos and Slate Company from 1893, the Asbestos and Asbestic Company from 1897) it was acquired in 1916 by the Manville Asbestos Company, which two years later re-formed as the Canadian Johns-Manville Company, the present owner.

During this period, more sophisticated mining and milling methods were introduced, notably derricks and aerial cableways to hoist ore to the surface. By 1920, the hoists had been replaced with a spiral bench system using steam locomotives to carry ore. This in turn was replaced by truck haulage of ore in 1950. Underground mining by the block-caving method was introduced in 1950 but abandoned as uneconomic in 1960. A 20-year expansion plan commenced in 1969 which involves considerable relocation of the adjacent town and the removal of 120 million tons of overburden, 390 million tons of waste rock, 183 million tons of ore and, it is to be hoped, many fine mineral specimens for museums and collectors.

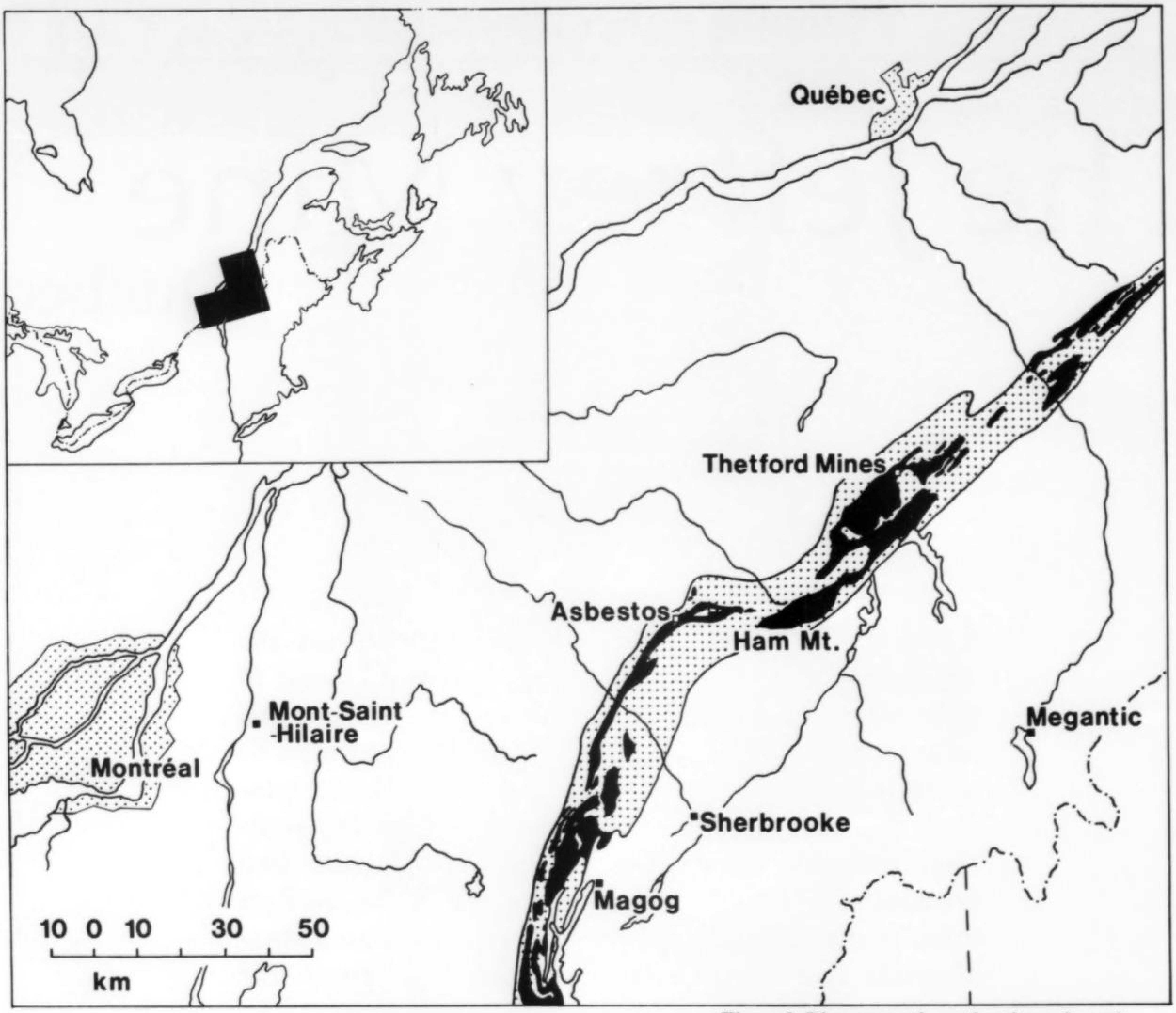
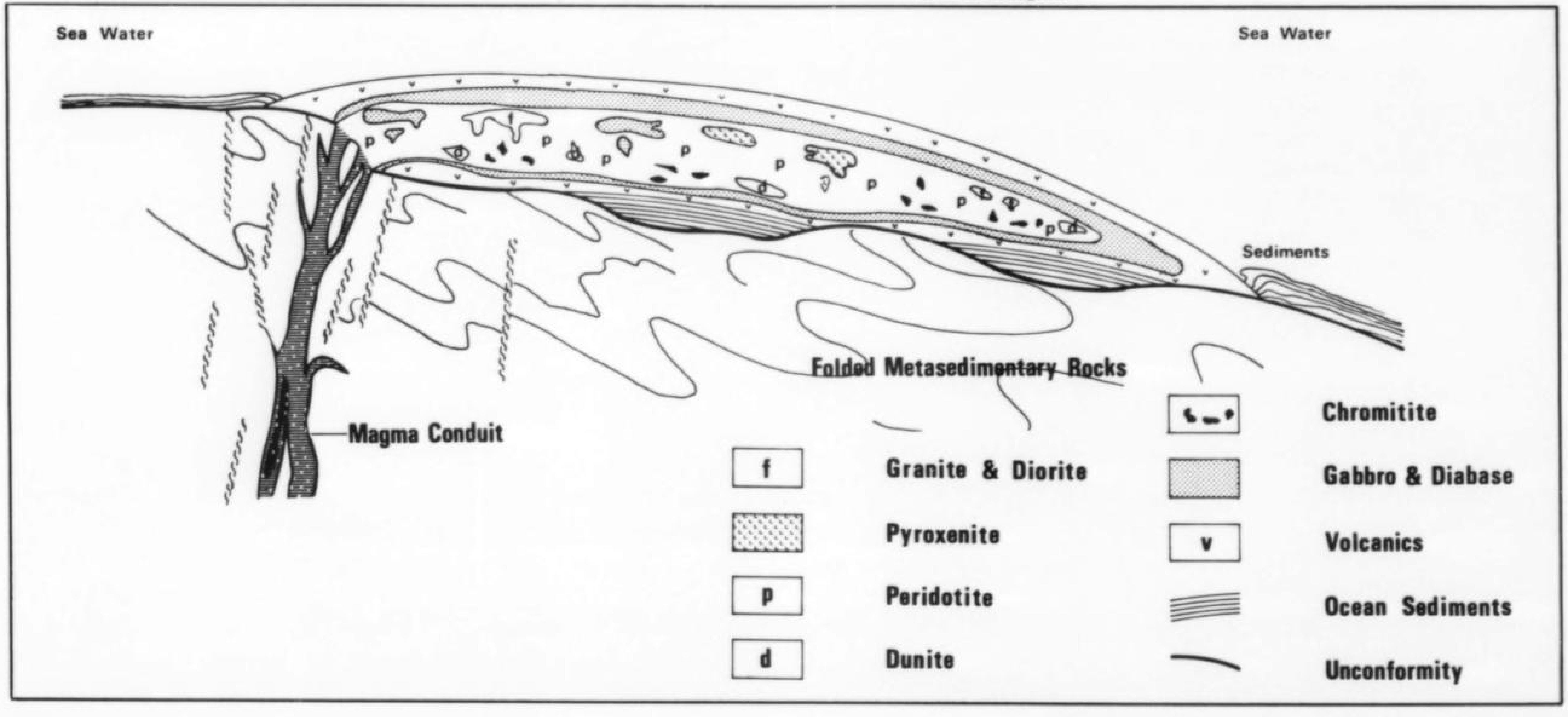


Figure 1. **Location map, showing ultramafic complexes (black) in the Serpentine Tectonic Belt (shaded), modified after Lamarche (1972).**

Figure 2. **Diagrammatic section through a submarine ophiolite flow, modified after Lamarche (1972). The size of the interior globules has been exaggerated. The flow may have exceeded 20 km in length.**



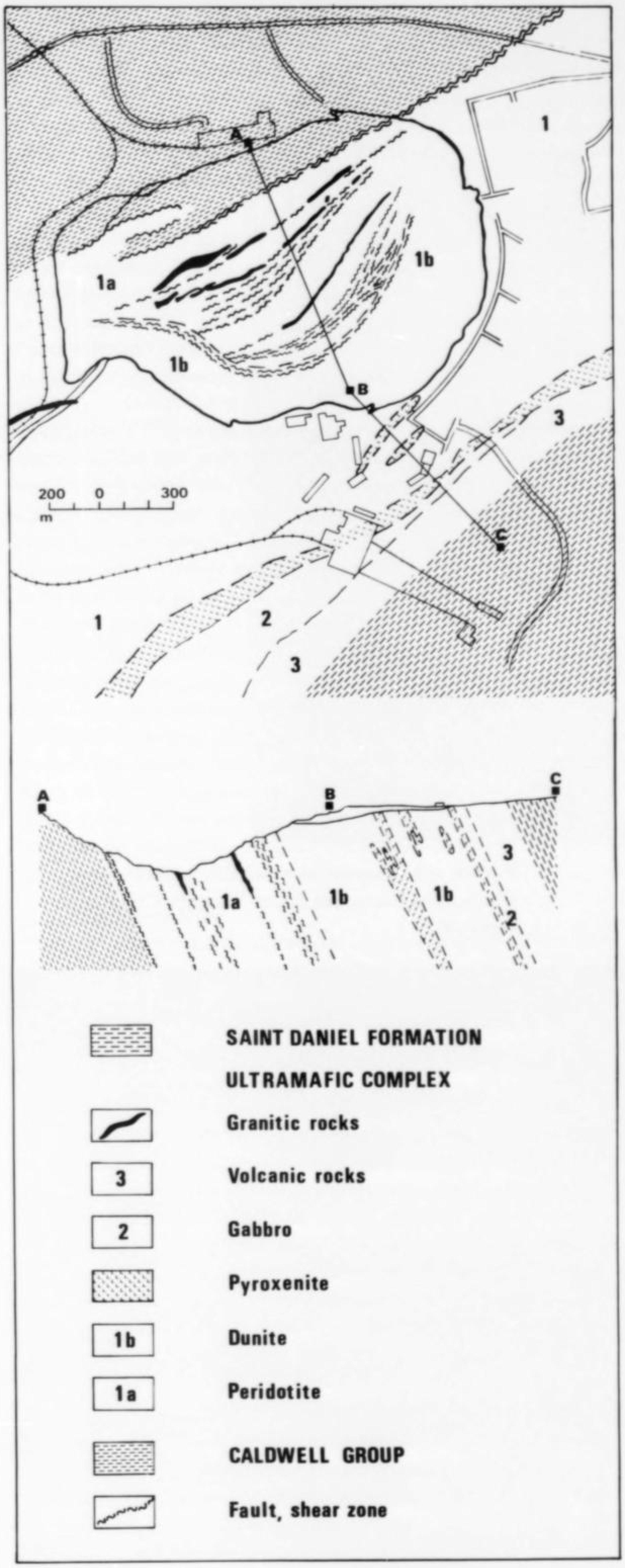


Figure 3. **Geological map and section of the Jeffrey mine.**

GEOLOGY

Regional

The Jeffrey mine is one of ten operating and at least that number of inactive mines located along a belt of ultramafic rocks extending northwards from Vermont into Québec within the Appalachian Mountain System. The ultramafic rocks lie within the Serpentine Tectonic Belt (Fig. 1), east of the Sutton-Bennett Belt and west of the Stoke Mountain Belt (Cady, 1969; St-Julien, 1967). They are composed of serpentinized dunite and peridotite (the host rock to the asbestos deposits), chromitite and pyroxenite with associated gabbro, dioritic, syenitic and granitic rocks, and mafic to intermediate volcanics.

The ultramafic complexes are considered (Lamarche, 1972) to be of probable Lower Ordovician age, as they occupy a constant stratigraphic position between underlying Lower Ordovician or older metasedimentary rocks of the Caldwell Group and overlying pre-Middle Ordovician rocks of the Saint Daniel formation. The Saint Daniel formation is overlain unconformably by rocks of the Magog Group that have been dated (Berry, 1962) as Normanskill (Middle Ordovician) and younger in age on the basis on their graptolite fauna. K-Ar dates of ± 480 million years (Poole *et al.*, 1963) on granitic rocks that Lamarche (1972) considered to be related in time if not directly comagmatic with ultrabasic rocks of the Thetford-Ham Complex (Fig. 1) would support a Lower Ordovician age.

The peridotite and dunite associated with the asbestos deposits are extensively serpentinized, particularly in places where they are sheared and intruded by dioritic to granitic masses. Away from the shear zones and intrusions, serpentinization is relatively uniform at about 30-40% of the rock, suggesting (Riordon, 1975) that serpentinization of the olivine constituent took place soon after its crystallization. Successive stages of serpentinization are evident (Riordon, 1975; Wicks and Whittaker, 1977), with a late, extensive serpentinization culminating in asbestos formation. The distribution of shears and fractures, which channeled asbestos forming solutions, was related to the relative competence of the different rock types present during regional deformation in late Ordovician and Devonian times. Granitic dikes localized shearing in the less competent peridotite they intrude while peridotite had the same effect on the less competent dunite surrounding it (Riordon, 1975).

Ophiolite complexes

Ophiolites, the association of ultramafic rocks with gabbro, diabase, volcanics and chert, are characteristically found in many orogenic fold-mountain chains. Their origin is explained most satisfactorily in terms of the plate tectonic theory as remnants of oceanic lithosphere. Oceanic lithosphere is composed of oceanic crust, made up of chert and other sedimentary rock, basaltic pillow lava, intrusive diabase and gabbro, and part of the upper mantle, composed of ultramafic rock—the typical ophiolite suite. Ophiolites are rarely preserved for oceanic lithosphere is absorbed back into the mantle at subduction zones as a consequence of seafloor spreading. It may be preserved, however, during the final stages of the closing of an ocean when an island arc system or continent being carried on one lithospheric plate collides with a continent carried on the other, converging plate. The ophiolite assemblage is scraped off the lithospheric plate and slides or is squeezed into the fold mountains resulting from the collision. Fold mountains mark the site of ancient oceans and ophiolites the precise suture.

The seafloor spreading model accounts accurately for features of ophiolite complexes found in mountain belts throughout the world including those of northern Newfoundland in the Appalachian Mountain System. The ultramafic rocks of the Thetford-Ham area of Québec have also been interpreted (Laurent, 1973; Osberg, 1978) as a typical ophiolite complex but there are differences between the classic ophiolite situation and that illustrated by the ultramafic complexes to the south. Chidester and Cady (1972), for instance, concluded that the ultramafics of southern Québec and Vermont are not oceanic crust remnants because many of the ultramafic bodies are intrusive; because

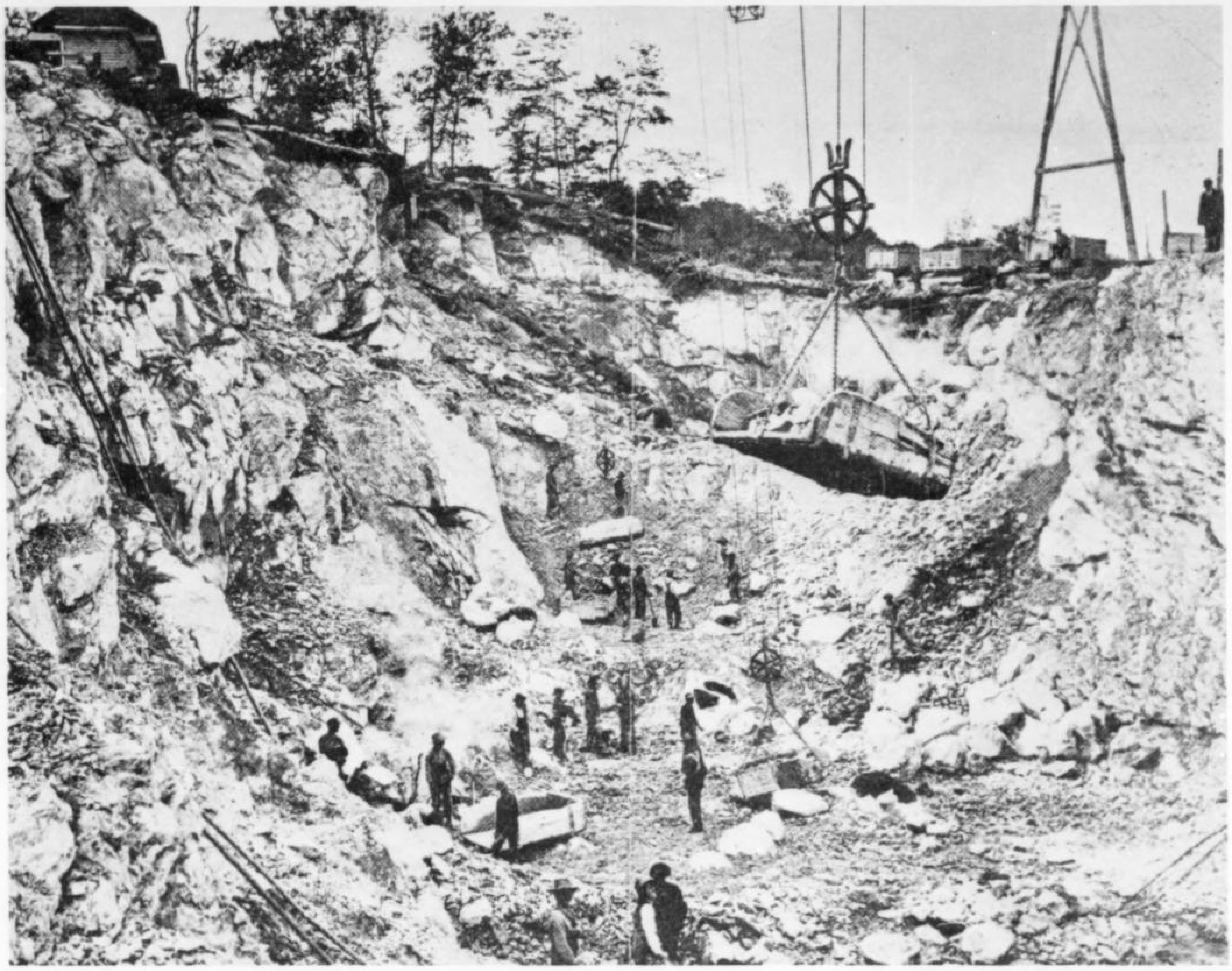


Figure 4(a). **The Jeffrey mine, circa 1910. Photo: The Public Archives of Canada.**

Figure 4(b). **Aerial view of the Jeffrey mine. Photo: The Canadian Johns-Manville Company Limited.**

peridotite is more common than other rock types; and because outcrops of Precambrian sialic rock in the area suggest that continental crust, not oceanic crust, formed the basement during emplacement times. They (Chidester and Cady, 1972) suggested that these ultramafics were generated in the upper mantle beneath the continent and emplaced as solid instrusions through and into the crust and overlying sedimentary rocks during deformation of the Appalachians.

Lamarche (1972) provided an alternative explanation, suggesting the Québec ultramafics to be giant submarine extrusions (Fig. 2) as the major complexes rest unconformably on, but are conformably overlain by, metasedimentary rocks of eugeosynclinal origin—rocks deposited as sediment on the continental rise and adjacent abyssal plain of the Proto-Atlantic, Appalachian Ocean. Intrusive ultramafics, often with marked contact metamorphism in adjacent rocks, such as those in strata underlying the Thetford-Ham Complex (Fig. 1), were interpreted (Lamarche, 1972) as the feeders or magma conduits to the submarine eruptions. Volcanic rocks rim the complexes and grade inwards to the coarser rock types which are dispersed irregularly with complicated contact relationships, generally sharp but without chilled margins or contact metamorphism. Lamarche (1972) considered these features to indicate that all igneous rocks of the complexes differentiated from the same parent magma by liquid immiscibility under a self-formed roof of volcanics in the relatively fast-cooling submarine environment.

Lamarche's (1972) interpretation is controversial particularly in terms of the close genetic relationship between the ultramafic rock types and the granitic intrusions. Indeed, Lamarche (1973) proposed a revised model in which the granitic material represents partly assimilated ocean sediment picked up from the seafloor by the moving volcanic flow. Riordon (1975) suggested the granitic dikes post-date the ultramafics and a ± 360 million year K-Ar date on a Jeffrey mine granitic rock, reported by De (1961), supports the interpretation that the dikes are younger and genetically unrelated.

The Jeffrey Mine

At the Jeffrey mine the ultramafic complex is about 1500 m thick. It is underlain on the northwest, footwall side by slate and phyllite of the Caldwell Group (Fig. 3) containing some quartzite and metagreywacke beds. Lenticular bodies of amphibolite and a small peridotite intrusion are also present and have been interpreted (Lamarche, 1973) as subsidiary feeders or apophyses of the supposed, main ultramafic magma conduit.

Peridotite, mostly harzburgite with some lherzolite, is the host rock to the orebody and occupies the northwest exposure of the complex. The peridotite is highly serpentinized with chrysotile, antigorite and lizardite the most common of the serpentine group minerals. The orebody, with a width of over 600 m, length over 900 m and depth in excess of 750 m, is bounded on all sides by shear zones which separate metasedimentary rocks on the footwall side and serpentinized dunite on the hanging-wall side. Internally, the orebody is divided into five ore zones bounded by shear zones associated with granitic intrusions.

Chrysotile asbestos ore occurs mainly in cross-fiber veins in concentrations up to 20% but averaging 5-7%. Most of the fiber is silky although some semi-harsh fiber is present. Intermediate fiber grades, with fiber veins about 0.5 cm wide and 1-2 m long, make up about 50% of the fiber recovered. Most of the remainder is short fiber, although long fiber grades, with vein widths to 2 cm and lengths to 10 m, account for a small percentage. Short or mass asbestos fiber is recovered also from the serpentinized peridotite where it locally amounts to 50% of the rock.

To the southeast, the peridotite grades into serpentinized dunite which contains rare, lenticular masses of chromitite and irregular lenses of serpentinized pyroxenite. A band of pyroxenite, mostly clinopyroxenite with some websterite, extends along the southeastern contact of the dunite, and, in turn, the pyroxenite grades into gabbro and diabase. Pillowed and brecciated, intermediate to mafic, locally spilitic, volcanic rocks constitute the upper part of the complex. They are conformably overlain by slate, phyllite and chert with minor quartzite and carbonate beds of the Saint Daniel formation.

Dike rocks

Irregular-shaped, dike-like masses from a few to several hundred meters long occur in the peridotite and dunite. They are important not only because of their role in the genesis of the asbestos deposits but because they are the source of grossular and the other minerals of interest to collectors. The most common dike rocks at the Jeffrey mine are diorites characterized by saussuritized plagioclase and abundant biotite. These are considered (De, 1961) to be earlier than the related granitic dikes and pegmatites that are mainly quartz monzonite but include a variety of rock types, albitite pegmatite, andalusite granite, loellingite-bearing pegmatite and syenite. Emplacement took place partly by stoping, as indicated by ultramafic xenoliths, and partly by wedging along existing fractures.

Many of the granitic and dioritic intrusions are associated with calcium-rich and aluminum-rich mineral assemblages (grossular, vesuvianite, diopside, prehnite, zoisite, chlorite) of hydrothermal origin. The assemblages replace granitic and dioritic rock at their contact with serpentinized ultramafic rock, occur as veins and joint fillings in dioritic rocks, replace diorite rock around veins and, rarely, occur as discrete dikes. The latter, known as rodingites, are composed predominantly of grossular with or without diopside.

According to De (1961), these minerals crystallized from a residual hydrous melt enriched in calcium and aluminum as a result of the crystallization of biotite instead of hornblende (or pyroxene) in the diorite, and the crystallization of anorthite-poor plagioclase (albite) in the granitic and dioritic rocks. This would occur because of an increase in water pressure in the crystallizing dike magma resulting from its intrusion into the hydrous environment of the serpentinized ultramafic rocks. Hornblende being unstable in such hydrous environments would convert to biotite, then to chlorite, and would release large amounts of lime which would contribute to the formation of the calcium silicate mineral assemblages.

The occurrence of the grossular-prehnite-epidote group-vesuvianite-diopside assemblage at the contact between granitic dikes and ultrabasic rocks suggests an alternative to De's (1961) explanation for the origin of these minerals. During serpentinization certain chemical elements would have been released by the breakdown of the ultramafic minerals. Serpentinization of olivine resulted in an excess of magnesium and silicon while the alteration of the monoclinic pyroxenes, augite and diopside, released calcium and aluminum. These are the essential elements of rodingite and of the mineral assemblage noted above. An additional source of silicon and aluminum may have been the granitic rocks, which may also have provided the sodium and potassium necessary for crystallization of pectolite and apophyllite, found only at the intrusion contacts. The olivine of ultramafic rocks commonly contains a small percentage of nickel. This would be released during serpentinization as nickel and is not readily taken into the serpentine crystal structure. The available nickel segregated as discrete blebs of nickel-iron in the serpentine rock and may have been involved in the crystallization of heazlewoodite, nickeline and maucherite on the dike rock contacts.

MINERALOGY

The minerals listed in Table 1 are those which have been identified and are represented in the National Mineral Collection of Canada. In addition to these, there are the essential minerals of the ultramafic and associated rocks that include olivine, augite and enstatite as well as some interesting accessory minerals reported by De (1961): apatite, anthophyllite, brugnatellite, halloysite, hematite, kaolinite, loellingite, rutile, titanite and zircon. Undoubtedly there will be numerous other species reported from this locality but to date this is the most complete list that could be produced from the existing collection. Only those

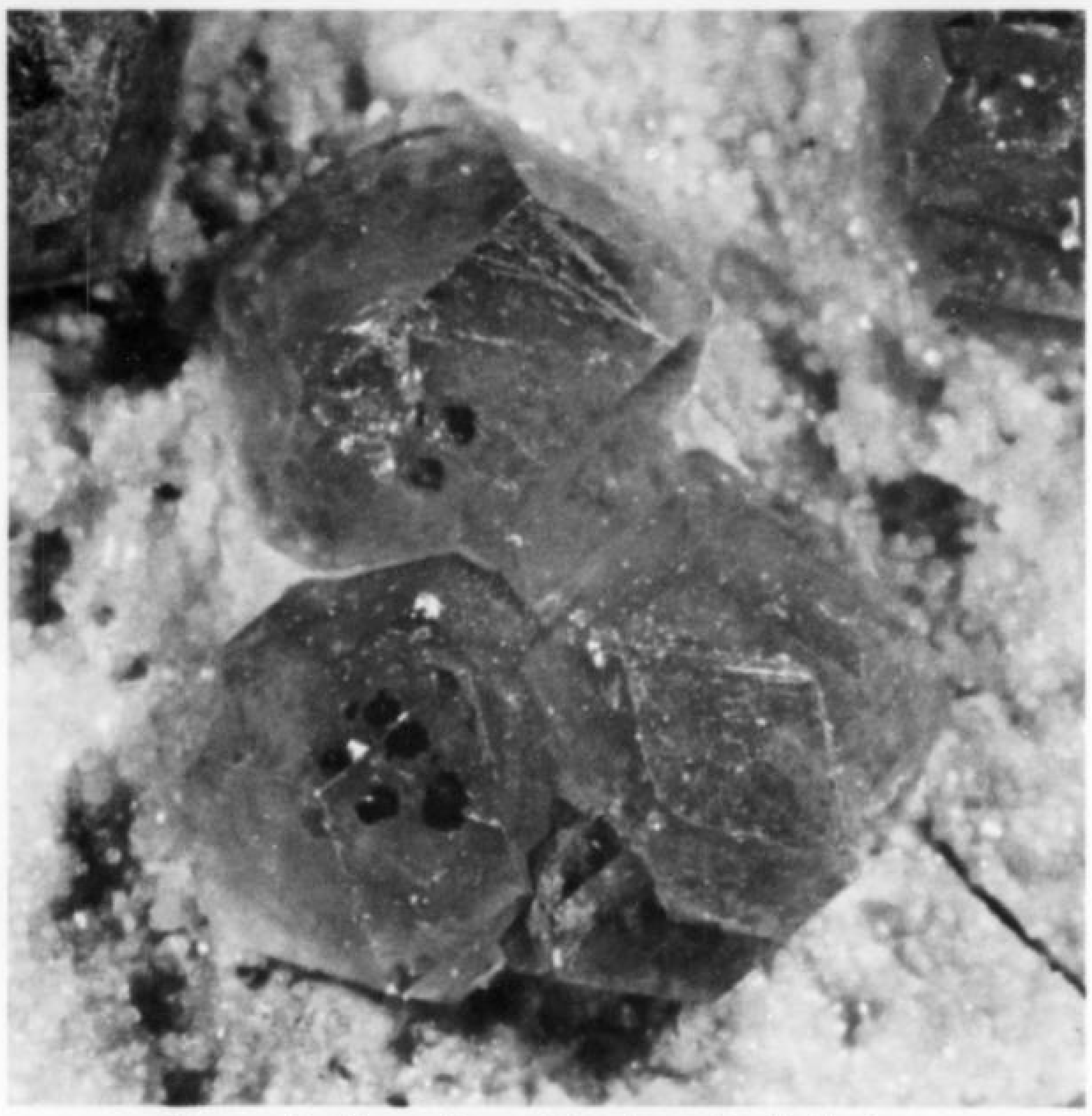


***Figure 5.* Grossular with chromite inclusions (NMNS #32026). Crystal diameter is 2 mm.**

minerals that are unusual in their occurrence or appearance are described in the following paragraphs. This represents a biased choice, but it is hoped that the selection will prove useful and interesting.

Where a visual identification was not sufficient X-ray and optical techniques were employed. Samples were chemically analyzed using an electron microprobe except where noted in Table 2. Water analyses were made by the Penfield method. Where Miller indices have been determined a contact goniometer was used on larger crystals and a reflecting goniometer on smaller crystals. If readers are comparing the Miller indices given in this paper with those described elsewhere, they should be aware of the fact that for some minerals the axial ratios have been revised in recent literature.

Grossular is the only documented species of garnet occurring at the Jeffrey mine. The color of the grossular varies from colorless through shades of white, pink, orange and green. The green variety has been incorrectly reported as uvarovite. The darkest green core encountered contained approximately 7 wt.% Cr_2O_3 (Table 2), which corresponds to only approximately 14 mol.% of the uvarovite molecule. It should be pointed out that only 0.5 wt.% of Cr_2O_3 and approximately the same amount of TiO_2 imparts a pale green color to these grossular crystals (this agrees with the analysis of Dunn, 1978). As would be expected the Cr-bearing grossular has a higher refractive index ($n = 1.742 \pm .002$) than the colorless to orange-colored grossular which fall within the range $n = 1.734 \pm .002$ to $n = 1.738 \pm .002$.

It is the *hessonite* variety or orange-colored grossular that originally made this locality popular with collectors. Since 1950, perhaps even earlier than this, specimens of this mineral have been widely distributed throughout North America and Europe. Hessonite has been cut into beautiful gemstones but unfortunately these have not received the same widespread distribution as the mineral specimens. In the National Mineral Collection the largest cut hessonite is 24 carats and this is believed to be the largest faceted stone from this locality. The orange color is probably due to the iron oxide in solid solution (approximately 2 wt.% FeO). Water was not detected in the analyzed sample. Often there are needle-like inclusions of diopside in the hessonite crystals.

The green variety of grossular is less common than the orange-colored grossular at the Jeffrey mine. Some examples of the green variety contain black inclusions of chromite (Fig. 5), which no doubt are the source of chromium causing the green color. Commonly a dark green core fades to an almost colorless grossular near the rim, while in other specimens the transition from the green spherical core to colorless euhedral rim (Fig. 6) is abrupt. The analysis given in Table 2 is of a specimen of this type: the core contains 6.97 wt.% Cr_2O_3 and 0.47 wt.% TiO_2, while the rim has 0.00 wt.% Cr_2O_3 and 0.06 wt.% TiO_2. On some specimens the small (approximately 200 μ diameter) green grossular spheres can be seen with no overgrowth of the colorless grossular.

Individual hessonite crystals range up to 3 cm in diameter but the green grossular crystals are smaller—commonly less than a centimeter in diameter. The garnets are most common on granitic rocks, associated with diopside, K-feldspar and quartz. Particularly attractive are those specimens with hessonite on biotite which forms a coating on diorite.

Only two crystal forms have been observed on the Jeffrey mine grossular specimens of the National Mineral Collection of Canada: the rhombic dodecahedron *d*{110}, which has 12 faces, and the trapezohedron *n*{211}, which has 24 faces. The trapezohedral and dodecahedral forms may occur independently or may be combined in the same crystal. On those crystals with a combination of forms, the dodecahedral faces are bright and even while the trapezohedral faces are heavily striated (Figs. 7 and 8), the striations resulting from the oscillatory growth between dodecahedral and trapezohedral forms.

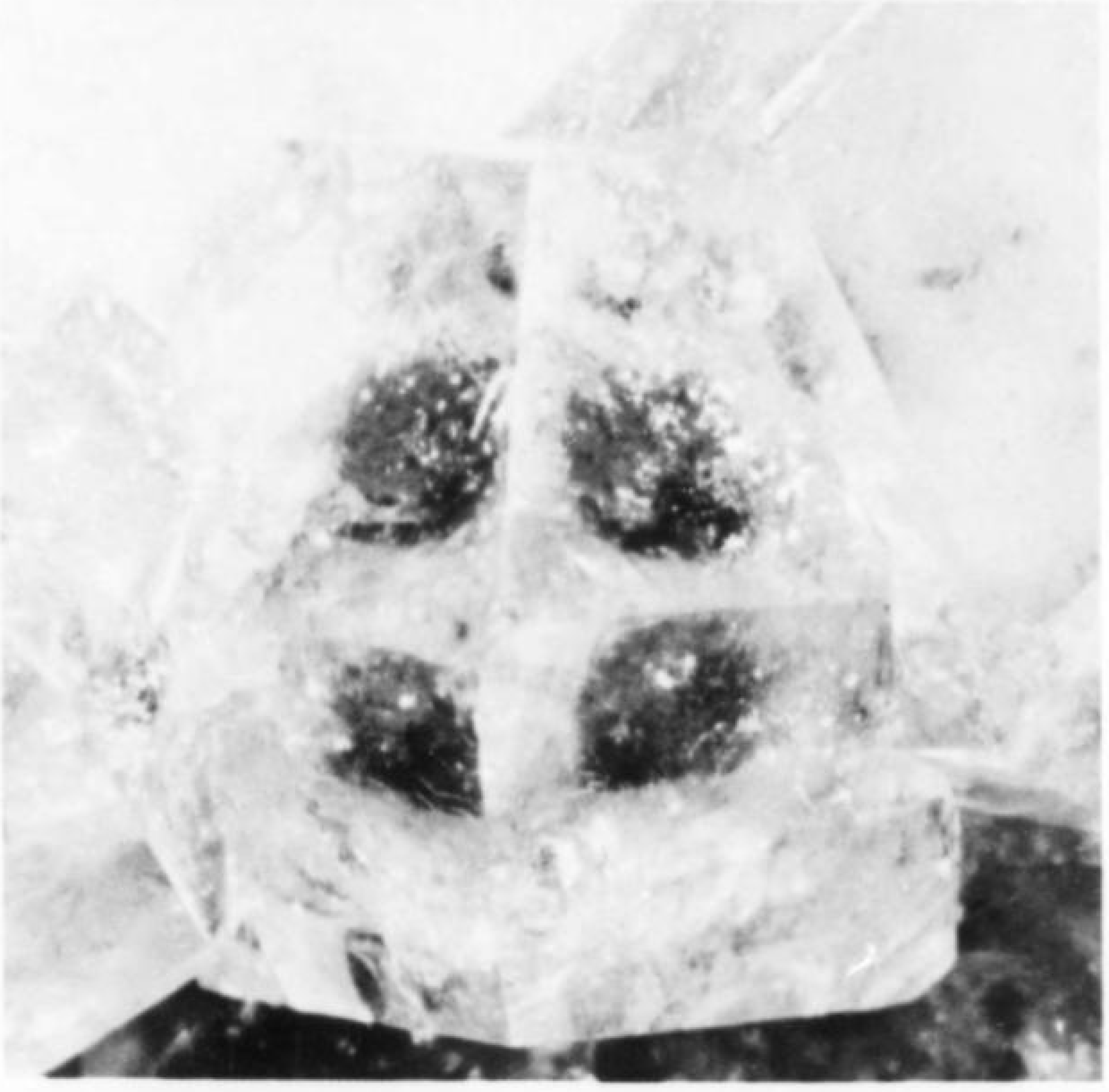
Prehnite in the Jeffrey mine has neither the color nor the habit usually associated with this mineral. Prehnite is common as green botryoidal masses but at this locality it forms good crystals which are usually colorless or white, but pale yellow and pale green shades are also present.

On the crystals examined three habits are prevalent: crystals on matrix are commonly combinations of domes and pyramids (Fig. 9); single crystals with two pyramids (Fig. 11); and multiple growth crystals which are lozenge-shaped and curved (Fig. 12). As prehnite crystals are relatively uncommon, the morphology of the Jeffrey mine specimens is described below.

Prehnite crystals belong to the orthorhombic crystal system and they appear to have symmetry denoted by the symbol $\frac{2}{m}\frac{2}{m}\frac{2}{m}$. With crystal structure refinements (Papike and Zoltai, 1967) it has become evident that the structural symmetry, although very close to that given above, is really non-centrosymmetric and has the symmetry symbol 2*mm*. The form names given below and in the figures are for crystal class 2*mm* and the Miller indices {hkl} given for each form as based on the unit cell ratio, $a_o:b_o:c_o$ 0.843:1:3.378.

Figure 10 is a sketch of the crystal photographed in Figure 9 and Figure 11 is a sketch of a doubly terminated crystal. Figure 13 is an

***Figure 6.* Grossular with chrome-rich core (NMNS #36492). Crystal diameter is 3 mm.**



idealized crystal drawing compiled from all the observed forms: *c*{001} pinacoid consisting of two parallel faces; *m*{110} and *t*{104} domes consisting of two nonparallel faces related by a mirror plane of symmetry; and *s*{111} rhombic pyramid consisting of four nonparallel faces capable of meeting at a point along the *a* axis. Due to the lack of a center of symmetry the two pyramids are not related by symmetry. On the prehnite crystals two distinct sets of striations may be observed. On {110} and {110} dome faces the striations are perpendicular to the *c* axis and are due to oscillatory growth between pyramidal and prismatic forms. The less pronounced striations on {001} are parallel to the *b* axis and are caused by oscillatory growth between the pinacoid {001} and the dome {104} or {$\bar{1}$04}.

Figure 7. Grossular, hessonite variety (NMNS #32028). Crystal diameter is 1.3 cm.

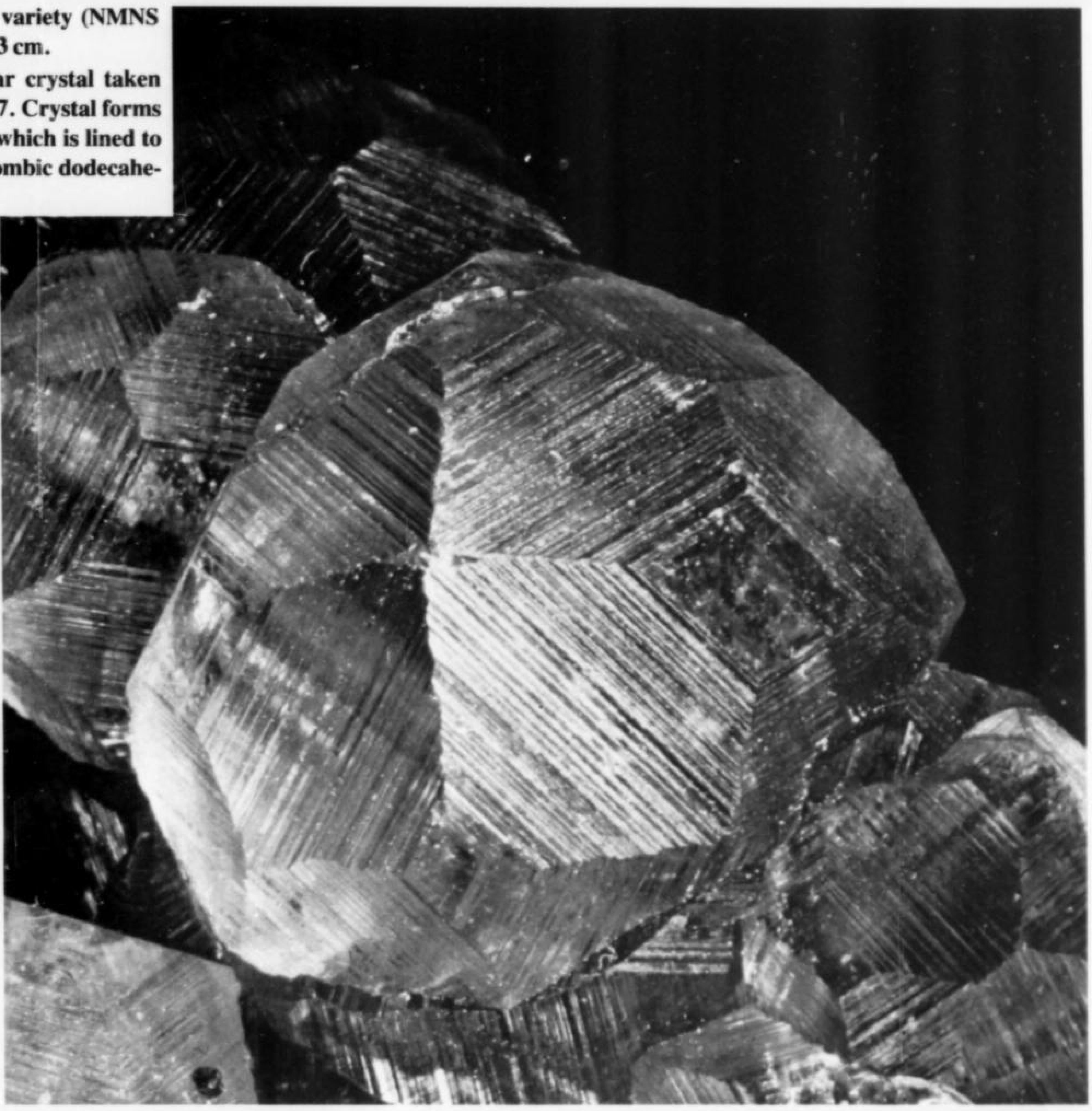
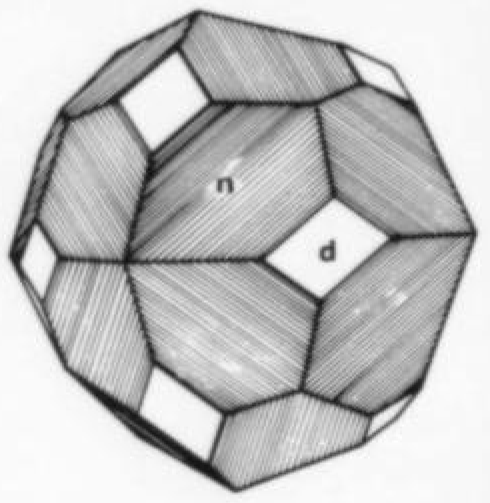


Figure 8. Sketch of a grossular crystal taken from the photograph in Figure 7. Crystal forms are the trapezohedron *n*{211}, which is lined to represent striations and the rhombic dodecahedron *d*{110}.



The only specimen of ***pumpellyite*** from this locality in the National Collection is associated with prehnite and diopside on fine-grained albite. The pumpellyite is pale green and forms needles approximately 5 mm in length.

Pectolite occurs as excellent tabular crystals, as acicular (Fig. 14) to fibrous bundles, and as "bow-tie" aggregates. The pectolite crystals are up to 2 cm in length and generally less than 1 cm in width. They are mainly translucent with bright faces and white to gray color.

Since well-formed pectolite crystals are uncommon their habit is described here. Pectolite crystals are in the triclinic crystal system and have a center of symmetry. With this symmetry each face must have a symmetry related face parallel to it; this form is called a pinacoid. Figure 15 is a composite drawing to show the various pinacoids observed. The crystals are elongated parallel to the *b* axis and terminated by the *m*{110} pinacoid and more rarely by the *b*{010} pinacoid. The other common pinacoids are *a*{100}, *c*{001} and *t*{10$\bar{1}$}; both the {100} and {001} faces are striated parallel to *b* due to oscillatory growth with the {10$\bar{1}$} face. The Miller indices given here are based on cell ratios *a*:*b*:*c* 1.135:1:0.997. Rarely, pectolite needles have a stellate overgrowth of ***thomsonite*** spikes up to 2mm long (Fig. 19).

Apophyllite from the Jeffrey mine occurs as excellent, clear, colorless crystals up to 4 cm in length and 2 cm across, as translucent, gray-white crystals that have stepped or curved faces and as clear, colorless coatings less than 5 mm thick on albite.

Figure 16 is a photograph of one of the best crystals and Figure 17 a sketch of this crystal. Apophyllite is in the tetragonal crystal system and the forms present are the basal pinacoid *c*{001}, tetragonal prism *m*{110}, and the tetragonal dipyramid *p*{011}.

Diopside is a common mineral in the Jeffrey mine. The two most common habits are white, curved, elongate crystals (Fig. 18) and green, bladed crystals. Chemical analyses of both these types are given in Table 2. It is not surprising that the green diopside contains approximately 6 wt.% more of Fe0 than the white. Less commonly, diopside occurs as gray to gray-green to lavender prismatic crystals up to 1 cm in length. Diopside is commonly associated with grossular at this locality.

Wollastonite occurs as white, fine-grained massive material and more commonly as long, white, compact fibers up to several cm. The latter habit is easily confused with the white, long fibers of ***actinolite*** (chemical analysis in Table 2) but the actinolite fibers are not as brittle or "woody" in appearance as the wollastonite. Also closely resembling wollastonite is ***xonotlite,*** which tends to have a more bladed appearance due to the one good cleavage. Another interesting habit of wollastonite is as fine-felted fibers. Occurring on this material, which has the

Figure 9. Prehnite crystal, 1.5 cm. long (NMNS #32663).

Figure 10. Sketch of prehnite crystal photographed in Figure 9. Crystal forms are the domes $m\{110\}$ and $\{\bar{1}10\}$, rhombic pyramids $s\{111\}$ and $\{\bar{1}11\}$, and pinacoid $c\{001\}$. Note that rhombic pyramid $\{\bar{1}11\}$ and dome $\{\bar{1}10\}$ are not seen in the sketch since they are behind the crystal.

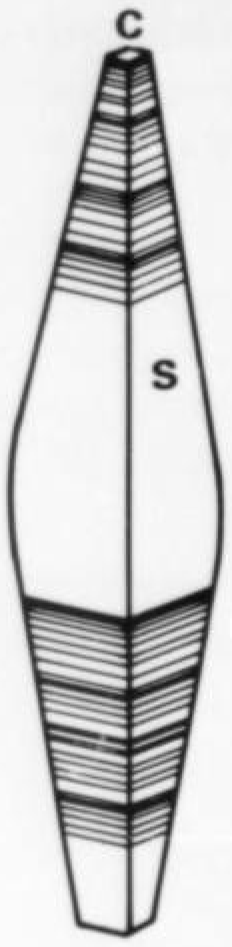


Figure 11. Sketch of a doubly terminated prehnite crystal (NMNS #32675). Crystal forms are the rhombic pyramid s$\{111\}$ and the pinacoid $c\{001\}$. The other $\{\bar{1}11\}$ pyramid is behind the crystal.

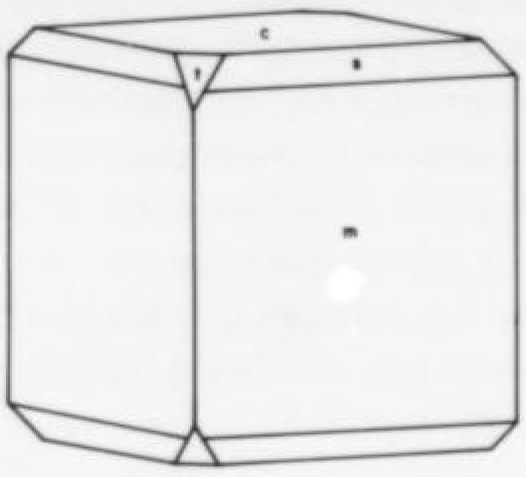


Figure 13. Idealized drawing of a prehnite crystal showing a compilation of all the observed forms: domes $m\{110\}$ and $t\{104\}$, rhombic pyramid s$\{111\}$ and pinacoid $c\{001\}$. The forms dome $\{\bar{1}10\}$, dome $\{\bar{1}04\}$, rhombic dipyramid $\{\bar{1}11\}$ are at the back of the crystal.

Figure 12. Pale yellow prehnite on pink grossular with minor amounts of fibrous wollastonite (NMNS #32664). The large prehnite crystal is 1.0 cm across.

appearance of "mountain leather," are small (approximately 8 mm diameter) botryoidal masses of radiating ***okenite*** (fig. 20).

Vesuvianite has two distinct appearances in the Jeffrey mine. The more common of the two is pale green in color and occurs as exquisite crystals less than 5 mm across and 1 cm long. A sketch of a crystal is shown in Figure 21. The crystal forms present are nearly perfect and include the tetragonal prisms $a\{100\}$ and $m\{110\}$, tetragonal dipyramid $p\{111\}$ and ditetragonal dipyramid $s\{311\}$. The larger green crystals up to 3.5 cm in length tend to be rounded but some show a double termination. The other type of vesuvianite seems less common. It consists of stubby, clove-brown crystals up to 0.8 mm by 1.5 mm long. These well-formed crystals are simpler and consist of the forms, tetragonal prism {110}, tetragonal dipyramid {111} and pinacoid {001}. All vesuvianites are associated with the granitic dikes. Table 2 includes a chemical analysis of each type and, as might be expected, the brown vesuvianite contains more iron and less magnesium than the green.

Three members of the *Epidote Group* have been identified from this locality: ***zoisite***, ***clinozoisite*** and ***allanite***. Chemical analyses for zoisite and clinozoisite are given in Table 2 but due to the small amounts of material no H_20 analysis was undertaken.

Manganese-bearing minerals are rare in the Jeffrey mine but three manganese hydroxide minerals were identified. Very small amounts of both ***manganite*** and one of its polymorphs, ***groutite***, were observed in association with vesuvianite, the crystals of both species being less than 1 cm in size. The manganite forms shiny, bladed crystals whereas the groutite is an aggregate of fine needles. The other manganese hydroxide, ***pyrochroite***, has a different association. It forms orange-yellow flexible scales on fine-grained serpentine. Another interesting mineral which has the same association as the pyrochroite is a ***pyroaurite group*** mineral which forms euhedral, pale amber crystals less than 0.5 mm in size.

Associated with the chrome-green grossular and diopside are two rare opaque minerals, ***heazlewoodite*** and ***maucherite***. The nickel sulfide heazlewoodite forms rough rhombohedra while the nickel arsenide maucherite occurs as elongate blebs. With maucherite are independent blebs of ***nickeline***.

No doubt there will be more unusual non-silicate minerals reported from the Jeffrey mine in the future but this paper represents those observed to date.

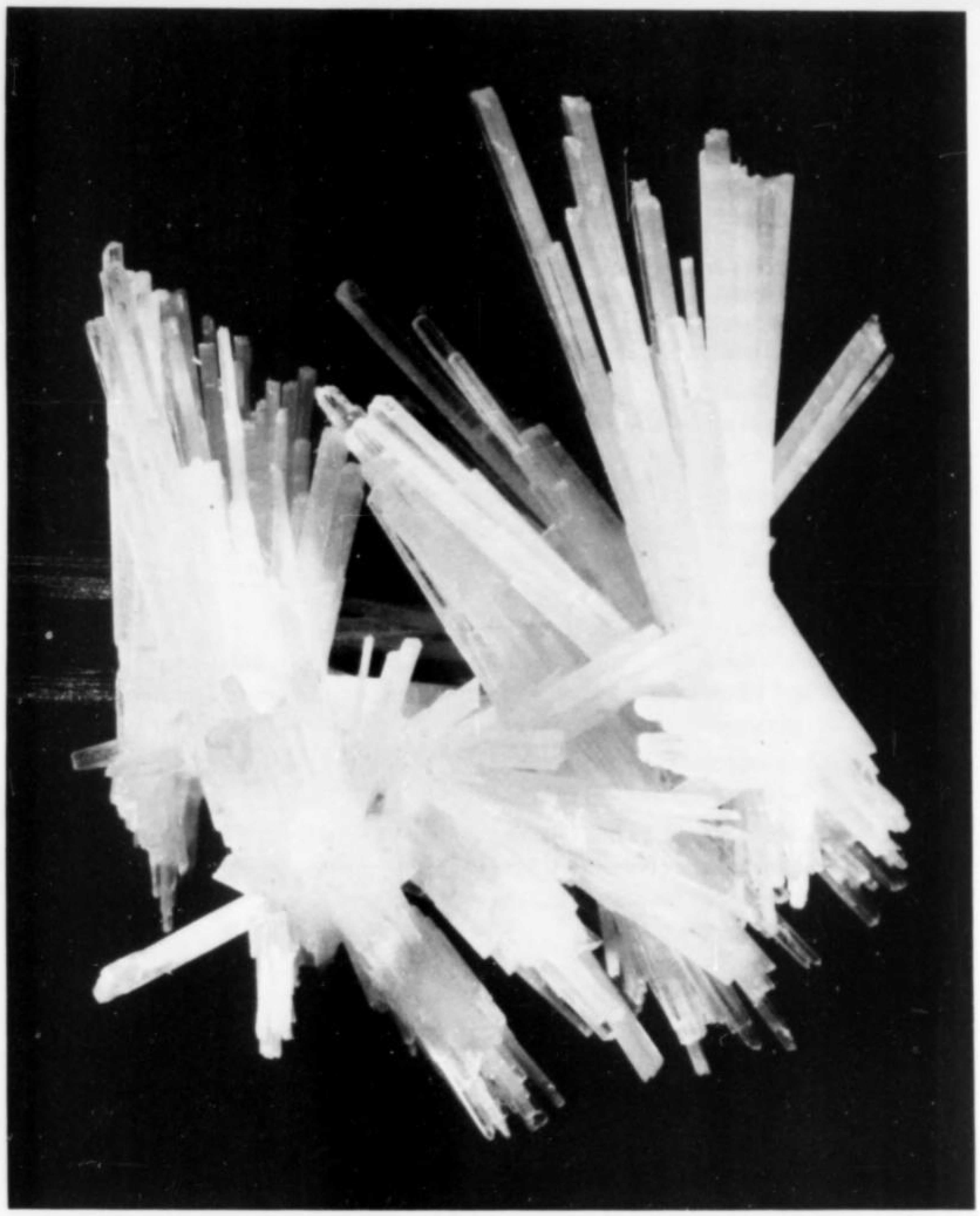


Figure 14. **White pectolite crystals (NMNS #30277) measuring 2.0 cm across.**

Figure 15. **Idealized drawing of a pectolite crystal showing the pinacoids *a*{100}, *b*{010}, *c*{001}, *m*{110} and *t*{10$\bar{1}$}.**

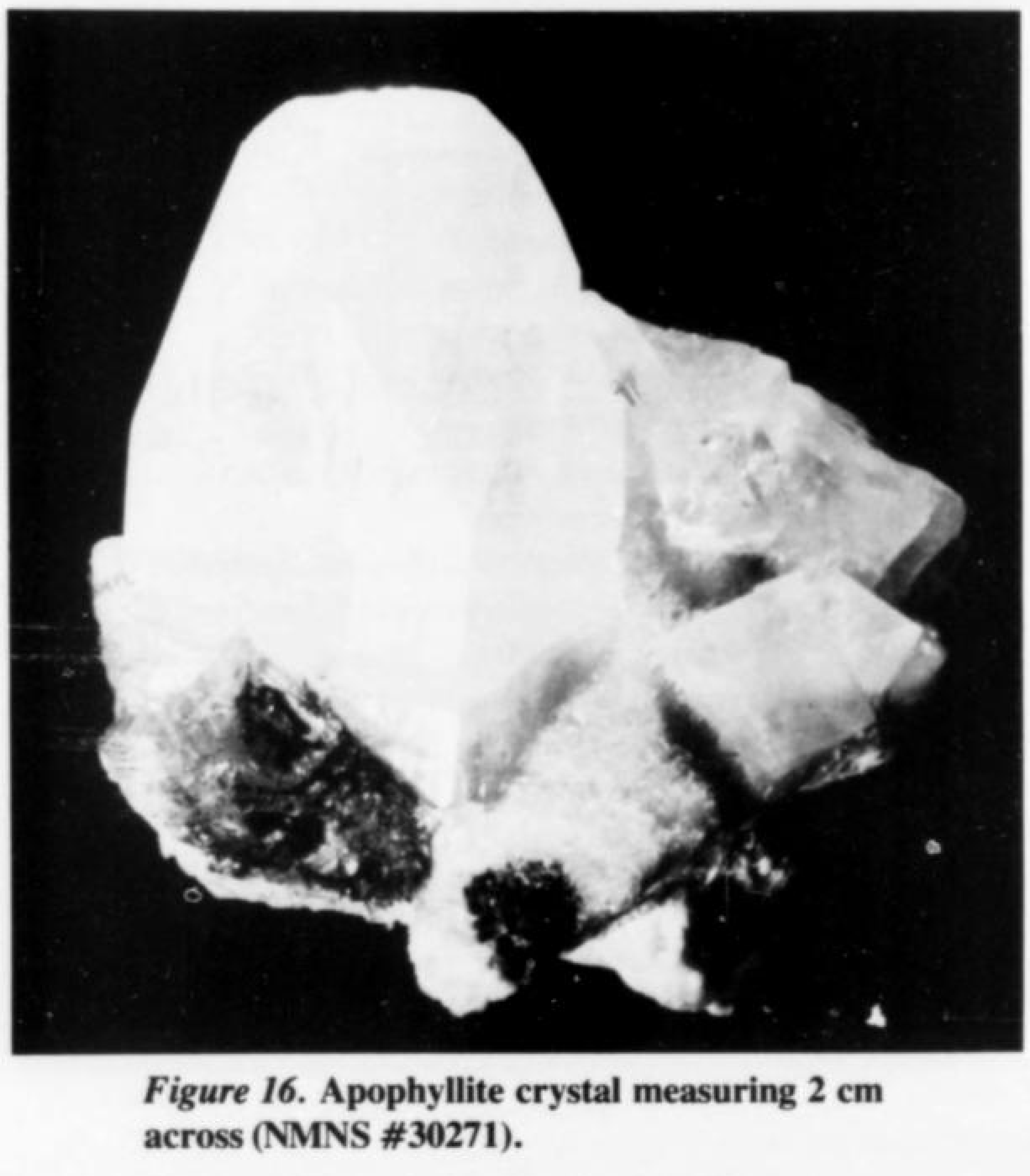


Figure 16. **Apophyllite crystal measuring 2 cm across (NMNS #30271).**

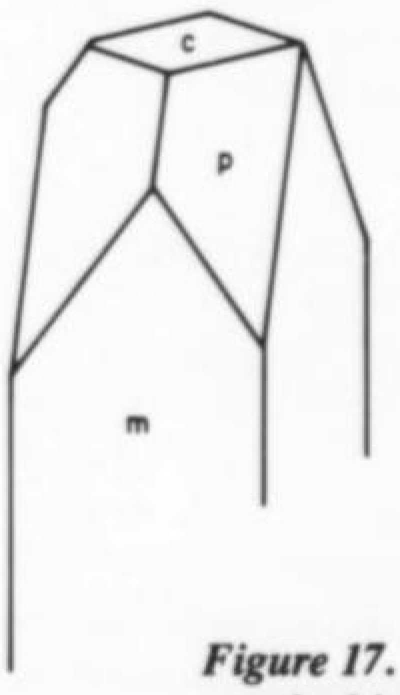


Figure 17. **Sketch of apophyllite crystal photographed in Figure 16. Crystal forms are: pinacoid *c*{001}, tetragonal prism *m*{110}, and the tetragonal dipyramid *p*{011}.**

Table 1. A list of minerals from the Jeffrey mine, Québec.

Actinolite*	$Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	White fibers up to 30 cm long—accessory mineral in granitic dikes
Albite	$NaAlSi_3O_8$	Common constituent of dike rocks — matrix for grossular, pectolite, prehnite — 8-cm crystals in some albitite pegmatites
Allanite	$(Ce,Ca,Y)_2(Al,Fe)_3(SiO_4)_3(OH)$	Brown-black, shiny, platy crystals to 1 mm
Andalusite	Al_2SiO_5	Lavender, prismatic, in bundles, to 15 cm in length — associated with quartz and muscovite in granitic pegmatites
Apophyllite*	$KCa_4Si_8O_{20}(OH)\cdot 8H_2O$	Clear, colorless crystals to 4 cm and thin coatings on albite
Aragonite	$CaCO_3$	White to pale yellow, fine needles, sometimes in radiating 1-cm hemispheres —on serpentine matrix
Biotite	$K(Fe,Mg)_3(Al,Fe)Si_3O_{10}(OH)_2$	Essential constituent of granitic and dioritic intrusions — plates to 10 cm
Brucite	$Mg(OH)_2$	Pale green — occurs in plates of compacted fine grains and in very long fibers to 15 cm
Calcite	$CaCO_3$	White — small rhombs to compact fibers
Chalcocite	Cu_2S	Anhedral blebs of a few mm associated with pyrrhotite and diopside
Chlorite group	$(Mg,Fe)_{5-6}(Al,Si)_4O_{10}(OH)_8$	Pale to dark green — some well-formed hexagonal plates to 5 mm
Chromite	$FeCr_2O_4$	Black blebs, usually less than 1 mm — found throughout serpentinized ultramafics and in dike rocks
Chrysotile	$Mg_3Si_2O_5(OH)_4$	Main ore constituent, mainly short fiber (6 mm) but long fiber (5 cm) also present — both harsh and soft fiber varieties
Copper	Cu	Flakes to 500μ in albite dike rocks
Clinozoisite*	$Ca_2Al_3Si_3O_{12}(OH)$	Clear prismatic crystals to 1.5 cm
Diaspore	$AlO(OH)$	Lavender-colored masses to 2 cm with good prismatic cleavage — associated with chlorite
Diopside*	$CaMgSi_2O_6$	White, lavender, pale to dark green, prismatic or bladed crystals, sometimes curved
Galena	PbS	Grains to a few mm at serpentine-dike contacts
Grossular*	$Ca_3Al_2(SiO_4)_3$	Colorless, white, pink, orange, green, euhedral crystals to 3 cm
Groutite*	$MnO(OH)$	Black, shiny bundles of fibers to 3 mm long
Heazlewoodite*	Ni_3S_2	Bronze-colored, irregular, deeply striated rhombohedra—often with chromian grossular
Lizardite	$Mg_3Si_2O_5(OH)_4$	White fine-grained coatings and intimately admixed with other serpentine minerals
Manganite*	$MnO(OH)$	Black, shiny, prismatic crystals to 7 mm on vesuvianite
Magnetite	Fe_3O_4	Ubiquitous as small blebs in serpentinized ultramafics, also fibrous to several cm
Maucherite*	$Ni_{11}As_8$	Tin-white, shiny blebs less than 100 μ associated with nickeline.
Molybdenite	MoS_2	Fine-grained masses less than 1 cm on albite.
Muscovite	$KAl_2(AlSi_3)O_{10}(OH)_2$	Common granitic dike mineral — books up to several cm
Nickel-Iron	(Ni,Fe)	Grains and acicular crystals to 100μ in serpentine
Nickeline	$NiAs$	Anhedral, bronze blebs to 250μ with maucherite.
Okenite*	$CaSi_2O_4(OH)_2\cdot H_2O$	White — fine fibers in radiating clusters to 8 mm on wollastonite.
Pectolite*	$Na,Ca_2Si_3O_8(OH)$	White to gray, tabular to fibrous crystals to 2 cm
Prehnite*	$Ca_2Al_2Si_3O_{10}(OH)_2$	Colorless, white, pale yellow, pale green — forming good crystals to a few cm
Pyrochroite*	$Mn(OH)_2$	Orange-yellow scales of a few mm on serpentine.
Pumpellyite*	$Ca_2MgAl_2(SiO_4)(Si_2O_7)(OH)_2\cdot H_2O$	Pale green needles less than 1 cm associated with prehnite on albite.
(Pyroaurite)*	$Mg_6Fe_2(CO_3)(OH)_{16}\cdot 4H_2O$	Clear, pale amber crystals to 300μ on serpentine.
Pyrrhotite	$Fe_{1-x}S$	Brassy blebs less than 1 cm associated with other sulfides in dike rocks.
Quartz	SiO_2	Colorless to white masses and crystals — good crystals to 5 cm are rare.
Schorl	$Na(Fe,Mg)_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$	Black prismatic crystals to a few cm
Thomsonite*	$NaCa_2(Al_5Si_5)O_{20}\cdot 6H_2O$	White, stellate needles of a few mm on pectolite with calcite
Vesuvianite*	$Ca_{10}Mg_2Al_4(SiO_4)_5(Si_2O_7)_2(OH)_4$	Brown to green, bright, shiny, prismatic crystals to 2 cm
Wollastonite*	$CaSiO_3$	White, fine-grained, massive to compact fibrous — fibers several cm long
Xonotlite*	$Ca_6Si_6O_{17}(OH)_2$	White, bladed to fibrous — blades several cm long
Zoisite*	$Ca_2Al_3(Si_3O_{12})(OH)$	Clear, pink elongate plates — prismatic cleavage evident — some radiating groups to several cm

* Further details in the text

***Figure 18.* Gray-white diopside crystals (NMNS #32811). Width of field of view is 1.5 cm.**

***Figure 19.* White thomsonite on pectolite (NMNS #32831). Width of field of view is 1.7 cm.**

Table 2. Chemical analyses of minerals from the Jeffrey mine, Québec.

Mineral	**Grossular**	**Grossular**	**Grossular**		**Diopside**	**Diopside**	**Actinolite**	**Vesuvianite**	**Vesuvianite**	**Zoisite**	**Clinozoisite**
Color	orange	light green	colorless rim	green core	white	green	white	green	brown	pink	gray
NMNS#	32755	30757	40146		32811	32815	40147	32839	36884	37969	30414
SiO_2	39.29	39.25	39.49	37.80	54.05	51.32	53.32	36.00	37.90	40.29	40.65
TiO_2	.05	.25	.06	1.20	.05	.04	.04	.06	—	—	—
Al_2O_3	22.17	21.70	21.69	17.04	.81	.27	.89	17.78	17.56	31.21	31.27
Cr_2O_3	.01	.22	.00	6.97	.00	.00	—	.00	—	—	—
Fe_2O_3	—	—	—	—	—	—	1.19	—	—	—	—
FeO*	1.85	2.02	.47	.94	9.03	15.01	17.00	.86	3.24	1.47	1.54
MnO	.57	.43	.31	.77	.83	1.08	.37	.57	.06	.05	.04
MgO	.00	.00	.00	.03	11.32	7.91	12.01	2.46	1.62	.04	.01
CaO	36.84	36.81	37.74	35.88	24.28	24.04	11.97	36.58	35.96	24.01	24.57
Na_2O	—	—	.00	.01	.30	.17	.09	—	—	—	—
K_2O	—	—	—	—	—	—	.10	—	—	—	—
H_2O	.00 **	—	—	—	—	—	2.18	2.69	1.87	—	—
Total	100.78	100.68	99.76	100.64	100.67	99.84	99.16	97.00	98.21	97.07	98.08

* Total iron given as FeO except for actinolite analysis.

** Thermogravimetric analysis.

Actinolite analysis by X-ray fluoresence (H_2O and Fe_2O_3 excepted).

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Figure 20. White spheres of okenite on pale brown wollastonite (NMNS #32041). Width of field of view is 1.4 cm.

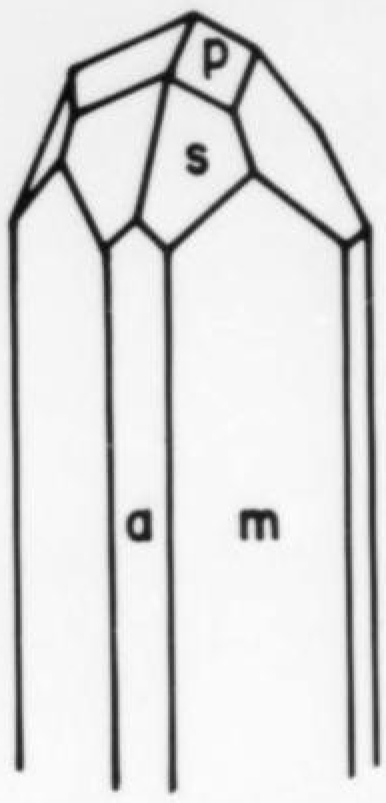

Figure 21. Sketch of a vesuvianite crystal. Crystal forms are: tetragonal prisms *a*{100} and *m*{110}, tetragonal dipyramid *p*{111} and ditetragonal dipyramid *s*{311}.

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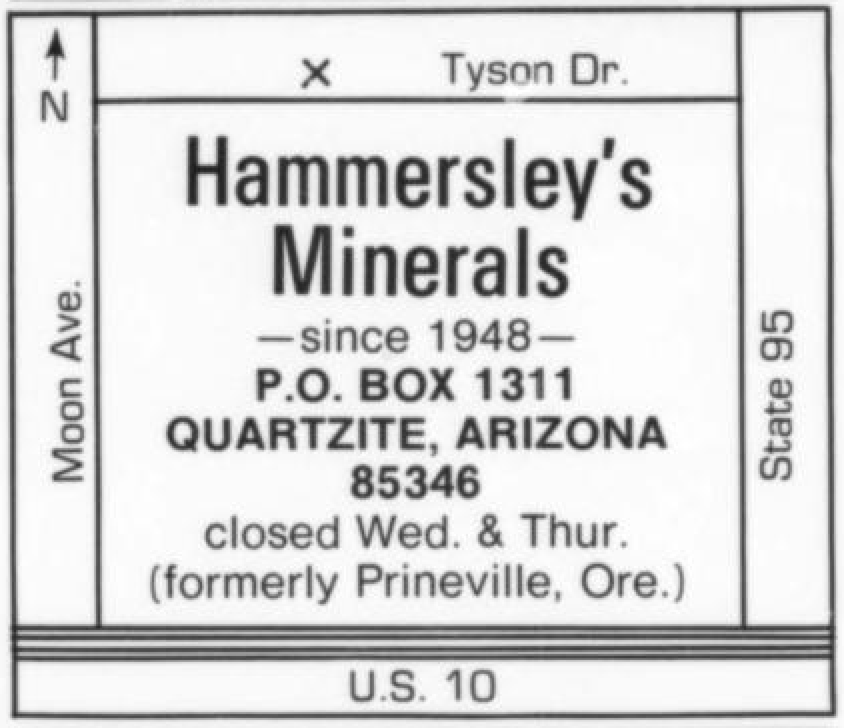

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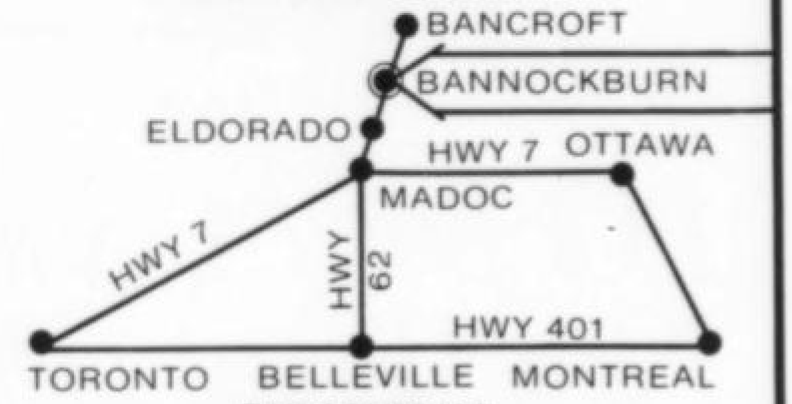

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Minerals of the ALPINE RODINGITES of Italy

by **Carlo M. Gramaccioli**
via Porpora 125
I-20131 Milan, Italy

Since the early years of mineralogy, the beautiful minerals of the Ala-Tal (Ala Valley) have been well known to scientists and collectors. This valley, approximately 50 km northwest of Torino, Italy, is accessible by a comfortable highway which passes through the little towns of Lanzo Torinese and Ceres, then ascends to about 1800 m (5850 feet) above sea level where it reaches the famous Mussa Alp and the Piano (plane) della Mussa, a long-time hiking and vacation favorite of the mountain-loving citizens of Torino.

From the Piano della Mussa and its neighboring areas (Giasset, Testa Ciarva, Roch Neir, Rocca Tova and others) come the majority of minerals from the Ala-Tal, among them splendid grossular of the *hessonite* variety in various colors, particularly the characteristic orange red. Also in great demand are the exceedingly transparent, light green *alaite* variety of diopside; olive-green, well-crystallized vesuvianite; epidote in yellow-green and commonly translucent crystals; the andradite variety *topazolite* from Roch Neir; apatite in clear, colorless, complex tabular crystals; pale green or yellow titanite; perovskite in large, splendid, cubic crystals (the finest specimens ever found were collected just recently); prehnite, and many more. All of these minerals are associated with clinochlore, which often forms fine pseudohexagonal crystals and vermiform aggregates.

The classical localities of the Piano della Mussa are off-limits to the public today, but many similar localities have since been discovered in the Ala-Tal itself (Becci della Corbassere, Borne del Brous, Laghi Verdi and others) as well as in other valleys relatively far from the Ala-Tal. They are all in the rodingite zone; rodingite is a relatively common rock which occurs with serpentine along a characteristic arc in the southern region of the Alps. Particularly pure varieties of rodingite occur in the westernmost regions of the Italian spur, such as Piemonte and Liguria. This rodingite arc follows the spread of greenstone

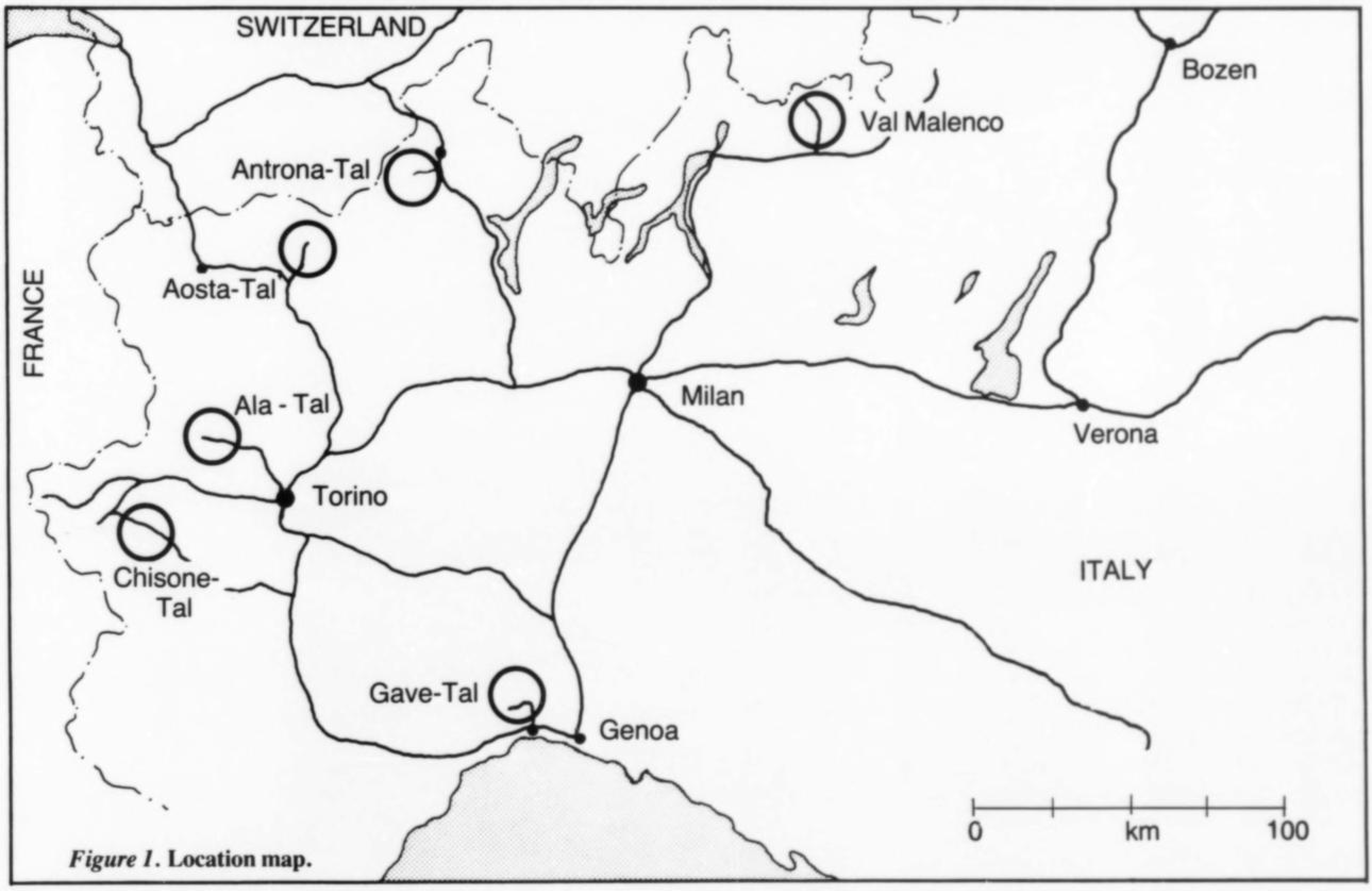

Figure 1. **Location map.**

containing calcareous schist, a formation familiar to anyone involved in Alpine geology. Though at present unknown to many collectors, numerous new localities are yielding specimens which rival the beauty of the classics from the Piano della Mussa. Some of these recent discoveries have associations similar to the earlier-known localities, some have very different associations, but each association is characteristic of the particular locality.

Following are descriptions of some of the best known new localities and their most outstanding minerals. The same species occur at many localities, differing at each locality in their abundance, appearance and occasionally their crystal forms.

Liguria

A region not lacking spectacular discoveries is Liguria. Geographically, Liguria is part of the Apennines and is not actually Alpine; geologically, however, it is obviously Alpine. The area is north of Arenzano and Cogolato and includes the famous Gave-Tal. Other areas of lesser importance include the area around Piampalude up the way from Urbe, and several others.

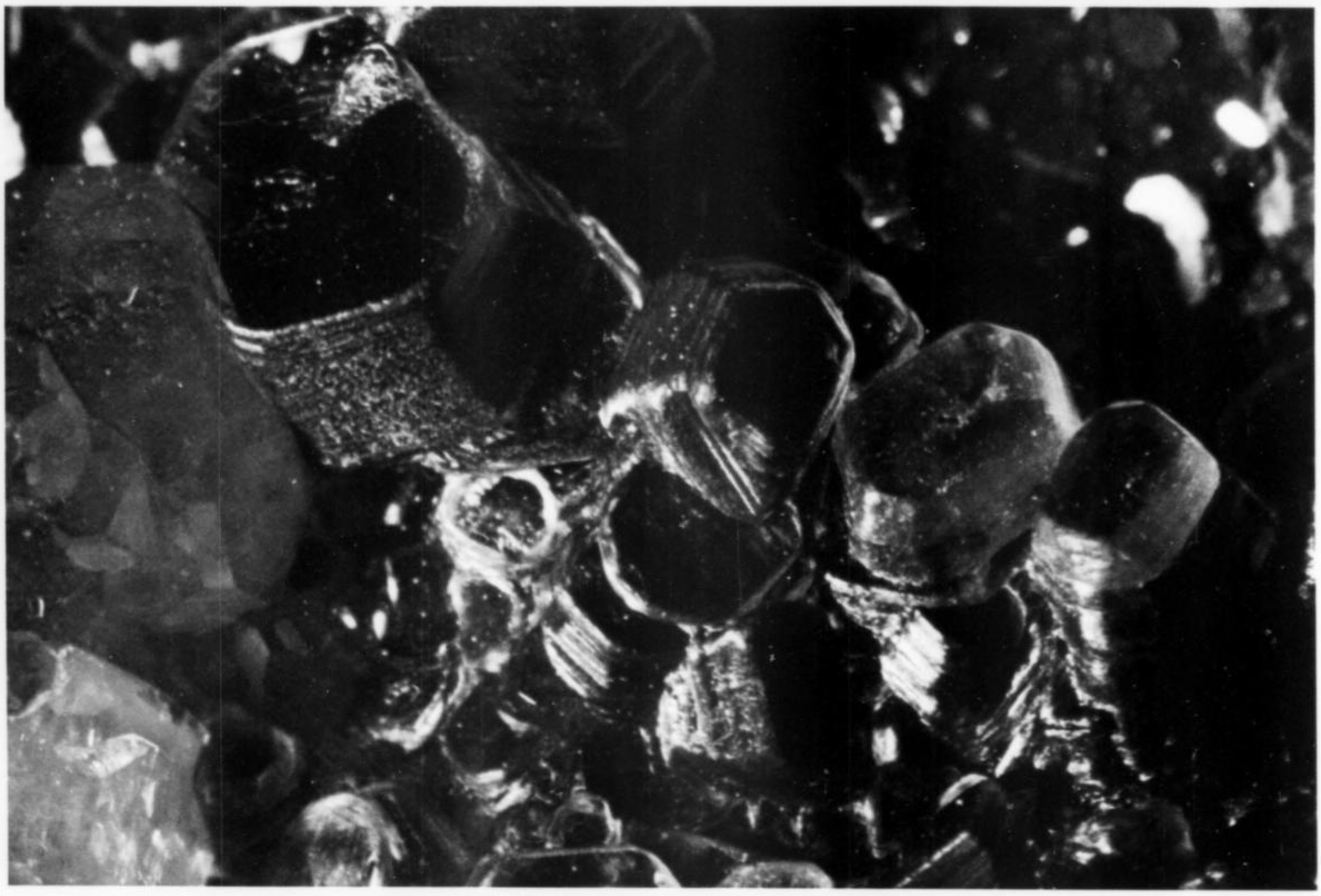

Figure 2. **Clinochlore crystals with orange grossular from Susa-Tal, Piemonte.**

Hessonite (grossular) has long been known from this region, especially from the Gave-Tal. It occurs as shiny, dark red, usually dodecahedral crystals darker in color than those from the Ala-Tal. Even darker varieties were discovered 10 years ago at the Faiallo Pass. The garnets of the area show cubic faces, sometimes to the exclusion of other forms, and also tetrahedron faces, both rare for garnets. Very fine vesuvianite crystals have also been found here, elongated, brown, very lustrous, commonly doubly terminated crystals to 4 cm in length, usually without matrix. Also noteworthy are the titanite crystals from the Gave-Tal, found in long, translucent, red, white or yellow-green crystals to 5 or 6 cm. Characteristic of the area is a yellowish variety of talc, known locally as *gavite*, which often encrusts the other minerals. In the Sansobbia-Tal above Albisola, bluish veins of rare corundum have been found.

Piemonte

The Ala-Tal and particularly the Susa-Tal in Piemonte have produced a number of discoveries. The area is not far from Avigliano (for example, Comba Robert and Sant' Ambrogio). Most interesting is the excellent vesuvianite found there. Lately Condove has yielded outstanding crystals of garnet, diopside and vesuvianite rivalling for clarity and beauty any ever found in the Piano della Mussa. Other promising areas are in the Chisone-Tal but news of these is, as yet, sparse. Antronapiano in the Valle d'Antrona is a well-known locality easily reached by a comfortable road from Domodossola. Beautiful epidote is found there, perhaps the finest of its kind from this type of environment. The crystals are a relatively transparent yellow-green, very lustrous and stout, commonly measuring several centimeters in length. Other localities for fine epidote are in the vicinity of Premosello where splendid red garnets are found in association.

Valle d' Aosta

The area near St. Vincent in the Valle d'Aosta (Ussel, Bellecombe, Montjovet) is the most productive area in the valley. Here the vesuvianite is truly extraordinary: dark, lustrous, stout crystals commonly of remarkable size. Many different shades of brown and green are found, the tabular, emerald-green crystals (perhaps containing chromium) being the most exceptional. A few very fine titanite

Figure 3. **Perovskite crystal on white diopside from Rocca Castellaccio, Lombardy.**

crystals have also been found in this area. The reddish, tabular, complex crystals occur up to 3 cm in size. Some of the less common minerals of the region include diopside in gray, acicular crystals; rare, tiny, emerald-green crystals of chromium-containing garnet; and pectolite in clusters of acicular crystals. Other promising areas in the Valle d'Aosta are around Monte Rosso di Verra in the upper Tal d'Ayas, above Champloluc. Yellow, red and orange garnet and epidote crystals resembling those from the Valle d'Antrona are found here, as well as less common minerals such as whitish titanite crystals.

Lombardy

Excellent examples of garnet, diopside and vesuvianite occur in the rodingites of Lombardy, particularly at Val Malenco (see also the article on mineral collecting in Val Malenco by Bedogne and Pagano in the *Record,* vol. 3, p. 120). The area of Pizzo Tre Mogge (2900 m above sea level) has also long been known for colorful minerals. But, for the lover of more interesting and unusual species, Corna Rossa may be the most profitable area. Corna Rossa is near Desio-Hütte on the road leading to the summit of Monte Disgrazia. Because of the effort required to reach this locality, not too many dig here, thus the chances of finding interesting material are still good. Possibilities include magnetite is exceedingly sharp, complex crystals; very dark garnet resembling magnetite; good crystals of apatite, and other more or less common species. The crystals from this area are small but remarkable for their excellent crystallization and brilliant luster. The beginning of the path ascending from Ciappanico up to Desio-Hütte in the Malenco Valley is close to Rocca Castellaccio. Rodingite boulders very rich in titanium occur here, containing such minerals as black or dark cherry-red andradite crystals; brown, very lustrous perovskite crystals to 1 cm; rare vesuvianite, titanite and epidote; and an odd, pure-white variety of diopside. At Pizzo (peak) Ventina, the peak of Monte Disgrazia, rodingite is also present, containing reddish garnet and gray-green vesuvianite crystals. An interesting occurrence here is scapolite, which also shows up at other locations on the Monte Forno in association with garnet and epidote among others. Also noteworthy from this area are natrolite and rhombohedral chabazite crystals. An unusually light colored rodingite occurs in the vicinity of Franscia, commonly containing colorless grossular and nearly white chlorite.

South Tyrol

Rodingites also occur in South Tyrol. The locality near the old Sterzinger Hutte at the Wildkreuzjoch in the Pfitschertal is probably the best known among local collectors. Here have been found numerous specimens of brown and green vesuvianite, dark and lustrous garnet, diopside, magnetite, perovskite, chlorite, titanite and zircon. Unfortunately the zircon from this locality, known since 1845, is found only rarely today, and then only in millimeter-size crystals. The zircon is lustrous, transparent and colorless, but pink to fire-red crystals also occur. The color fades on exposure to light, but returns in the darkness. Zircon is exceedingly rare in rodingites but is known from localities in Austria (Stubachtal, Kraubath, etc.), Switzerland (Zermatt), Val Malenco (Corna Rossa) and in Val d'Ossola (Antronapiana), as well as Pfitschertal.

This article originally appeared in German in *Lapis* magazine and is reprinted here with the permission of the publisher. English translation by Al Falster.

Figure 4. **Vesuvianite crystals from Montjovet, Valle d'Aosta.**

Table 1. Minerals of the Alpine Rodingites in Piemonte and Liguria, Western Italian Alps

Species	Description	Abundance	Locality
Albite	Occurrence uncertain	**rare**	
Allanite	Brown, tabular crystals	**very rare**	Viù-Tal
Andradite	Yellow (*topazolite*), black (*melanite*) and hydrated varieties	**common**	Ala-Tal and Val Malenco
Apatite	Very lustrous, colorless, tabular crystals	**uncommon**	Ala-Tal, Val Malenco and St. Vincent
Calcite and Aragonite	Common as crusts	**common**	
Chabazite	White, rhombohedral	**very rare**	Val Malenco
Chalcocite (or digenite?)	Gray crystals with minor bluish surface alteration	**very rare**	Ala-Tal
Chlorite	Greenish tabular crystals, also nearly white, also in vermiform aggregates	**common**	ubiquitous
Clinozoisite	Pink to pinkish yellow	**rare**	Ala-Tal
Corundum	Bluish veins	**very rare**	Sansobbia-Tal
Diopside	White to greenish prismatic crystals	**common**	ubiquitous
Dysanalite (niobian perovskite)	Nearly black, containing rare-earth elements	**very rare**	Ala-Tal
Epidote	Yellow to green, commonly sharp and lustrous	**common**	Antronapiano, Monte Rosso di Verra, etc.
Grossular	Several color varieties	**common**	ubiquitous
Natrolite	White radiating clusters	**very rare**	Val Malenco
Pectolite	Radiating white bundles	**very rare**	Bellecombe, St. Vincent
Perovskite	Lustrous, brown to very dark, usually well-developed cubes	**rare**	Ala-Tal and Val Malenco
Prehnite	Greenish crystals	**rare**	Ala-Tal
Scapolite	White crystals and groups	**rare**	Val Malenco
Talc	Greenish (*gavite*) or in white, tabular crystals closely resembling chlorite	**rare**	Gave-Tal and Val Malenco
Titanite	Tabular, pink, greenish or whitish	**common**	St. Vincent, Gave-Tal, and others
Uvarovite	Tiny crystals commonly with chrome-diopside	**very rare**	Montjovet
Vesuvianite	Green to brown, stout to elongate	**common**	Faiallo, Condove, Ala-Tal and Susa-Tal
Wollastonite	Radiating white aggregates	**rare**	Val Malenco
Zircon	Lustrous, colorless to pink and red, small	**very rare**	Pfitschertal, Antrona Val Malenco
Zoisite	Yellowish crystals, pink variety "thulite"	**rare**	Val Malenco

Figure 5. **Apatite crystals from Susa-Tal.**

Figure 6. **Diopside crystals from Ala-Tal, Piemonte.**

Figure 7. **Grossular crystals from Bellecombe-St. Vincent, Valle d'Aosta.**

Figure 8. **Grossular, Campo Franscia very pale**


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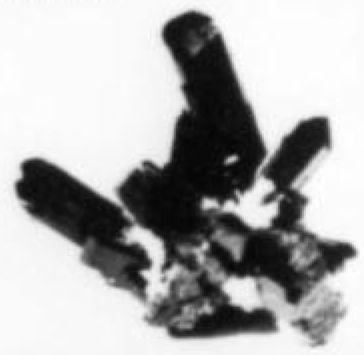

Photographic Record

Minerals of Laacher See

by **Harald Esser**
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4000 Düsseldorf
West Germany

The July-August, 1977, issue of the *Record* carried an article by Gerhard Hentschel, *Selected minerals from the volcanic district of Laacher See, Germany*. Laacher See is a world-famous micromount locality and Dr. Hentschel's article, illustrated by 82 crystal drawings, provides micromounters with an excellent reference. Lacking, however, were photographs. Presented here as a supplement to Dr. Hentschel's article are 25 photographs of minerals from the Laacher See volcanic region.

For these photographs I used a Nikon EL camera with bellows and a Zeiss Luminar 25 mm macro lens. Lighting was provided by a halogen spotlight, softened by diffusers, and, where necessary, a fiber-optic light source. Some of the photos were originally taken in color on Agfachrome 50 L, others were taken with Agfapan 25 black and white film.

Figure 1. (above) **Topaz spray about 2 mm long from the Bellerberg quarry (see the map in the article by Hentschel, vol.8, no.4, p.314, for specific locations in the Laacher See area). Collection of B. Ternes.**

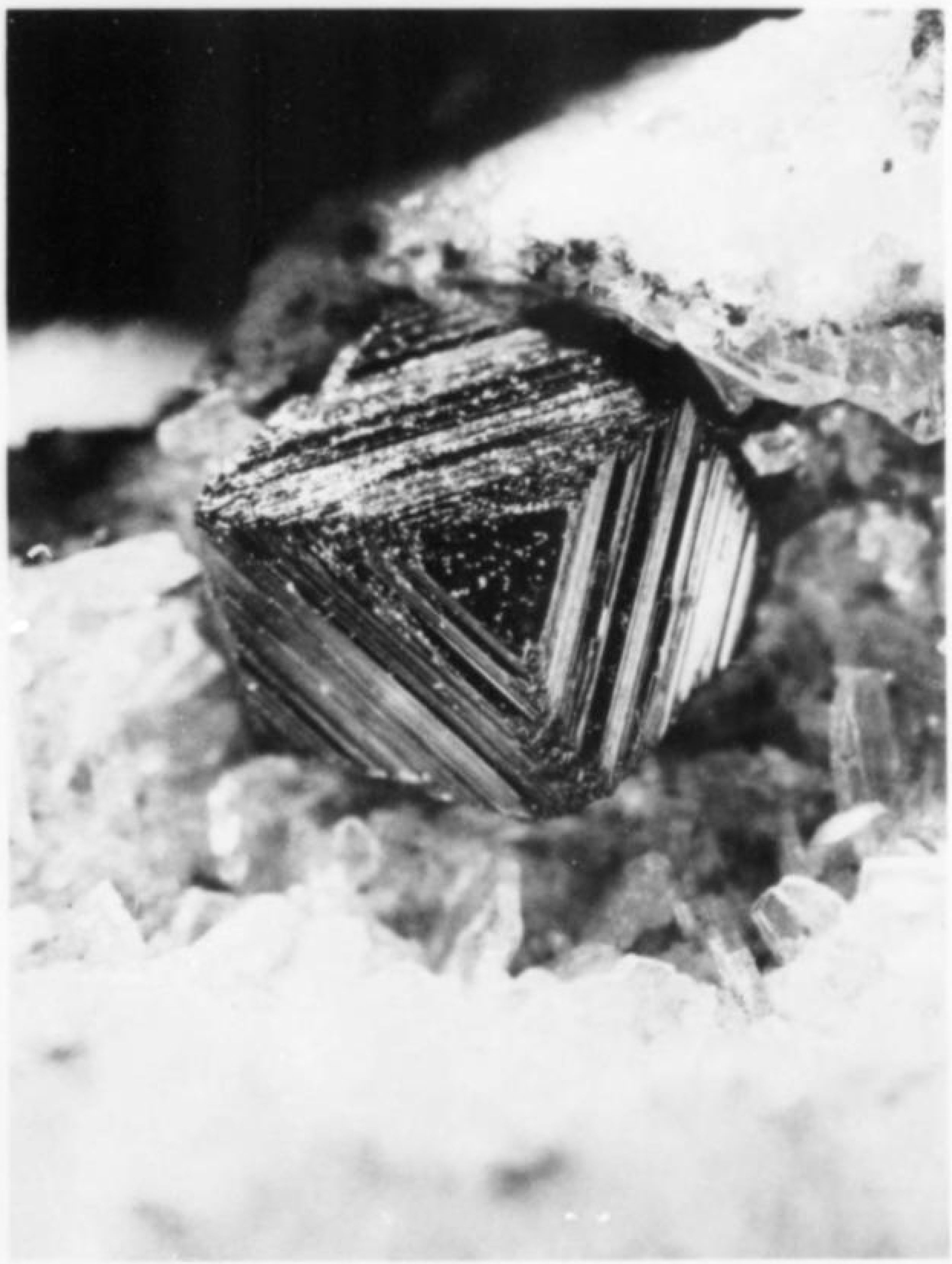


Figure 2. (right) **Magnetite crystal about 4 mm across from near Mayen. Collection of B. Ternes.**

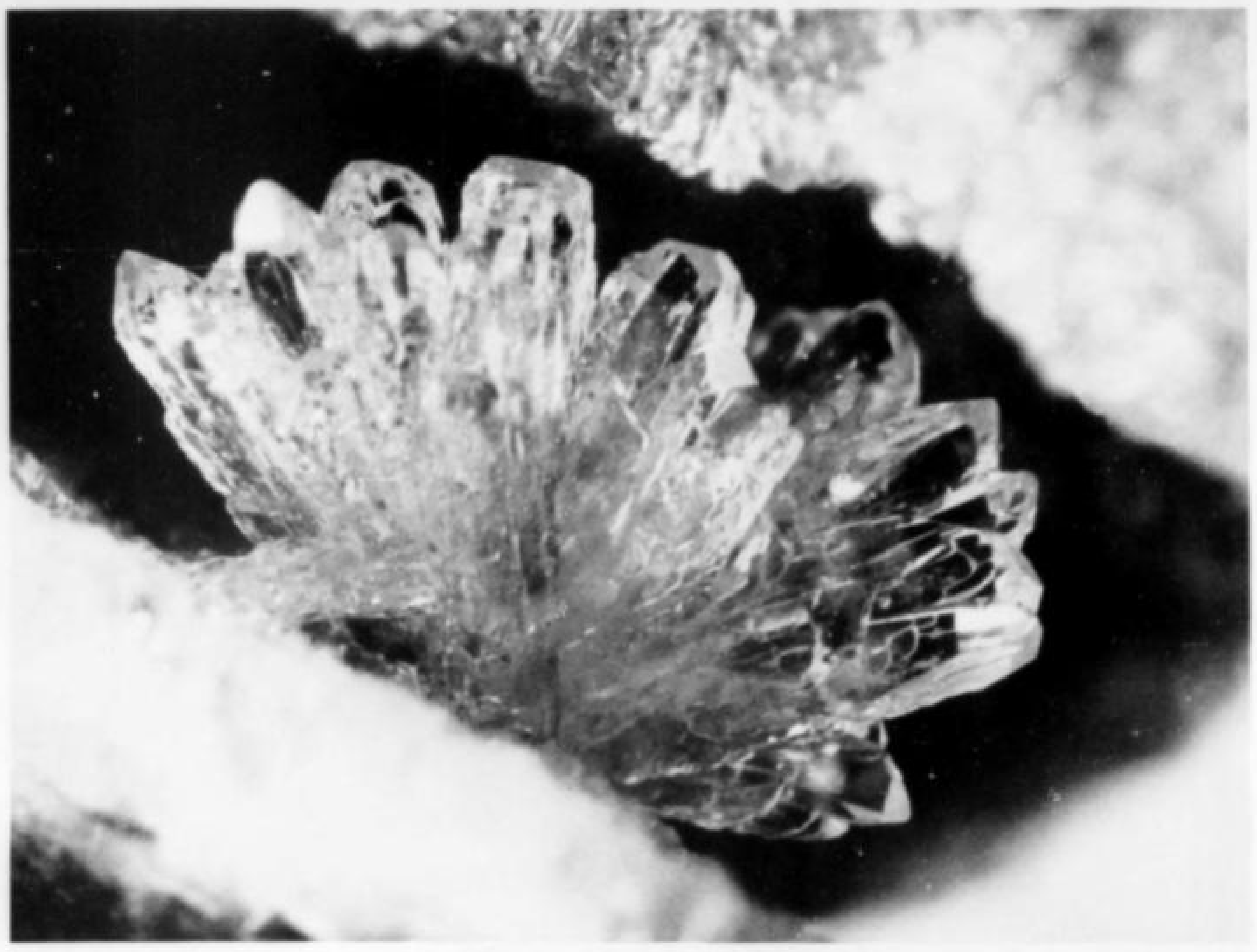


Figure 4. (above) **Brenkite crystal group about 4 mm across from the Schellkopf quarry. Collection of B. Ternes.**

Figure 3. (above left) **Calcite crystals about 4 mm long from the Schellkopf quarry. Collection of Harald Esser.**

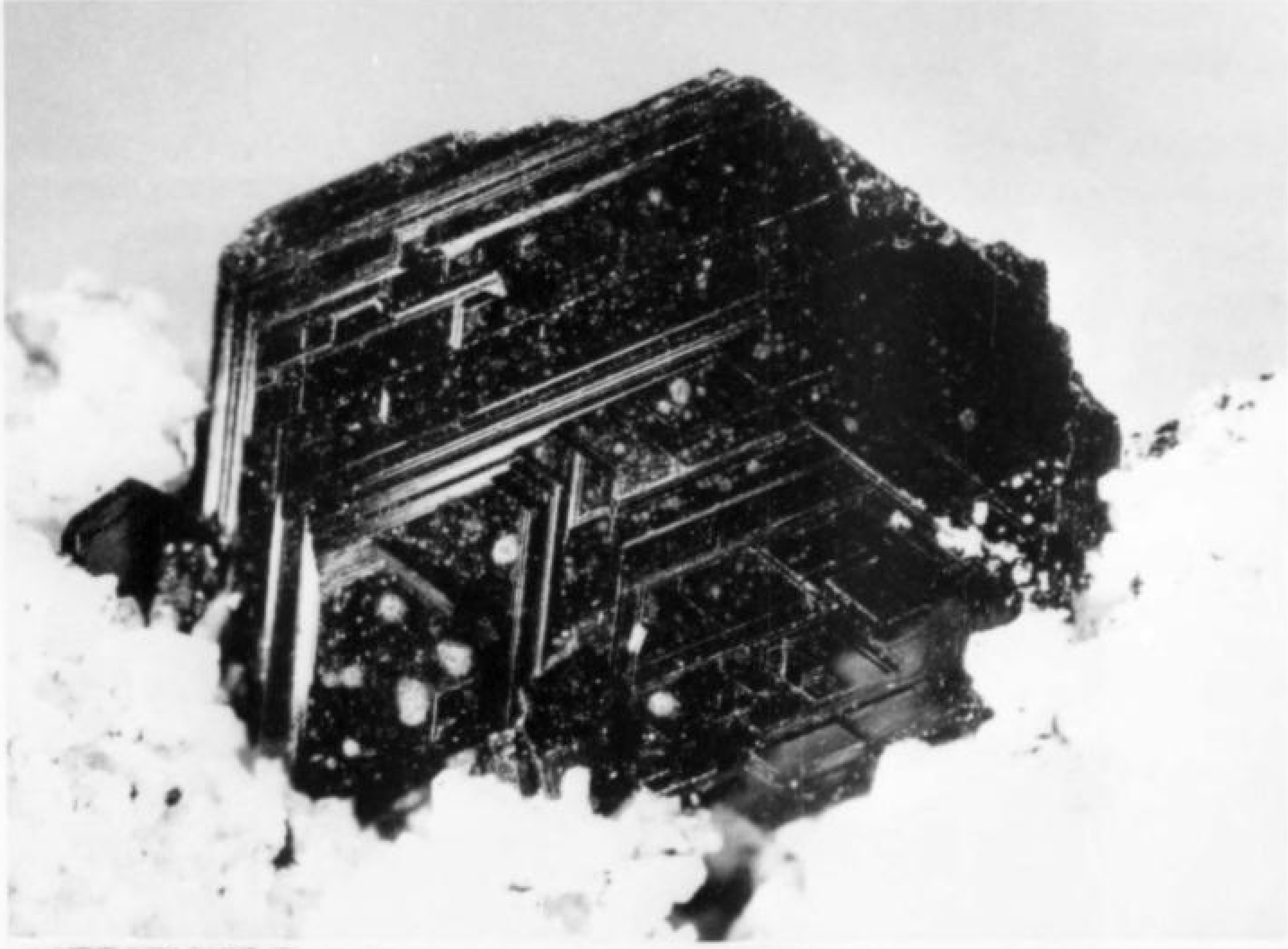
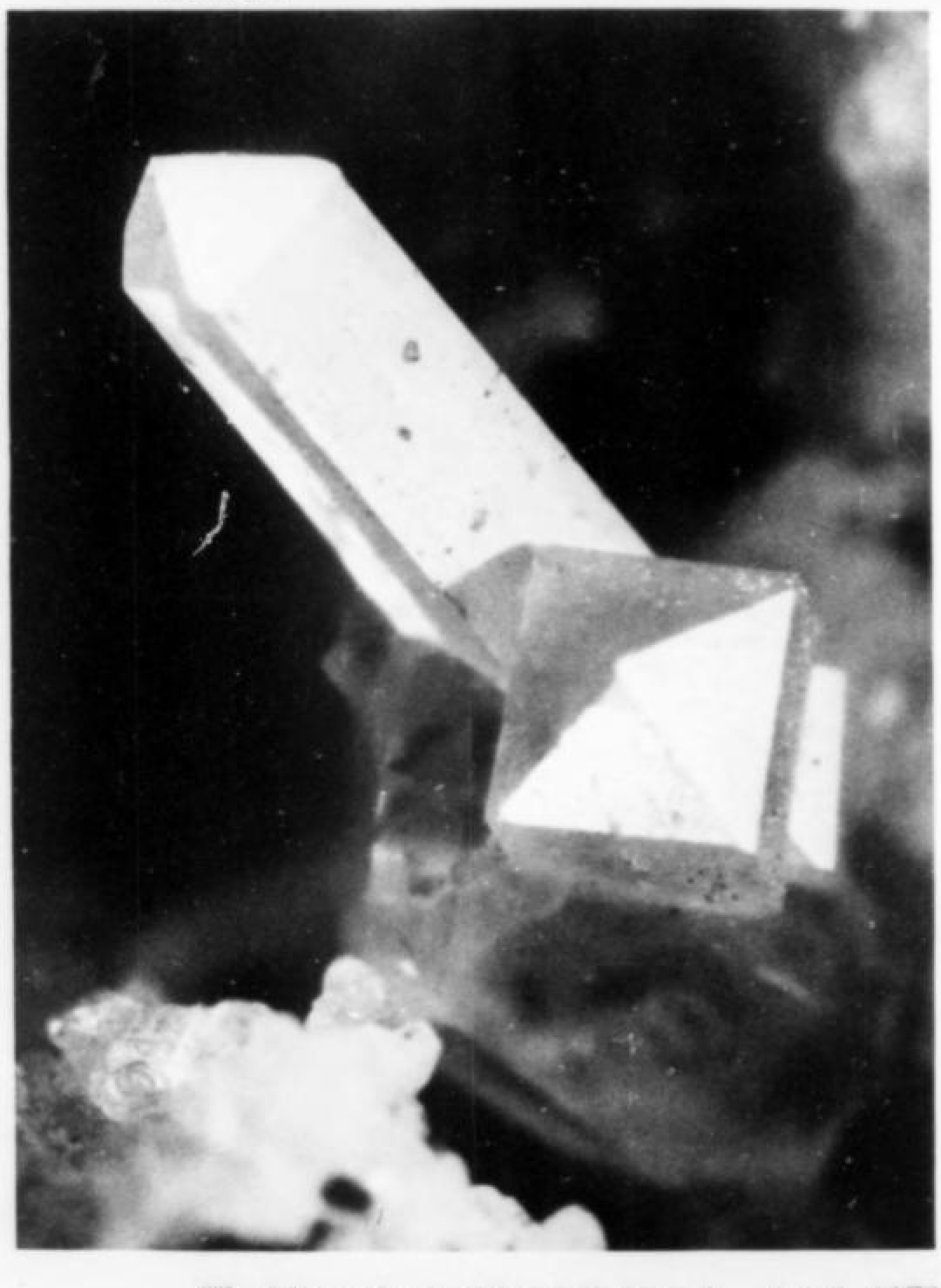
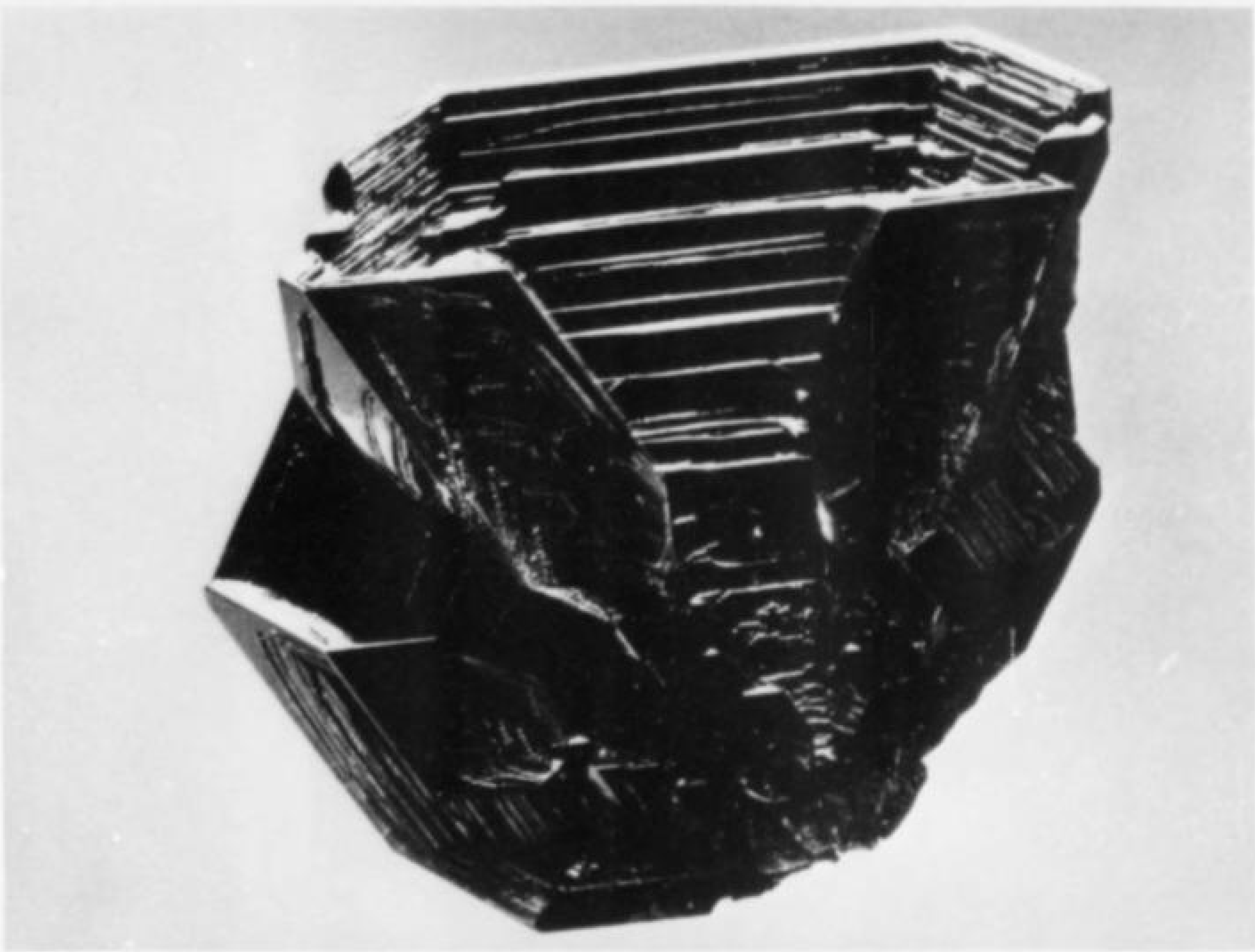


Figure 5. (left) **Biotite crystal about 5 mm across from near Mendig. Collection of H. Speis.**

Figure 6. (below left) **Arborescent perovskite group about 1 mm tall from the Hannebacher Ley quarry. Collection of Harald Esser.**

Figure 7. (below) **Zircon crystals about 2 mm long from near Mendig. Collection of B. Ternes.**





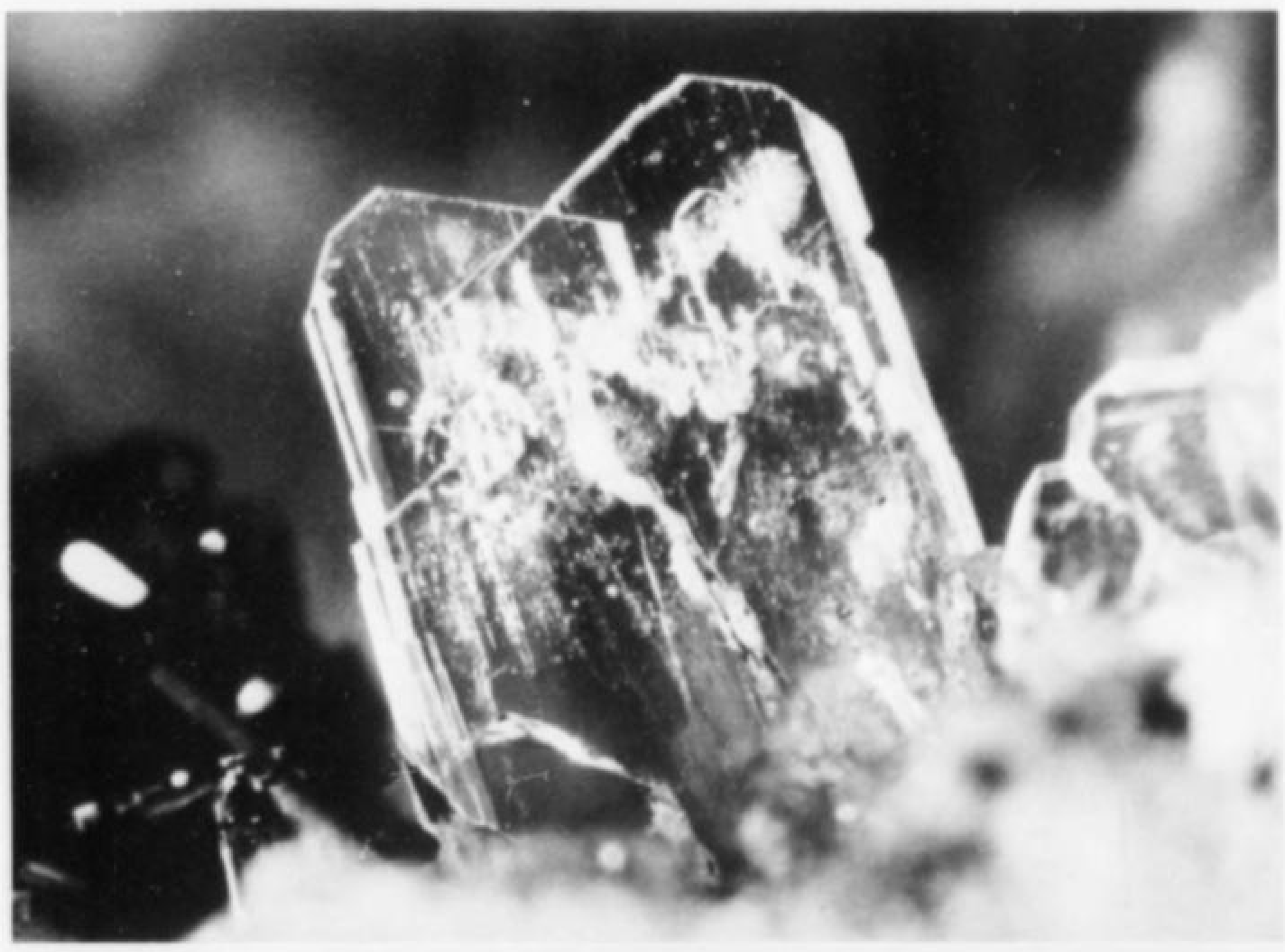


Figure 8. (above) **Hematite crystal 2 mm tall from the Bellerberg quarry. Collection of B. Ternes.**

Figure 9. (above right) **Hematite crystal about 9 mm across from near Nickenich. Collection of J. Brzezicha.**

Figure 10. (right) **Sanidine crystals, twinned, about 1 mm tall, from near Mendig. Collection of Harald Esser.**

Figure 11. (below right) **Titanite crystal about 2mm tall from Gleeser Felder. Collection of Harald Esser.**

Figure 12. (below) **Cristobalite crystal about 1 mm across from the Bellerberg quarry. Collection of Rothkegel.**

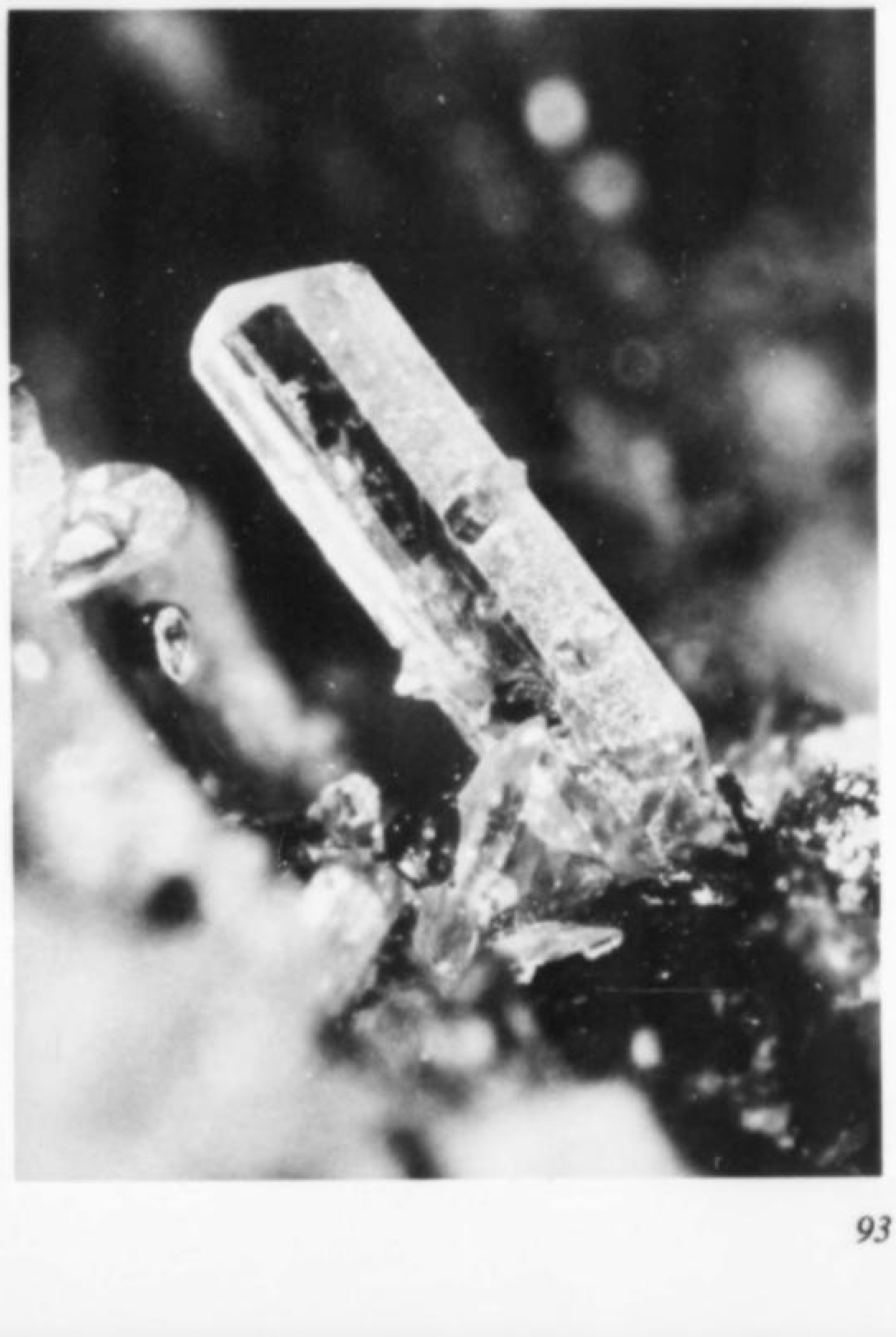


Figure 13. (above left) **Roedderite crystals about 1 mm long from the Bellerberg quarry. Collection of B. Ternes.**

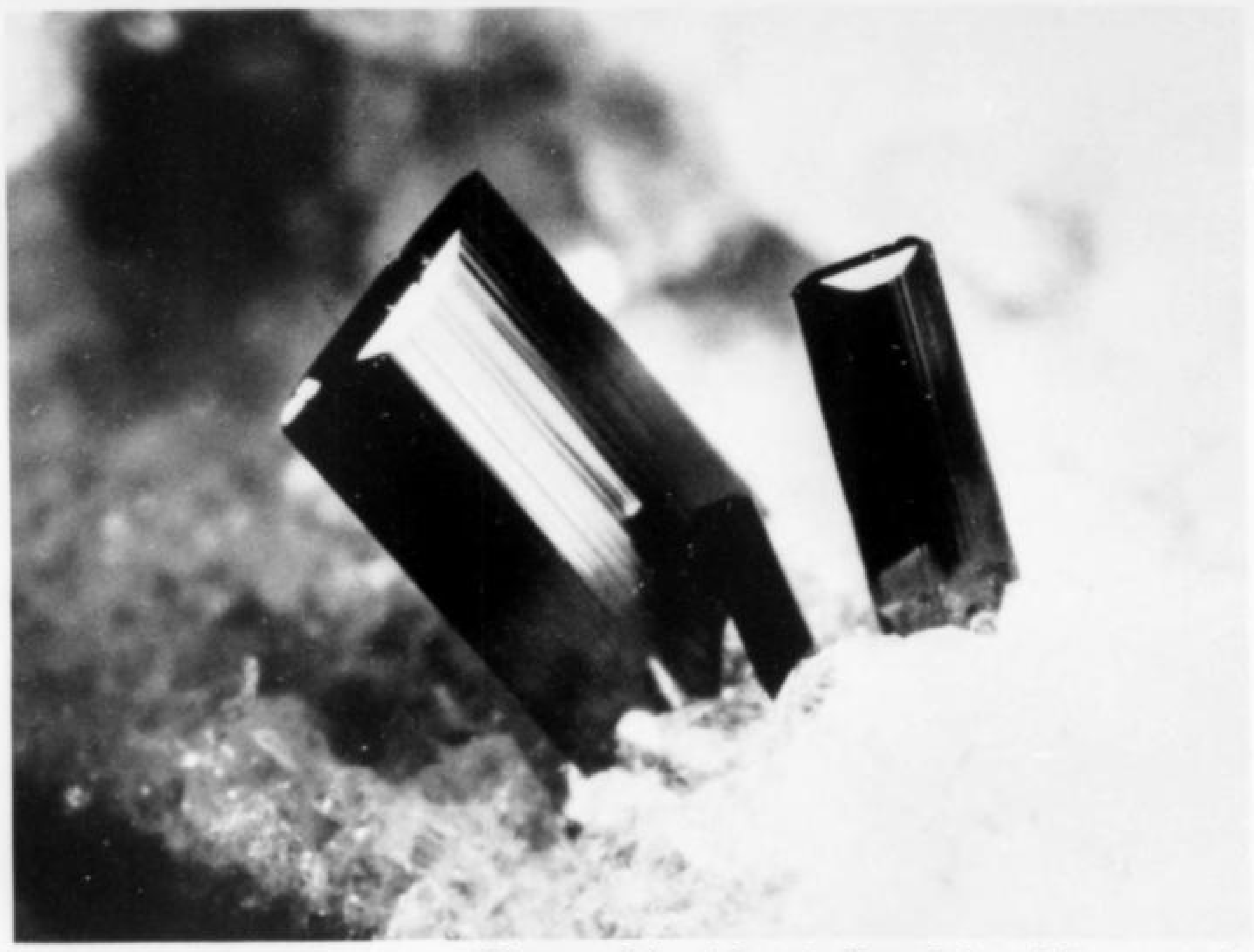


Figure 14. (above) **Pseudobrookite crystals about 1 mm tall from near Nickenich. Collection of B. Ternes.**

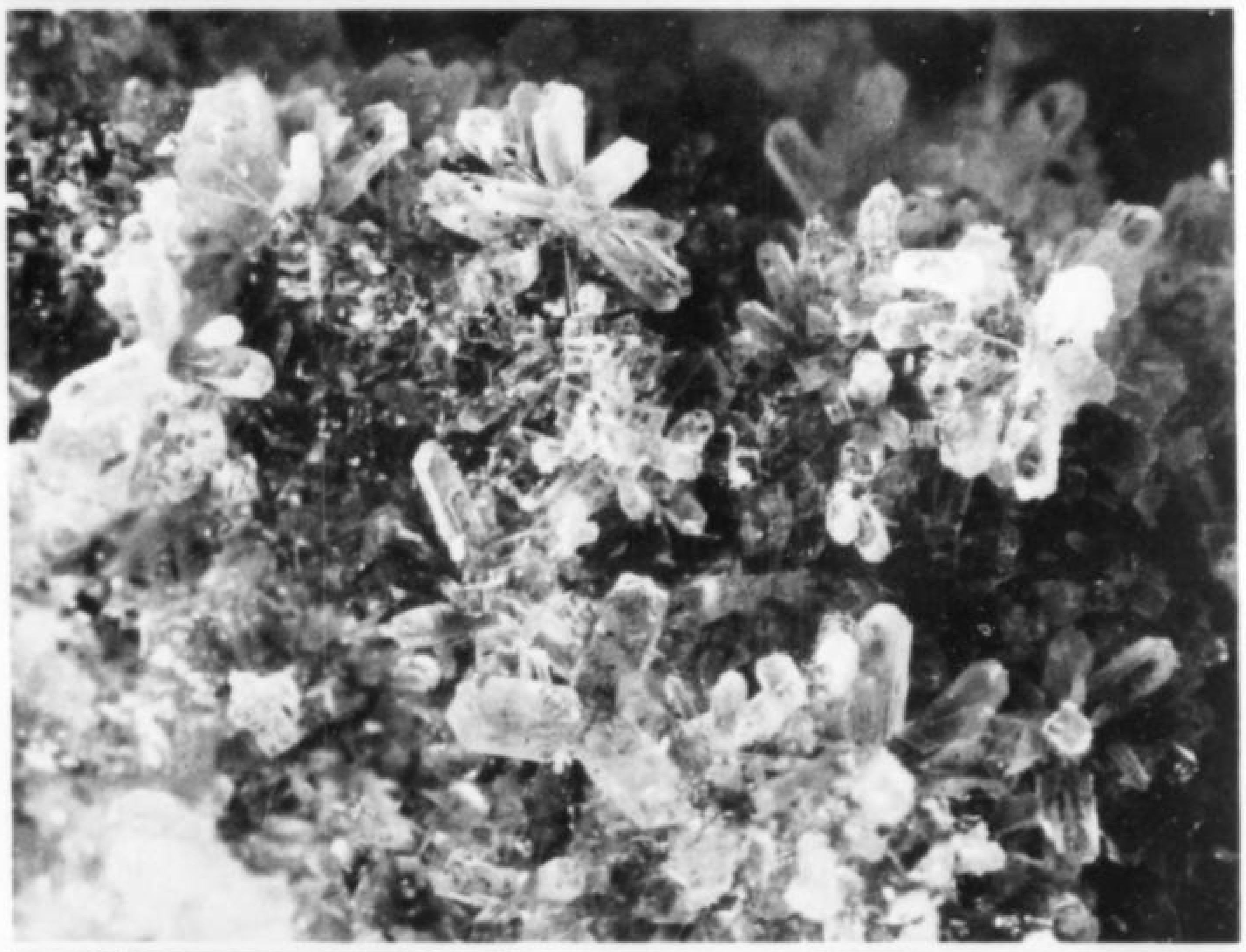


Figure 15. (left) **Phillipsite crystals, some twinned, about 0.5 mm each, from the Schellkopf quarry. Collection of Harald Esser.**

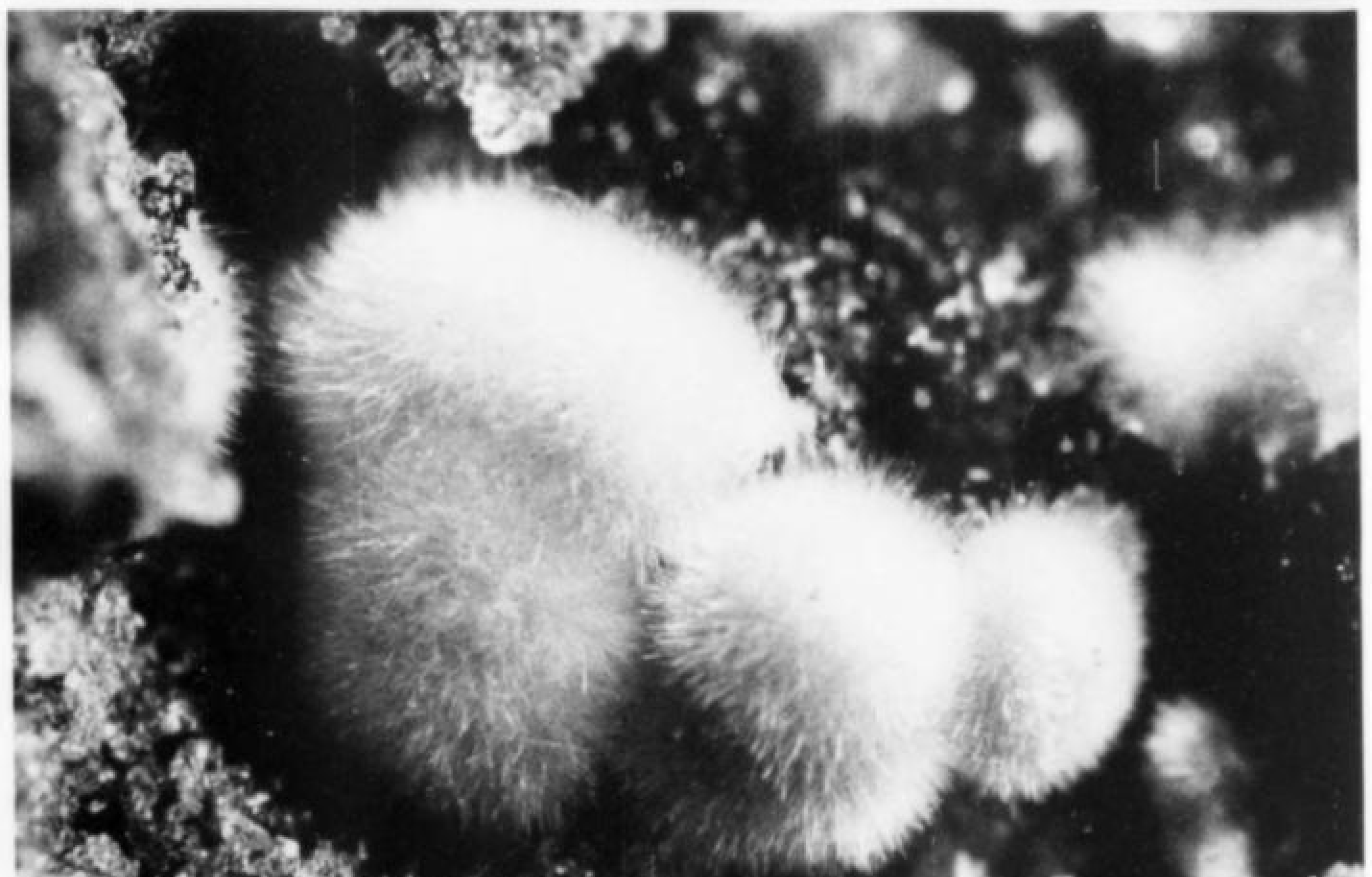


Figure 16. (below left) **Mullite tufts about 3 mm across from the Sattelberg quarry. Collection of B. Ternes.**

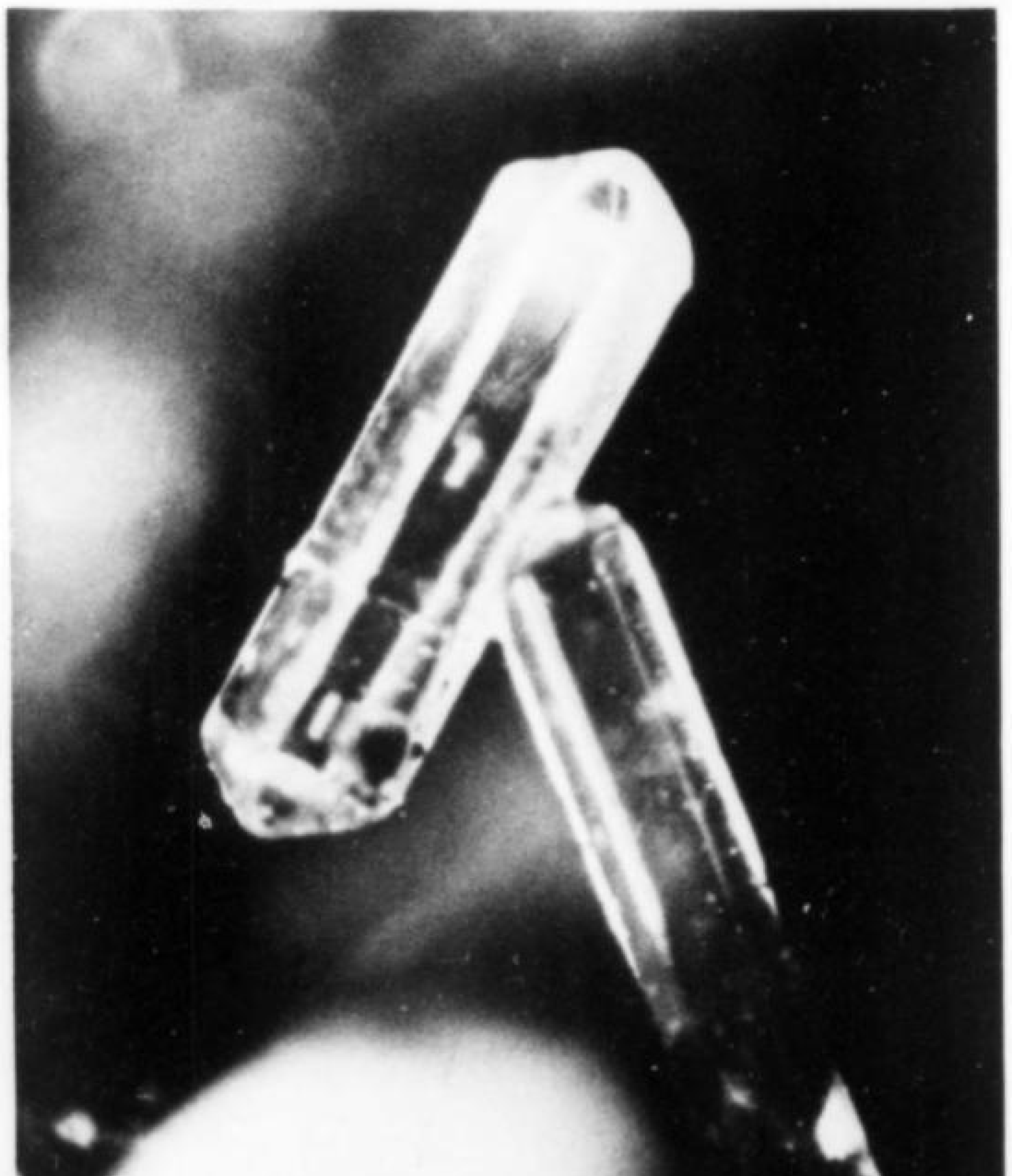


Figure 17. (below) **Apatite crystals about 1 mm long from near Mendig. Collection of Harald Esser.**

Figure 18. (above) **Quartz crystal about 2 mm long from the Bellerberg quarry. Collection of Harald Esser.**

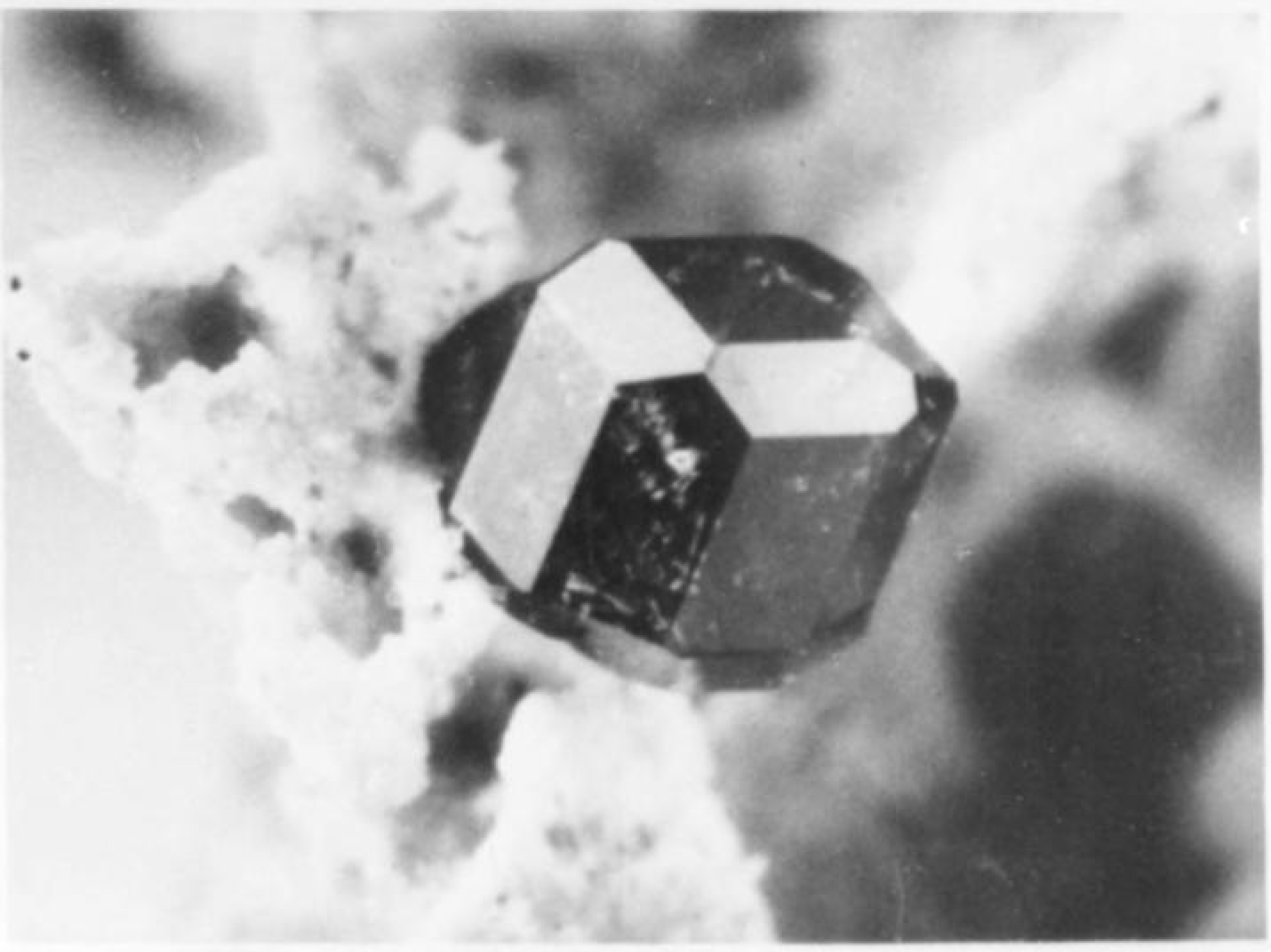


Figure 19. (above right) **Garnet crystal about 1 mm across from the Bellerberg quarry. Collection of B. Ternes.**

Figure 20. (right) **Aragonite sprays about 3 mm across from near Nickenich. Collection of Harald Esser.**

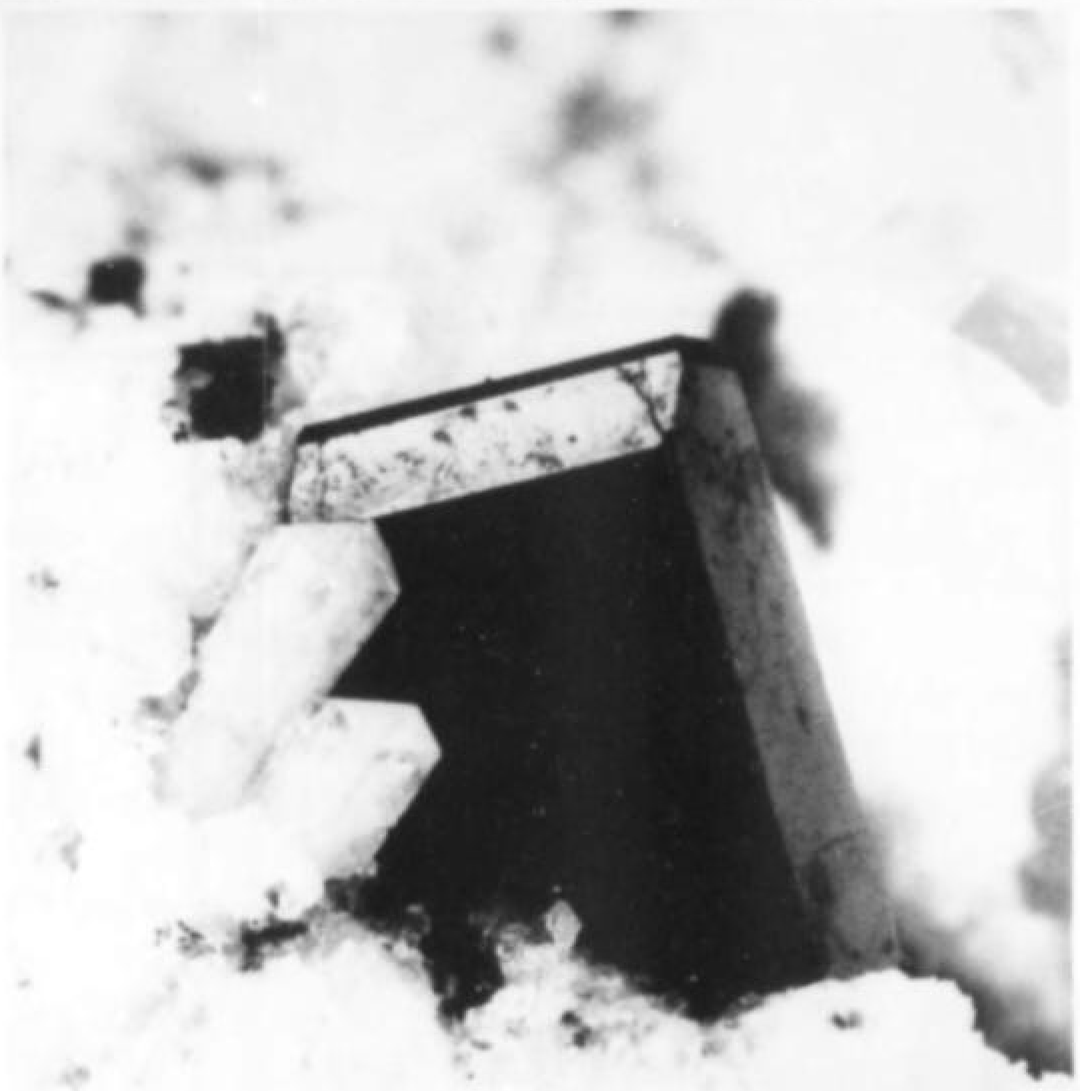


Figure 21. (below right) **Black allanite crystal about 2 mm tall with white zircon crystals from near Mendig. Collection of B. Ternes.**

Figure 22. (below) **White gonnardite spheres about 3 mm across on phillipsite from the Schellkopf quarry. Collection of B. Ternes.**

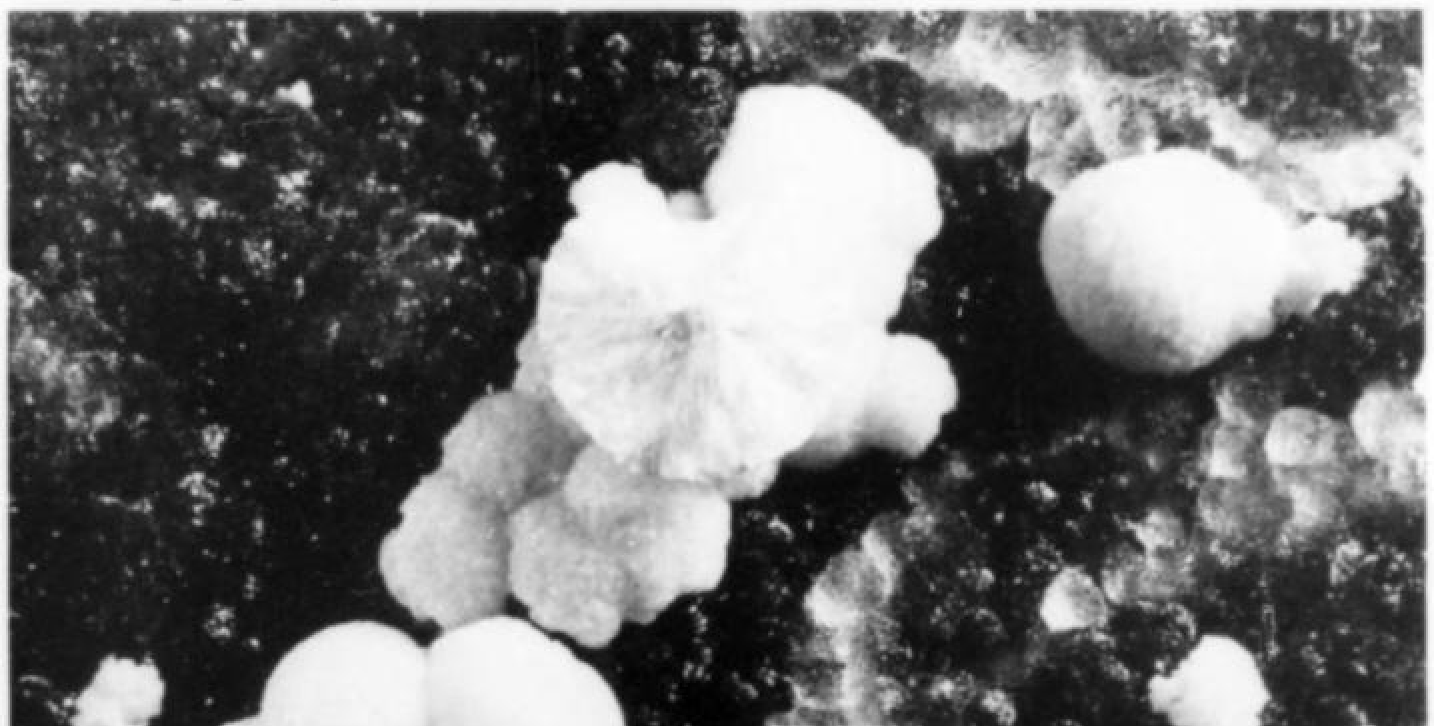


Figure 23. *(left)* **Ettringite crystal about 4 mm tall from the Bellerberg quarry. Collection of B. Ternes.**

Figure 24. *(above)* **Ettringite crystals about 1 mm across from the Schellkopf quarry. Collection of Harald Esser.**

Figure 25. *(left)* **Ettringite crystals to about 2 mm in size from the Schellkopf quarry. Collection of B. Ternes.**

Mineralogical Notes

ORIENTED OVERGROWTHS OF LABUNTSOVITE ON ELPIDITE FROM MONT. ST. HILAIRE, QUEBEC, CANADA

by William A. Henderson, Jr.
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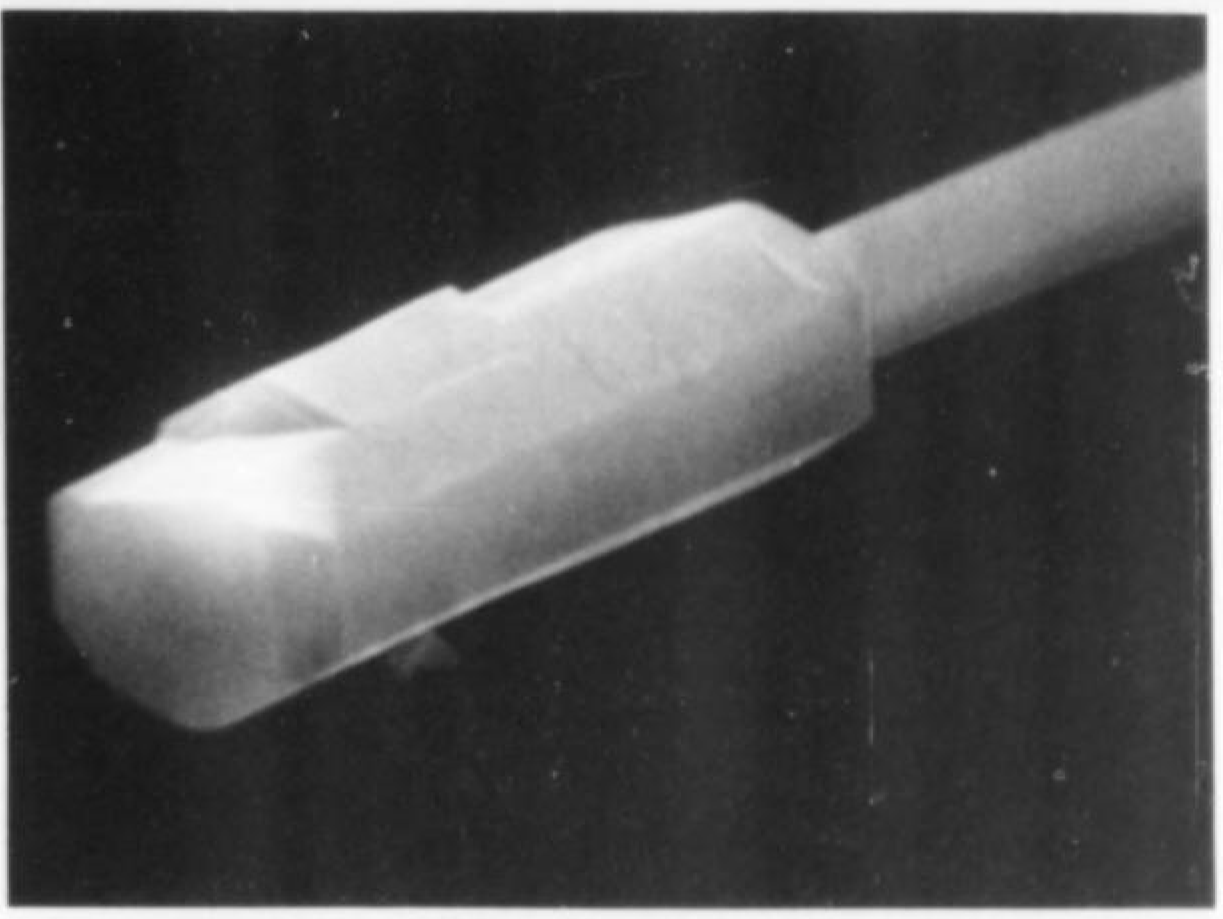

***Figure 2*. SEM photograph of labuntsovite epitaxially oriented on elpidite from Mont St. Hilaire, Quebec (higher magnification than Figure 1).**

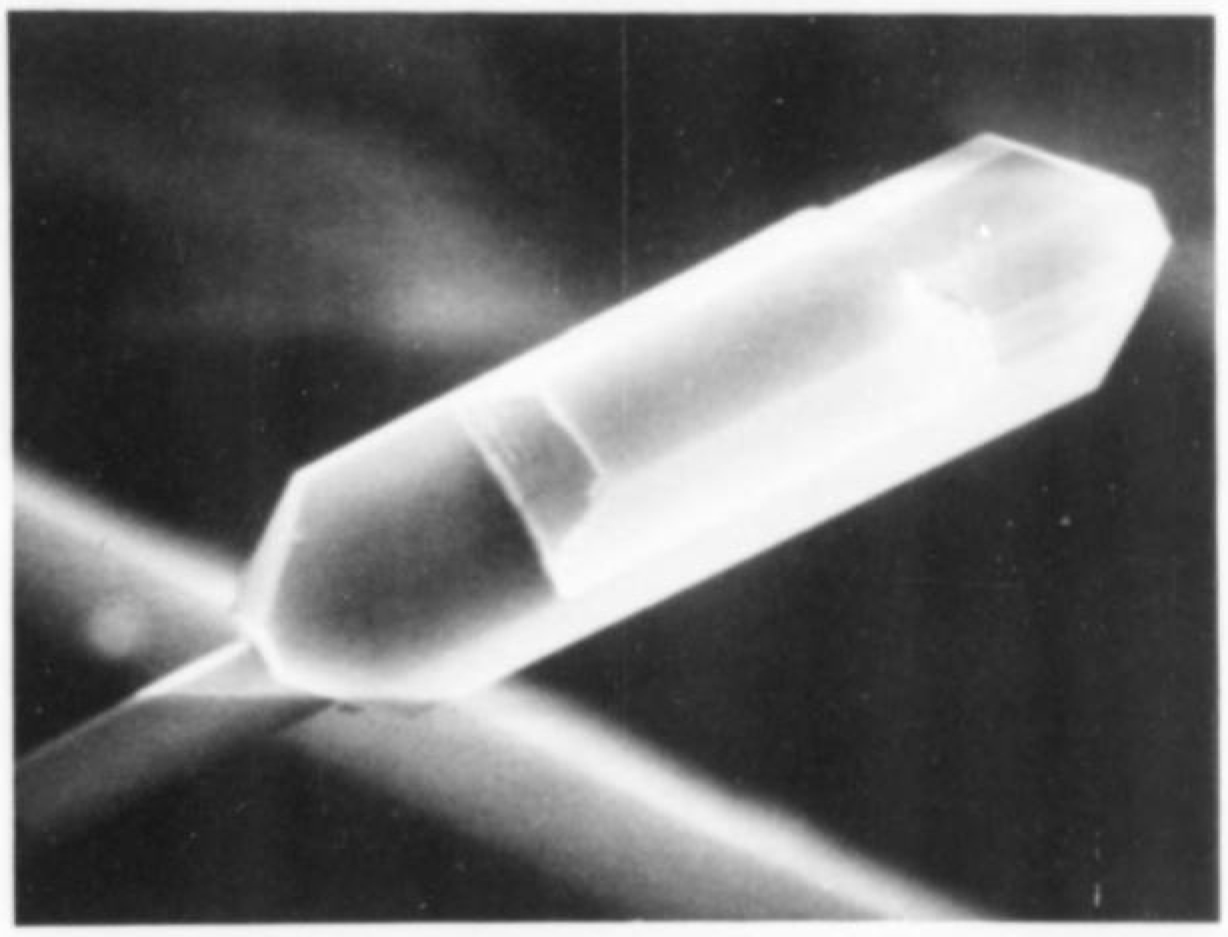

***Figure 3*. SEM photograph of the same labuntsovite specimen as shown in Figure 2, from a different direction.**

The following is a brief description of the epitaxial overgrowth of labuntsovite on elpidite resulting in a habit resembling orange lollypops. The specimens all came from a single small vug collected by the author in 1975 at the De-Mix quarry, Mont St. Hilaire, Quebec.

Labuntsovite is not uncommon at Mont St. Hilaire, where it occurs in silicate vugs in strikingly beautiful, brilliant, orange to red columnar crystals, usually of microscopic size. Elpidite also occurs in silicate vugs, in other associations. It is found in columnar to acicular crystals varying from colorless through straw-yellow to yellow-brown.

The examples of epitaxial growth shown here all came from a single silicate vug in nepheline syenite breccia, the vug being approximately 5 cm in greatest dimension. Less than 100 of the "lollypops" were found, all less than 1 mm in length. The labuntsovite is of a bright orange color typical of small crystals of the mineral, whereas the elpidite is almost colorless. Associated minerals are albite, soda amphibole (arfvedsonite?), analcime, ancylite, and a micaceous, brown, unknown mineral. The labuntsovite and elpidite were first identified optically by the author, who is indebted to G. Y. Chao of Carleton University for X-ray confirmation of both identifications.

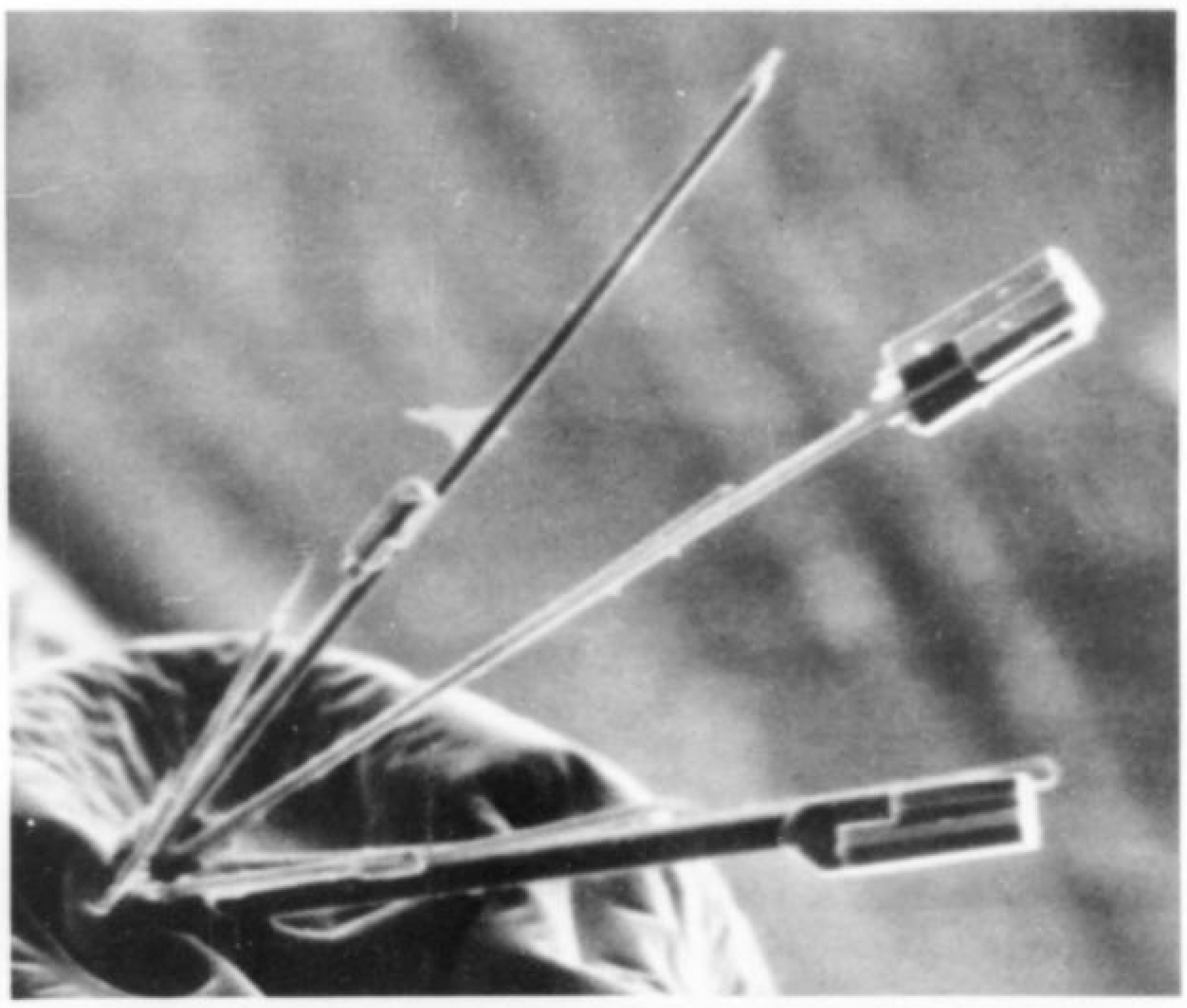

***Figure 1*. Scanning electron microscope (SEM) photograph of labuntsovite epitaxially oriented on elpidite from Mont St. Hilaire, Quebec.**

Four of these "lollypops" are shown in Figure 1. The base in this photograph is not, of course, matrix, but mounting medium used to prepare the group for SEM photography. The striking parallelism of the long axes of both minerals in these examples of epitaxial growth is shown in Figures 2 and 3.

Elpidite, $Na_2ZrSi_6O_{15}\cdot 3H_2O$, is orthorhombic. Labuntsovite, $(K,Ba,Na)(Ti,Nb)(Si,Al)_2(O,OH)_7\cdot H_2O$, is variously described as orthorhombic or as monoclinic with $\beta = 117°$. Since the unit cell of labuntsovite does not seem to have been conclusively established, it seems premature to hazard a guess as to which planes in the crystal structures of the two minerals have atomic spacings similar enough to provide a basis for an epitaxial relationship. Still, the bright color of the labuntsovite and the parallelism of the two minerals make these extremely beautiful examples of epitaxial growth.

EPIDIDYMITE FROM MONT ST. HILAIRE, QUEBEC

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Epididymite, $NaBeSi_3O_7(OH)$, is a reasonably common mineral in the quarries of Mont St. Hilaire. To the distress of the amateur collector, however, it can be either very easy or very difficult to distinguish, depending on its mode of occurrence.

The original report of epididymite (Mandarino *et al.*, 1965) described "small, pseudohexagonal prisms." Later reports (Worcester Mineral Club, 1972) added "tan colored pseudo-hexagonal prisms, short and tabular in shape" and "transparent groups of radiating lath-shaped crystals which are slightly elongated." Unfortunately, the vast majority of the pseudohexagonal prisms are very small indeed, and at that size become difficult to distinguish from apatite, nenadkevichite or catapleiite by morphology alone. The difficulty is accentuated by the fact that both epididymite and nenadkevichite are late additions to the mineral assemblage, and they often appear together, speared on aegirine, or in the interstices of a friable albite-aegirine-serandite intergrowth.

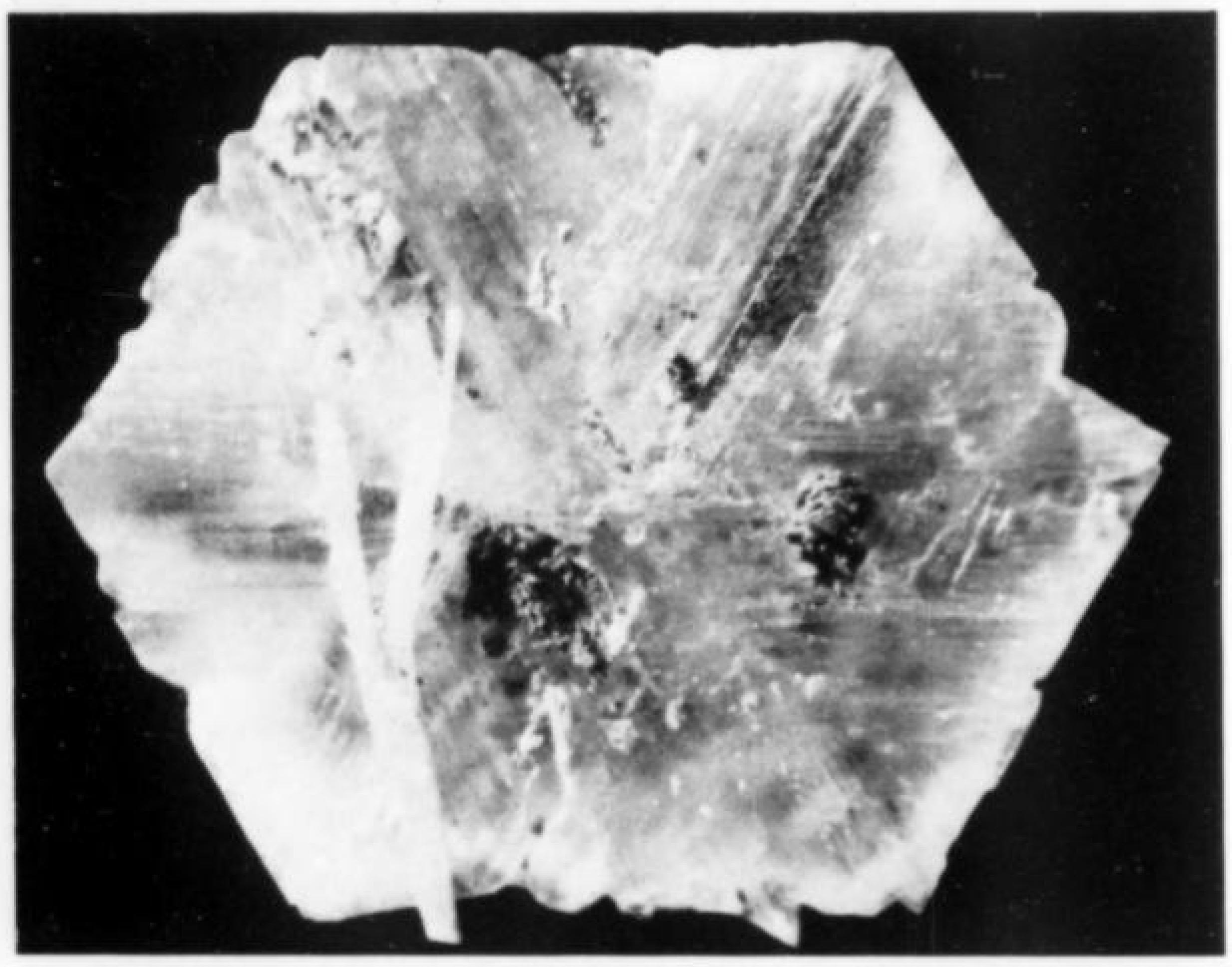

***Figure 1.* Epididymite sixling twin composed of three members intergrown at angles of 60° to each other, about 3 mm across. The acicular crystal on the epididymite crystal is elpidite.**

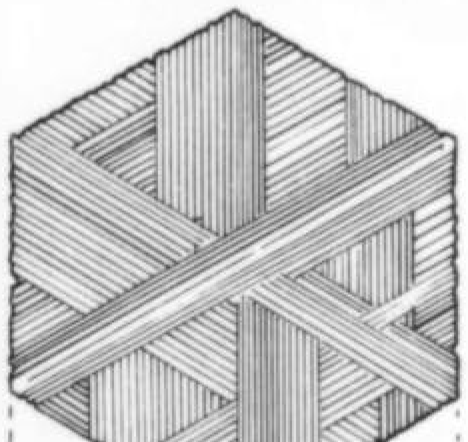

***Figure 2*. Sketch illustrating the twinning habit of Mont. St. Hilaire epididymite.**

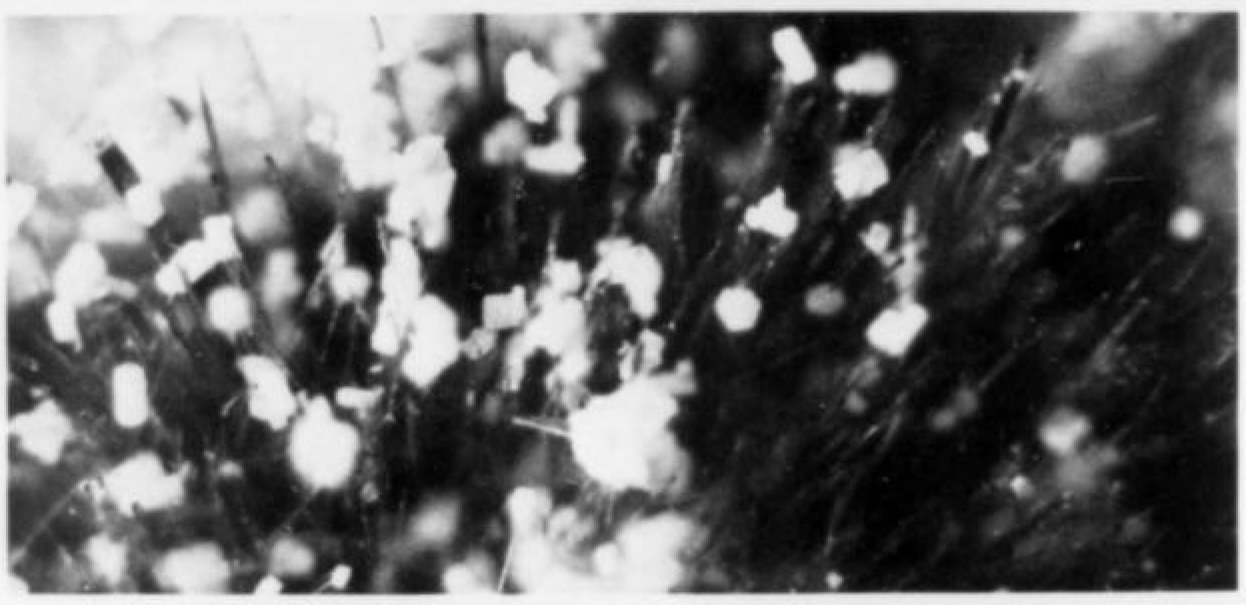

***Figure 3.* Epididymite and nenadkevichite crystals occurring speared by aegirine needles.**

On the other hand, there are two habits of epididymite at Mont St. Hilaire which are readily distinguishable to the eye, both in terms of morphology and in terms of association. The first of these takes a form generally approaching that of a "barite rose," ranging from an almost spherical blob through a "rose cluster" habit to hexagonal plates with rounded, scalloped, edges, thicker in the center than at the edge. These crystals have a powdery white or cream surface but when broken or rubbed reveal a colorless, transparent core. In its most symmetrical pseudohexagonal form, particularly when speared on hairlike aegirine, as it frequently is, it becomes the eye-catching "snowflake" epididymite. Crystals rarely exceed one millimeter in size. Epididymite of this sort appeared in some quantity in early 1970 in the pipes near the central sodalite-syenite stock in the original De-Mix quarry. It was associated with blocky microcline, yellowish, glassy natrolite, polylithionite, aegirine, eudialyte, analcime, pyrochlore and micro serandite. The earlier-forming minerals are often coated with a brittle tan-to-mahogany material containing zinc and sulfur.

The second easily recognizable habit is the most spectacular of the Mont St. Hilaire epididymites. In this form, the orthorhombic epididymite appears as colorless sixlings ranging up to 5 mm or more across and 2 mm thick. The interpenetrating crystals forming the sixling appear to be flattened parallel to the *c* face {001}. The intergrowths are built of several layers of crystals. The striations on the individual crystals stand out clearly on the *c* axis of the sixlings, and the tips of the crystals form a rough, sharp edge. Twinning may take place in two or more planes at the same time. Again, the associations of this habit are unmistakable. The most characteristic companion is a fine green mud and a soft, dingy black material. When dry, the mud has the powdery green appearance of verdigris; in water it demonstrates intense staining power and a great many washings are required to disperse it. Along with the mud, which is amorphous in nature, are microcline, albite, pyrite, rutile, and above all, elpidite, most commonly as long fibers, but also in euhedral crystals (Bøggild, 1953). There is evidence for at least three phases of development in this assemblage. Since the epididymite often encloses the elpidite, it is probable that the latter crystallized first. Many of the epididymite crystals, however, now contain holes, filled only with the green mud, revealing that at least one other mineral, now leached away, was also present. Most of the epididymite of this sort came from one hole in the floor of the De-Mix quarry on 22 May 1972, although a similar occurrence was reported in the mid-sixties.

Most of the black and green material may be cleaned off successfully by prolonged soaking in concentrated oxalic acid. Since the oxalic acid aso removes the elpidite, however, some forethought is advisable in preparing cleaning solutions.

MANDARINO, J. A., HARRIS, D. C., and BRADLEY, J. (1965) Mangan-neptunite, epididymite and new species from Mont St. Hilaire, Quebec. *The Canadian Mineralogist*, **8**, 398 (Abstr.)

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WHAT'S NEW FROM MONT ST. HILAIRE, QUEBEC.

by
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Eleven years ago, Chao *et al*. (1967) published a list of minerals from Mont. St. Hilaire, Quebec, which included 87 mineral names (84 species) and ten unidentified minerals. Since then, nine of the unidentified minerals have been either shown to be previously known species or established as new species. The number of recognized species has been expanded to 131, and the number of unidentified minerals has been increased to 22. In addition, a tetragonal polymorph of natrolite and a closely related higher hydrate have recently acquired species rank and will be described in a forthcoming paper. Thus, the minerals from Mont St. Hilaire that have been identified and studied in the authors' laboratory total 155. Additional analyses of chlorites, micas, apatites, pyroxenes and amphiboles will probably add more species to the list.

The minerals identified since 1967 from Mont St. Hilaire are listed in Table 1. References are given only for those minerals for which Mont St. Hilaire is the type locality; these are marked with an asterisk. Carleton University numbers for unidentified minerals used in the original 1967 list, or assigned subsequently, are given in brackets. The supplementary list again includes a number of rare minerals also found in similar alkaline rock occurrences in Greenland, the Kola Peninsula, U.S.S.R. and elsewhere. One of the more surprising minerals is wulfenite, which was found as yellow prismatic micro crystals in an alteration rim around galena.

Brief descriptions of the current unknowns, including optical and crystallographic data, are given in Table 2. It should be noted that most of these minerals are rare, some being known from only one specimen or one occurrence.

The authors wish to take this opportunity to express their sincere thanks to the numerous mineral collectors who have generously donated or loaned specimens for our study. Because the number of individuals involved is large, it is impractical to name them here.

Table 1. Minerals from Mont St. Hilaire Identified Since 1967

Anatase
Antigorite
Aragonite
Arfvedsonite
Ashcroftine
Barylite
Behoite
*Carletonite (UK15) (Chao, 1971)
Chabazite
Cordylite (UK12)
*Donnayite (UK33) (Chao, *et al*, 1978)
Ekanite (UK4)
Ewaldite (UK37)
*Gaidonnayite (UK23) (Chao and Watkinson, 1974)
Gibbsite
Gmelinite
Harmotome
Hedenbergite
*Hilairite (UK20) (Chao, Watkinson and Chen, 1974)
Hiortdahlite
Hydrotalcite
Joaquinite
Kaersutite
Kainosite
Kaolinite
Labuntsovite (UK5)
Låvenite
*Lemoynite (UK13) (Perrault, *et al*, 1969)
Loellingite
Mckelveyite (UK30)
*Monteregianite (UK6) (Chao, 1978)
Nenadkevichite (UK19)
Nordstrandite
Parisite
Phillipsite
Raite
Rhabdophane
Richterite
Scheelite
Sepiolite
Steenstrupine
Stillwellite
Strontianite
Thaumasite
Thorite
Tundrite (UK18)
Villiaumite
Vinogradovite (UK28)
Wollastonite
Wulfenite
*Yofortierite (UK25) (Perrault, *et al*, 1975)

*Minerals for which Mont St. Hilaire is the type locality.

Table 2. Current Unidentified Minerals from Mont St. Hilaire, Quebec

Designation	Properties and Remarks
UK17	As described by Chao, *et al*. (1967). No additional information is available as the original specimen has been lost.
UK22	Pale brown, minute, prismatic crystals in irregular clusters associated with pectolite, calcite, fluorite, albite, biotite, UK24, apatite, etc. Uniaxial (–), $n \sim 1.745$, low birefringence. A silicate of Ca, Ce and La, with the apatite-type structure, probably a variety of britholite. The strongest X-ray lines are: 4.2 (50), 3.24 (40), 3.15 (50), 2.87 (100), 2.84 (70), 2.78 (70).
UK24	Pale green acicular and prismatic crystals (up to 15 mm long) associated with UK22. Biaxial (+), $n \sim 1.662–1.670$, $2V \sim 10°$, dispersion moderate, $r > v$. Properties and X-ray powder pattern similar to those of götzenite. The strongest X-ray lines are: 3.09 (100), 3.00 (80), 2.81 (50), 1.92 (30), 1.85 (30), 1.68 (30).
UK26	White to beige prismatic crystals (0.1-0.5 mm) and radiating clusters of acicular crystals in dark hornfels. Effervescent in HCl. Strongest X-ray lines are: 4.8 (30), 3.52 (100), 3.18 (40), 2.86 (40), 2.78 (30), 2.03 (40).
UK27	Small (0.1-0.5 mmm) white to colorless irregular grains embedded in a poorly crystalline, white, earthy material, associated with yofortierite and analcime. Fluorescent green in short-wave UV. The strongest X-ray lines are: 8.3 (30), 7.4 (100), 5.1 (20), 4.2 (60), 3.45 (20), 3.23 (30).
UK29	Minute golden brown flakes in the interstices of coarse natrolite, associated with gaidonnayite, hilairite, ancylite, etc. The strongest X-ray lines

are: 12.2 (100), 3.10 (30), 2.64 (30), 2.50 (30), 1.69 (10), 1.54 (20).

UK31 Pink, brown, and purplish red, dull to silky cotton-wool-like fibrous aggregates, usually associated with natrolite, analcime, albite, polylithionite, yofortierite and UK38. The mineral is structurally and chemically related to yofortierite and gives poor and somewhat variable X-ray powder patterns. The strongest X-ray lines of a typical pattern are: 10.9 (100), 5.5 (20), 4.2 (20), 3.48 (20), 3.29 (20), 2.68 (20).

UK32 or †WMC-1 Colorless, acicular, hexagonal crystals and white, silky, fibrous aggregates associated with albite, microcline, arfvedsonite, monteregianite, rhodochrosite, catapleiite, natrolite, etc. Hexagonal, space group *P6/mmm, P622, P6mm,* $P\bar{6}m2$ or $P\bar{6}2m$, with $a = 10.84$, $c = 10.30$Å. Uniaxial (–), $\epsilon = 1.503$, $\omega = 1.532$. Probe analysis gave Ca, Y, Al and P approximately in the ratios 5:4:3:2. Soluble in HCl with strong effervescence. Density (measured) 2.15 g/cm^3. The strongest X-ray lines are: 9.3 (100), 4.6 (20), 3.78 (20), 3.36 (40), 2.48 (30), 2.14 (30). More material is required for the analysis of volatiles.

UK34 The mineral occurs as pale brown to reddish brown, thin, polycrystalline crusts forming the exterior of hollow crystals with stubby hexagonal form, associated with microcline, serandite, and natrolite. The interiors of the hollow crystals are often partially filled with ancylite. Birefringence low, n~1.67. Not effervescent in HCl. The strongest X-ray lines are: 4.4 (40), 3.08 (100), 2.88 (20), 2.81 (40), 2.15 (50), 1.86 (40). The mineral is a member of the rhabdophane-brockite-grayite-ningyoite group.

UK35 Minute white and colorless hexagonal plates on pink apophyllite, associated with microcline and analcime. The X-ray powder pattern bears close similarities to that of chabazite. The strongest X-ray lines are: 9.4 (100), 4.4 (40), 3.90 (40), 2.95 (100), 2.64 (40), 2.55 (40).

UK36 Purplish red, prismatic, bladed crytals (up to 5 mm) and radiating fibroid aggregates, associated with pectolite, calcite, fluorite, wollastonite and eudialyte in a marble xenolith. Triclinic, *P*1 or $P\bar{1}$, with $a = 10.049$, $b = 15.950$, $c = 7.388$ Å, $\alpha = 96.52°$, $\beta = 111.11°$, $\gamma = 76.27°$. Biaxial (–), $\alpha \sim 1.574$, $\beta \sim 1.579$, $\gamma \sim 1.583$, 2V~80°. Density (measured) 2.91 g/cm^3. Cleavage {001} distinct. The microprobe analysis corresponds to $KCa_4HSi_5O_{15} \cdot 2H_2O$. The strongest X-ray lines are: 15.5 (90), 3.12 (100), 3.06 (80), 2.90 (100), 2.77 (70), 2.65 (70).

UK37a White, gray, greenish gray, and brown, dull and opaque barrel-shaped and pagoda-shaped crystals. Also found as earthy overgrowths on donnayite, and as syntactic intergrowths with ewaldite. Microprobe analysis and X-ray studies show the mineral to be a Sr-analog of ewaldite. The strongest X-ray lines are: 6.2 (30), 4.5 (20), 4.2 (70), 3.02 (100), 2.59 (30), 1.96 (40).

UK38 Minute yellow flakes associated with UK31. Weakly birefringent, n~1.568. The strongest X-ray lines are: 12.5 (100), 3.20 (60), 2.82 (40), 2.64 (40), 2.40 (30), 1.66 (30).

UK39 Rosettes of yellowish brown tabular crystals, associated with microcline, albite, ancylite, aegirine, synchysite, titanite and calcite. The strongest X-ray lines are: 4.7 (100), 4.2 (30), 3.45 (30), 3.22 (40), 2.64 (80), 1.89 (50).

UK40 Yellow, irregular grains associated with ancylite, donnayite, albite, titanite, biotite, and microcline. The strongest X-ray lines are: 6.4 (50), 5.2 (50), 4.8 (60), 2.97 (100), 2.93 (60), 2.56 (60).

UK41 Colorless to white, tabular, prismatic crystals in one small cluster, associated with microcline, albite, aegirine, ancylite, catapleiite, calcite and nenadkevichite. The strongest X-ray lines are: 8.4 (100), 5.3 (80), 4.00 (60), 3.34 (70), 2.88 (80), 2.67 (70).

UK42 Greenish yellow irregular grains (up to 1 cm across) in the interstices of coarse biotite crystals associated with cancrinite, mosandrite, aegirine, zircon, catapleiite, natrolite, fluorite, lavenite, etc. Monoclinic, $P2_1$ or $P2_1/m$, with $a = 10.791$, $b = 14.505$, $c = 6.626$Å, $\beta = 113.21°$. Cleavages {010} perfect, {110} good and {100} distinct. Hardness 5. Biaxial (+), $\alpha = 1.596$, $\beta = 1.598$, $\gamma = 1.632$, 2V = 25-30°. The mineral is essentially a hydrous sodium zirconium silicate. The strongest X-ray lines are: 7.3 (80), 6.1 (50), 4.1 (90), 3.21 (50), 3.04 (50), 2.91 (100).

UK43 Small spherical clusters of silky acicular crystals, associated with sodalite, microcline, albite, dawsonite, analcime, siderite and pyrite. The strongest X-ray lines are: 11.0 (100), 5.6 (30), 4.2 (30), 3.20 (30), 3.10 (30), 2.62 (20).

UK44 Yellow hemimorphic crystals (0.2-0.5 mm) displaying a trigonal pyramid and a pedion, associated with microcline, albite, pyrite and a dark green, fine-grained chlorite. Soluble in HCl with strong effervescence. Polysynthetic twinning along at least three directions is apparent under the polarizing microscope. The strongest X-ray lines are: 5.1 (60), 3.92 (80), 3.15 (100), 2.50 (70), 2.11 (60), 2.03 (50).

UK45 Rosettes and irregular aggregates of soft, colorless, tabular crystals (0.2 mm across) associated with calcite in a matrix of albite, siderite and fluorite. Biaxial (+), n~1.54 and 1.55, 2V~60°. The strongest X-ray lines are: 4.8 (100), 2.35 (25), 2.32 (25), 1.97 (30), 1.85 (30), 1.84 (30).

UK46 Colorless, beige and pink micaceous mass with pearly luster, associated with aegirine, nenadkevichite and a reddish brown, fibrous, amorphous material. Biaxial (–), n~1.65-1.70, 2V~70°. Poor and somewhat variable X-ray powder patterns. The strongest X-ray lines are: 12.2 (100), 4.3 (100), 2.90 (80), 2.15 (80), 1.78 (80), 1.62 (80). The mineral is probably altered murmanite.

UK47 Colorless micro-crystals on donnayite, associated with natrolite, etc. The strongest X-ray lines are: 9.4 (70), 6.0 (80), 4.7 (70), 4.5 (70), 3.23 (70), 2.90 (100). The powder pattern is strongly similar to that of chabazite and UK35.

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† Worcester Mineral Club designation. See: Geology and Mineralogy of Mount St. Hilaire, Quebec, Canada, Worcester Mineral Club, 1973.

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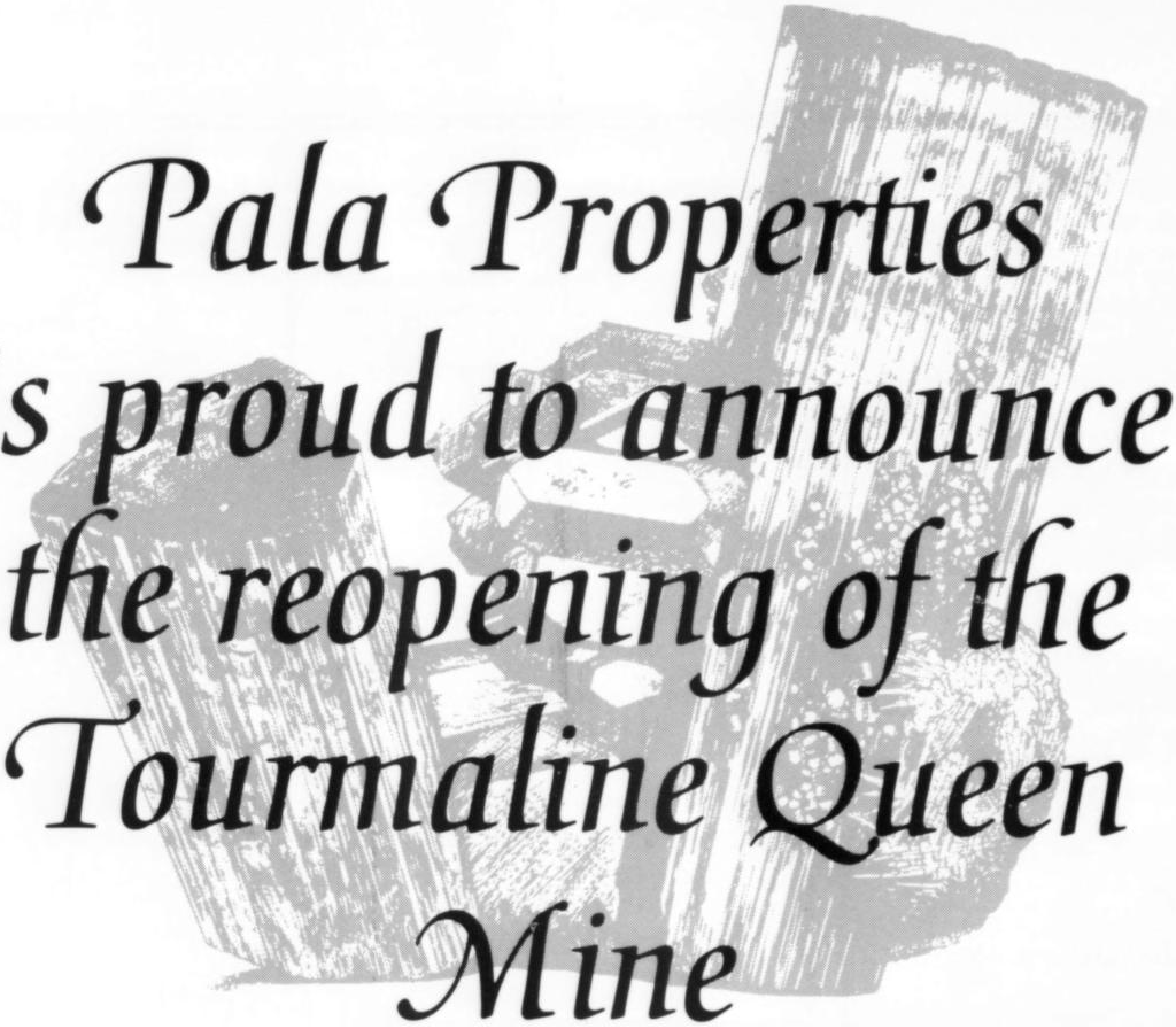

Microminerals

by Violet Anderson

Before I become involved in the intricacies of a particular suite of microminerals, I want to pass on a word about Neal Yedlin's forthcoming book on micromounts which Paul Desautels has been preparing for publication. The publisher tells me he hopes to have the book out by early spring, 1979. "Buy and use a good mineral book."

And now, this month I want to devote the entire column to the microminerals of Mont St. Hilaire, which means that about 150 minerals must be dealt with, arranged in some sort of order, some dismissed, others selected, and the chosen ones succinctly described.

Unlike the minerals from some other rare-mineral localities, the minerals of Mont St. Hilaire are usually attractive in a rather unbrash way, their colors often muted, their shapes set in contrast to each other on every crowded specimen. Only those sloshed over with "an amorphous material rich in iron and manganese" produce effects somewhat short of appealing.

Many of you already know Mont St. Hilaire, that little mound southeast of the St. Lawrence River near Montreal, the northeast corner of which is being quarried for crushed stone. Mont St. Hilaire is one of the Monteregian Hills strung along from west to east across the St. Lawrence Lowlands and part way into the Appalachians for about 120 miles. These intrusions mark a continuation of the Ottawa graben, itself part of the larger St. Lawrence rift system in much of which an impressive amount of alkaline activity has occurred apparently on and off for about 600 million years. The Monteregian Hills are the most recent manifestation of this, being somewhere between 120 and 200 million years old, which puts their origin in the Cretaceous.

The composition of the rocks in these hills varies from mafic or ultramafic to salic. Mont St. Hilaire is half mafic or intermediate, and half salic. It is in the latter and younger part, characterized by nepheline and sodalite syenites, where the quarries have been developed. It contains intrusive breccias of syenites and other rock fragments, pegmatite dikes of the two syenites mentioned, and hydrothermal vugs. Not all of these mineral formations were emplaced at the same time, and the breccias would probably be of little interest to us were it not for their subsequent alteration. Hydrothermal activity was responsible for many of the rare minerals, bringing onto the scene new elements while decomposing older rocks.

Anyone wishing to delve further into the geology of Mont St. Hilaire and related areas should read a small book on the proceedings of a symposium held in 1969. It is entitled *Alkaline Rocks: The Monteregian Hills*, edited by Guy Perrault, and was published by the Mineralogical Association of Canada in 1970. As to the minerals themselves, the best you can do is to refer constantly to the *Canadian Mineralogist*, including many back issues.

It might be easiest to deal with the minerals by grouping them in their chemical classes. The selection for description poses a dilemma. Obviously the more common ones would be easier for collectors to find; if I concentrate on the rarer species collectors may be frustrated trying to unearth them. Perhaps, however, the decision should be made in favor of the rare ones, if only for the fascination of what's difficult.

St. Hilaire is not noted for its sulfides. **Pyrite, sphalerite,** and **galena** are commonly found there, **chalcopyrite** rarely. **Sphalerite** usually occurs in almost black tetrahedral shaped crystals, occasionally intricately modified. **Pyrrhotite, wurtzite,** and arsenopyrite may be found. An **arsenopyrite** micro crystal of the most elongated growth I have ever seen came from there. The same collector possesses, in addition to the arsenopyrite, a well-defined little **molybdenite** crystal.

The oxides contain considerable titanium or manganese. Of the titanium oxides, the polymorphs, **anatase**, **brookite**, and **rutile** occur, anatase most rarely. Rutile is slightly more in evidence, twinned in its various ways. **Ilmenite**, the iron titanium oxide, produces small shining black overlapping plates; **pyrophanite**, the manganese analog, plates of hidden fire or at times plainly brick-colored. **Pyrochlore**, very rare at St. Hilaire, is usually in minute octahedrons strung along or topping a crystal of aegirine. Only an occasional larger-sized octahedron occurs. It is noteworthy that so many mineral crystals are found speared, like shish kebab, on aegirine at St. Hilaire. I have complete little crystals of albite, analcime, catapleiite, ekanite, fluorite, genthelvite, nenadkevichite, rhodochrosite, and pyrochlore, each spiked by aegirine. It is a typical habit of St. Hilaire pyrochlore to crystallize on aegirine.

Nordstrandite, a simple aluminum hydroxide, should be mentioned here, since it is very rare, but it is also very unexciting—pinkish, vaguely botryoidal at 50X on your scope, secretly monoclinic. **Behoite**, another rare one, an orthorhombic beryllium hydroxide, is more attractive, with wide, whitish grey blades shading to darker grey at the ends.

Of the halides, **fluorite** is the most abundant, **villiaumite**, a sodium fluoride, rare. Villiaumite dissolves in water so it is rarely seen, and then only in cleavages indicative of its cubic nature. Its color hovers around rose-red. The fluorite at St. Hilaire is commonly colorless to pale or brighter green, in semi-transparent cubes modified by the dodecahedron. My prize specimen is a complete classic dodecahedron. Minute purple octahedrons have also been found.

For the sulfates I must let **barite** stand in as the sole representative, of which I have seen but one example, a little gem of a transparent yellow crystal, close to equidimensional, with an impressive number of forms.

For the phosphates, there is **apatite**. So far as I know, it always occurs with sparkling clear hexagonal prisms, terminated neatly by a pinacoid.

Wulfenite has been found there, much to everyone's surprise, but in tiny pyramidal shapes, almost needles, and yellow.

The carbonates and the silicates are the most important chemical groups to be found at St. Hilaire, particularly the silicates. Among the carbonates the most common of the significant minerals is the orthorhombic, pink, mauve pink, or orange pink **ancylite**, a mineral containing strontium and cerium. It quite typically appears in tight clusters, sometimes even in sheaves, but also as well developed moderately prismatic single crystals or such crystals in loose sprays. **Synchysite** is another important carbonate; it contains cerium and lanthanum, occurs in little hexagonal plates, singly or in groups, with a color brownish, tan, or a lovely pale gray, although the description of its color by Cynthia Peat has gone down in Canadian history as "purplish brown" which often enough aptly fits it.

There is plenty of **calcite**, **rhodochrosite**, and **siderite** of varying habits, and some **strontianite** in relatively large single crystals, but the most interesting and rarest carbonate is probably **burbankite**. This vitreous mineral, with its complex chemical formula (including strontium, cerium, and barium) is of a faint yellow, almost white or colorless. It has long, slender, hexagonal or dihexagonal prisms with terminations often so difficult to make out you are left wondering what really are you seeing? However, it can appear with well defined prism forms and quite easily seen shallow pyramidal terminations, all of a stronger color such as pinkish yellow.

About on a par for rarity with burbankite is **cordylite**, a carbonate containing barium, lanthanum, and fluorine. It too is hexagonal, yellowish pink or pinkish yellow, the crystals stubby, some of them showing opacity and signs of layering or parting, others a pyramidal termination with curved aspect.

A new carbonate mineral, **donnayite**, the yttrium analog of weloganite (the latter found at the Francon quarry, Quebec) is described in a recent issue of the *Canadian Mineralogist* (vol. 16, p. 335). **Bastnaesite**, another carbonate with cerium and lanthanum is, like nordstrandite among the oxides, more honored for its rarity at St. Hilaire than for its beauty. We find it as little pinkish balls, like burrs, which when split open reveal somewhat silky radiating crystals if you magnify them sufficiently; or as white flaky coatings.

The silicates comprise the "greats" among St. Hilaire minerals. They can be grouped as those significant for their beryllium content, those for their zirconium, titanium or niobium content (and perhaps cerium), and those whose chemical nature is not exactly impressive, but which occasionally produces a rare mineral. Most of the St. Hilaire silicates are nesosilicates (if you include in this term all the ring-like structures). I can think of only two tectosilicates containing beryllium, for instance, which are not found easily elsewhere: they are **leifite** and **genthelvite**. Both are very rare at St. Hilaire, especially leifite, a trigonal mineral found with crystals of two types: one in sprays of long aggressively white, fine, silky, acicular crystals, the other quite large crystals, rather short prismatic, highly striated, which could be made up of the needles tightly packed in parallel growth.

Genthelvite is readily recognized by its tetrahedral shape combined with its pale yellow color, some of the crystals tangled in an underbrush of aegirine, others found singly atop a white matrix. They also appear in close-knit parallel growth, or in looser groups with crystals partially overlapping, their upper points making a jagged outline. Some colorless but etched crystals have been called end members of a series, for while retaining their zinc, they have no iron or manganese.

Epididymite, another beryllium silicate, is being discussed elsewhere in this issue by Quintin Wight. **Leucophanite**, orthorhombic but often appearing tetragonal, is again a rare mineral rich in beryllium, white to off-white, and seen in small square plates, singly or grouped together in neat little slices. Twinning will produce star-shaped crystals. Larger, well-formed, brick-like crystals occur frequently.

Among the silicates those containing zirconium are zircon, catapleiite, elpidite, eudialyte, gaidonnayite, hilairite, lemoynite and wöhlerite. Those containing titanium include nenadkevichite, lorenzenite, titanite, leucosphenite, labuntsovite, mangan-neptunite, narsarsukite, mosandrite. These lists are limited to those I know.

The radioactive **ekanite** stands alone. It has thorium and uranium in it rather than zirconium, and is one of the rarest minerals of St. Hilaire. We collected crystals of this in 1969 and I do not believe they have been collected since then. They are tetragonal; brown, tan, grey, even cream; with a proclivity towards twinning into crosses and double crosses. A coating (unknown) covers the prism faces only, stopping short of meeting at the edges of these faces.

Zircon (which in many cases has thorium and uranium traces as well as zirconium) I had intended to omit, but I have just heard of a new find of gemmy transparent yellow crystals complete with prisms. The most common habit of this tetragonal mineral at St. Hilaire is bipyramidal, without prisms, and opaque tan or brown.

Catapleiite occurs in thin hexagonal plates in a run of cyrstals (as if a pile of them had slipped) which often display iridescence. Or the crystals are sturdier and clearly transparent with splendid bevels marking bipyramidal faces.

Elpidite (orthorhombic) is at its best when seen in handsome shining blades, white or cream-colored, heavily striated vertically. It is more commonly needle-like and much less impressive.

Eudialyte is common enough at St. Hilaire to be by-passed were it not for the red glowing trigonal crystals of micro size which are by no means as abundant as blebs and the odd rather curdled face or so of large crystals.

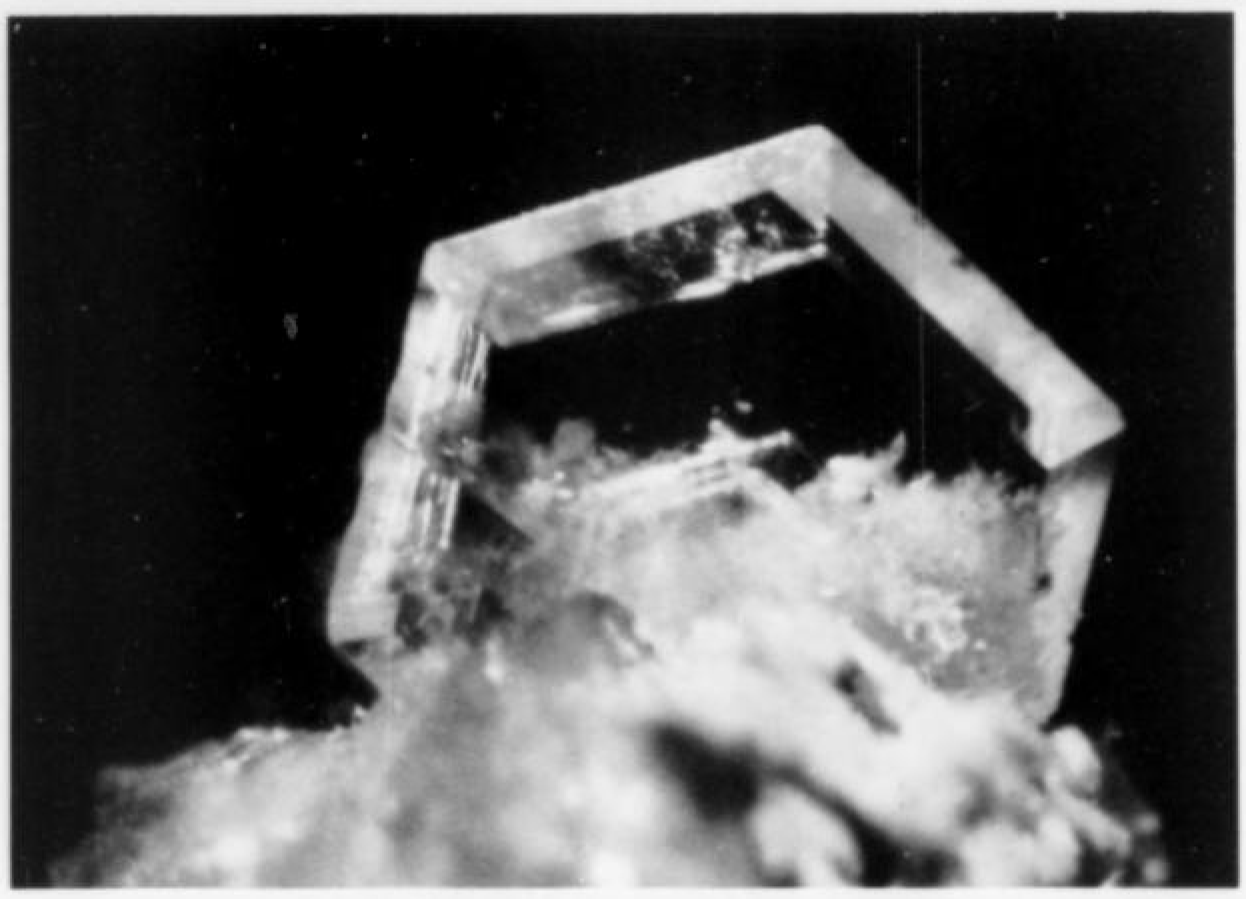

***Figure 1*. Catapleiite from Mont St. Hilaire; the colorless crystal is about 1.3 mm wide. Peter Tarassoff specimen.**

Gaidonnayite and **hilairite** tend to appear together, although gaidonnayite can be seen alone in orthorhombic semitransparent flattened crystals looking best with the narrow *a* face up, and the *b* face in the foreground with prism faces sloping towards it. Hilairite, differing from gaidonnayite chemistry only by the addition of one water molecule, occurs usually as pale brown trigonal crystals. To make out the difference between a rhombohedral face and a prism face in hilairite, though simple on paper, is quite a feat in practice. These two minerals are new minerals, found first at St. Hilaire.

***Figure 2*. Gaidonnayite from Mont St. Hilaire; the narrow top face of the white crystal is about 1 mm across. Henry Budgen specimen.**

Lemoynite, exceedingly rare, is another new mineral. It occurs white to grey to pale yellow in whorls of radiating, rather flat, monoclinic crystals, sometimes satiny. They can pick up a pink tint from hematite.

Wöhlerite (with zirconium and niobium) is monoclinic, and clearly yellow. In my specimen the crystals are quite rectangular but flat.

Turning now to the minerals containing titanium, there is the old UK#19, **nenadkevichite**, which contains also niobium as do so many titanium minerals. I first saw this mineral in 1969 in minute pink barrels thickly scattered through much fine gold wire-like aegirine, associated with blebby eudialyte, albite, analcime, natrolite, and ekanite. Today larger crystals are occasionally found, but none beyond micro size. They are orthorhombic, pseudohexagonal, a yellowish pink.

Leucosphenite is semi-transparent, just off-white towards the blue, which is of value for identification. The monoclinic crystals are commonly elongated parallel to the *c* axis or to the *a* axis. In the former case, a series of vertical faces may produce a slightly tall or slightly short chunky crystal, or fewer faces may end up creating a tabular crystal. When elongated parallel to the *a* axis, a high development of {130} will give rise to a wedge-shaped crystal, thin as a blade or thick. Orienting this crystal is not easy, but it remains beautiful no matter how you look at it.

Labuntsovite, that colorful orange-red mineral which can contain not only titanium but niobium and barium, is being discussed in an unusual combination with elpidite by William Henderson on another page, but I must direct attention here to the labuntsovite crystals belonging to Charles and Marcelle Weber which took second prize in a contest run in 1975 for the best St. Hilaire micro specimens from private collections. The center Weber crystal is over 6 mm long, a very rare mineral in a most unusual size. The crystals are tightly packed together rather than in the more familiar loose clusters.

Mangan-neptunite, a monclinic mineral, has to be mentioned, partly for its rarity at St. Hilaire, partly for its color. This mineral has a higher content of manganese over iron than is common to neptunite. A rich red platy crystal won honorable mention in the St. Hilaire contest.

Narsarsukite is a neat tetragonal mineral no matter what the crystal habit. The usual habit is tabular with large basal pincoid and short prisms of the first and second order. Pyramidal faces are truncated. The color is opaque yellow with greenish cast or inclusions of green grains. These crystals construct interesting build-ups of parallel growth, pinacoid face upon pinacoid face. However, this mineral can also appear in gemmy, transparent, elongated crystals, yellow or very slightly greenish yellow. For such a specimen, William Henderson took first prize in the above-mentioned contest.

Lorenzenite should probably take precedence over triclinic **mosandrite**, since the brown acicular crystals I call mosandrite (and which others may call rinkite) is difficult to be sure about, whereas lorenzenite (formerly ramsayite) which also comes in brown acicular crystals, as well as lightly tinted or white crystals, at least has the grace to be orthorhombic, a much more identifiable quality. However, mosandrite (or rinkite) is exceedingly rare, so acicular light brown crystals are worth examining closely. If reddish brown, of course, they may just be monoclinic aegirine (or acmite).

Astrophyllite adds insult to injury. It is common at St. Hilaire, triclinic, and appears in broad brown blades, brown acicular crystals, or straw-colored fibers. When in doubt look for a slight bronze cast in the brown.

We can move quickly past all this to the two rare minerals: ashcroftine and monteregianite, both of which have yttrium rather than titanium among their cations. **Ashcroftine** occurs in pale pinkish needles, very delicate, concealing their tetragonal nature. Although Kostov puts it among the zeolites, it has recently been shown that this is in error.

Monteregianite is a new mineral, the last one I shall mention containing rare elements. It is orthorhombic, showing long flat plates, colorless to white or silver-grey when semi-transparent, slightly cream when opaque. Luster is pearly.

Of the minerals left (in my acquaintance)—pectolite, serandite, delhayelite, spessartine, andradite, vesuvianite, hemimorphite (tiny white spheres, with the wulfenite), willemite, aegirine, various amphiboles, yofortierite, polylithionite, biotite, muscovite, apophyllite, quartz, albite, microcline, nepheline, sodalite (and variety, hackmanite), gmelinite, analcime, natrolite, tetranatrolite, thomsonite, and harmotome—I choose only serandite, delhayelite, yofortierite, polylithionite, muscovite, gmelinite, and tetranatrolite for brief mention. The harmotome I have examined has been too small to see.

Figure 3. **Monteregianite from Mont St. Hilaire; the crystals, very pale yellowish white, show about 2.5 mm of their 5 mm length. ROM specimen.**

Figure 4. **Serandite from Mont St. Hilaire; the crystal is about 2.3 mm tall, and of a pretty pink color. Les Horvath specimen.**

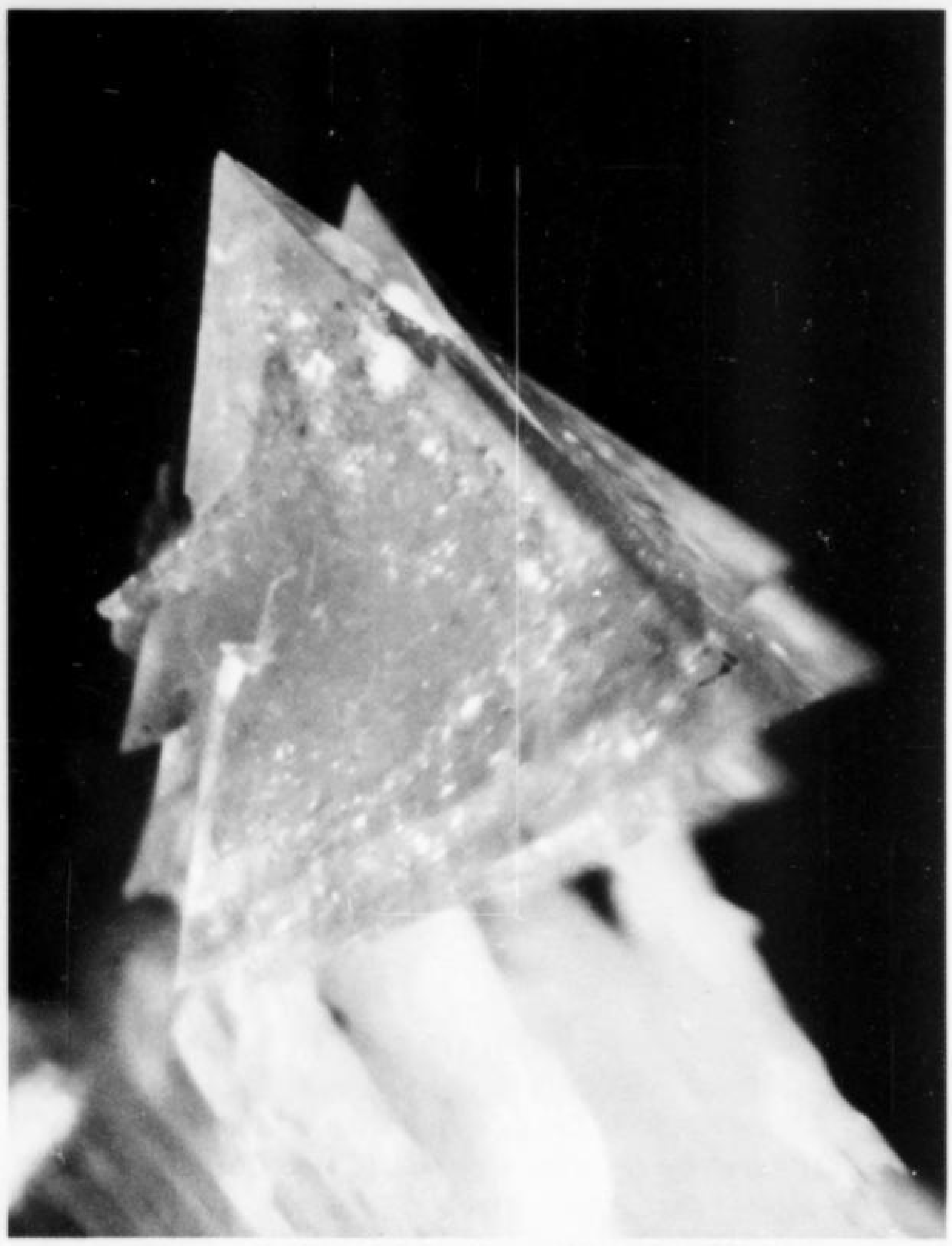

Figure 5. Genthelvite from Mont St. Hilaire; the crystal group is 1.7 mm tall. Peter Tarassoff specimen.

Figure 6. Ekanite from Mont St. Hilaire; the crystal group measures about 0.8 mm vertically. Violet Anderson specimen.

Figure 7. Wulfenite from Mont St. Hilaire; the central crystal is about 0.9 mm in length. Royal Ontario Museum (ROM) specimen.

(All photos by Violet Anderson.)

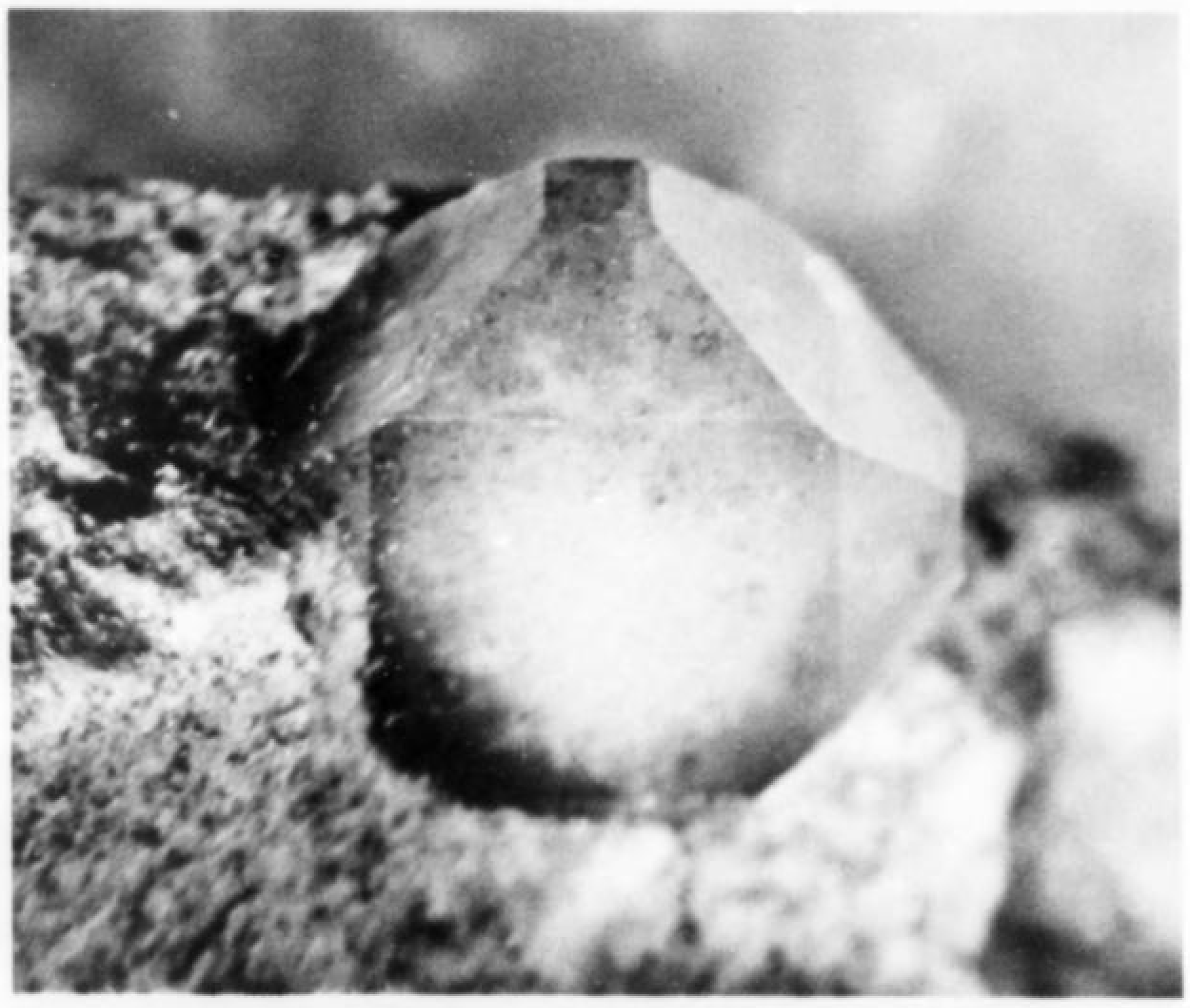

Figure 8. Narsarsukite from Mont St. Hilaire; width of the *c* face (foreground) is 1.8 mm ROM specimen.

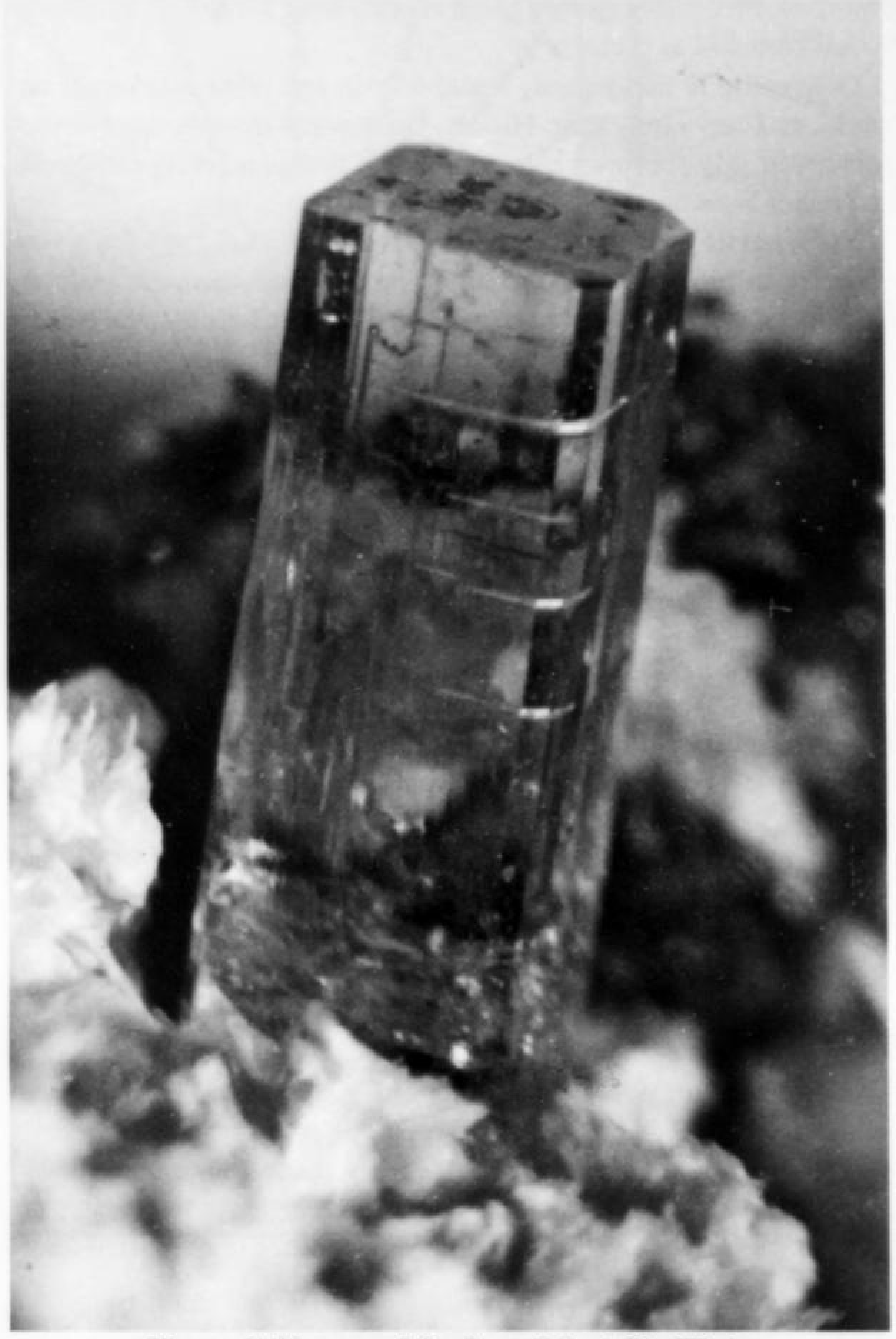

Figure 9. **Narsarsukite from Mont St. Hilaire; the crystal is about 2 mm tall. William Henderson specimen.**

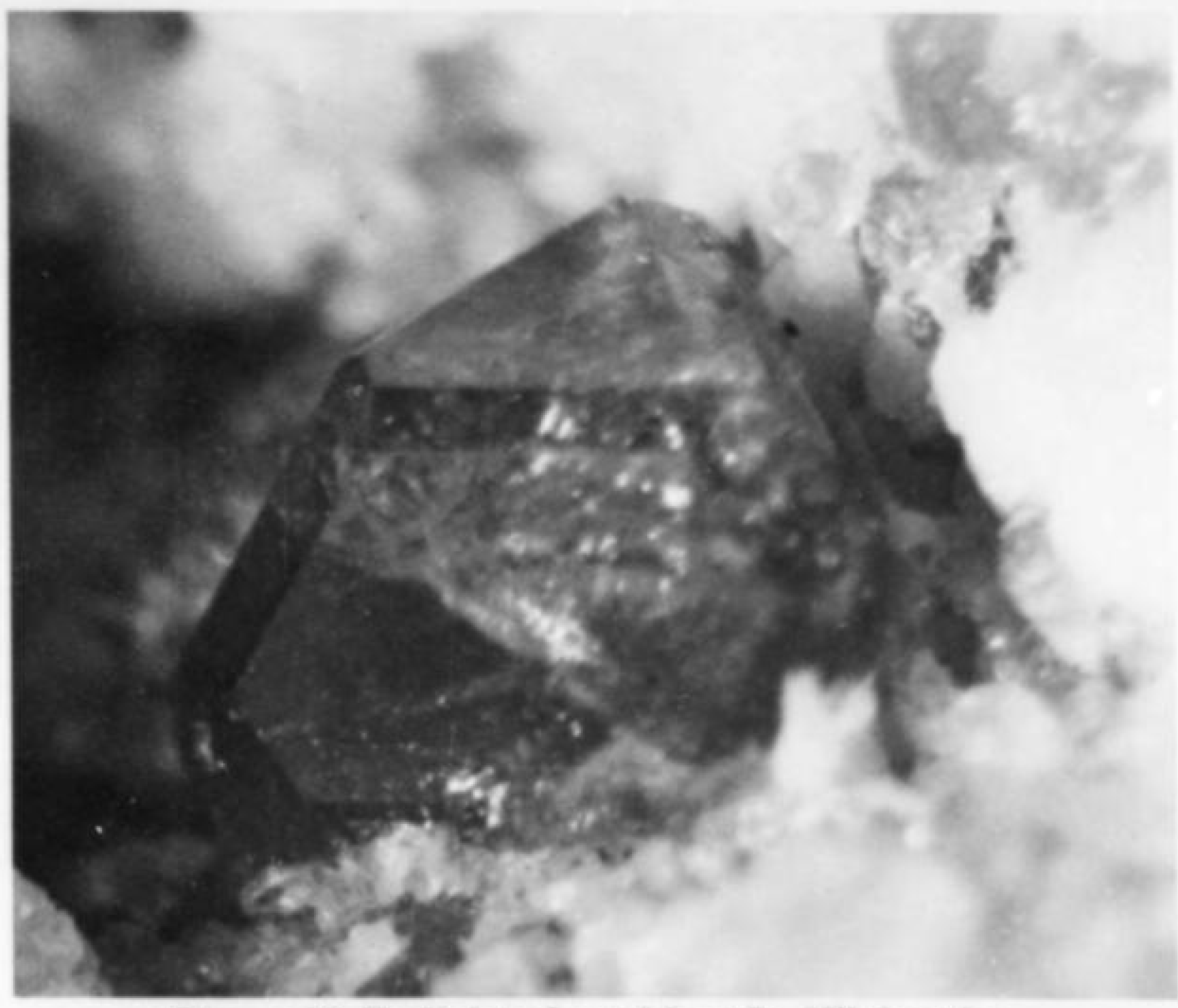

Figure 10. **Eudialyte from Mont St. Hilaire; the crystal is 1.6 mm wide. Henry Budgen specimen.**

Figure 12. **Labuntsovite from Mont St. Hilaire; the crystal is about 6.4 mm high. Marcelle Weber specimen.**

Figure 11. **Mangan-neptunite from Mont St. Hilaire; the crystal is 1 mm across. Peter Tarassoff specimen.**

Figure 13. **Muscovite from Mont St. Hilaire; the top crystal is about 0.35 mm wide and pale pink to mauve-pink in color. Marcelle Weber specimen.**

We are with the silicates to the end. **Serandite** by now is known to everyone. It is the manganese analog of pectolite, and of various shades of pink to orange. It occurs as large, well-formed, obviously triclinic crystals and as mere jackstraws of a creamish color. I mention it only because it was the serandite brought from Mont St. Hilaire by Frank Melanson to Ottawa for identification which put Mont St. Hilaire on the mineralogical map. (Incidentally, **pectolite** is not always white or colorless. Free-standing pale green crystals from St. Hilaire have been X-ray identified as pectolite.)

Dehayelite is rare indeed, found only in one other location in the world, and very rarely at St. Hilaire. The crystals are orthorhombic and pale green. My specimen shows them in a flat spray, platy elongated, and rather lustrous.

Yofortierite is both very rare and a new mineral. My batch was collected in 1969 with the ekanite. When the specimens were washed, the mineral promptly showed signs of matting. It is fibrous, pale pink to violet to almost black, and tends to form in large sprays embedded in the matrix as aegirine will often do. Its cations are magnesium and manganese.

Polylithionite is a clear transparent lithium mica which rarely seems to offer nice clean-cut crystals, its edges usually being floppy and ragged. It picks up color easily from its associates, and where serandite is present will look quite pink.

Muscovite is mentioned only because Marcelle Weber discovered the most beautiful twinned muscovite, which formed minute elongated crystals star-shaped in cross section, with a pale mauve-pink aspect. The picture cannot do it justice, since the crystals are so small (about 0.35 mm in width at the top end) that they cry out for stereoscopic viewing.

Let gmelinite and tetranatrolite represent the zeolites. Both are extremely rare at St. Hilaire, but so also is the more common zeolite, thomsonite. The **gmelinite** I have studied is of two somewhat different habits, although both show hexagonal plates. In the first type, the plates are very thin, white, translucent, with parallel striations following the hexagonal shape of the crystal. In the second type, the plates are much thicker, transparent, and have arranged themselves in complicated rosettes.

Tetranatrolite is a new mineral. The specimen I have seen shows minute bundles of fibers shooting out at right angles to long plates of white monteregianite. This mineral does not differ in chemistry from orthorhombic natrolite.

To finish off I might say that I should be more than pleased to have quantities of new information coming in about Mont St. Hilaire minerals.

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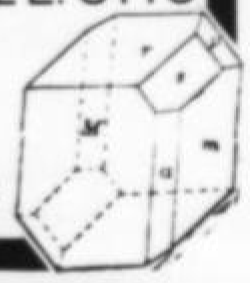

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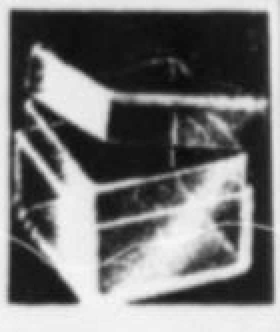

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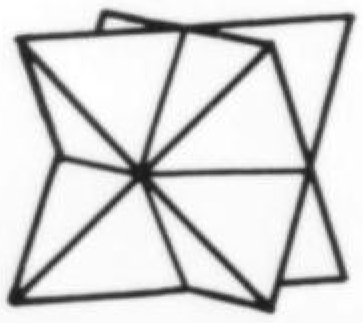

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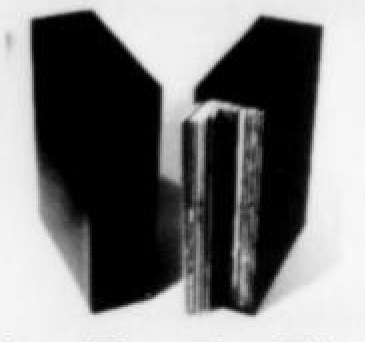

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TSUMEB NOTES

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*The **Mineralogical Record** produced, as its May–June 1977 issue, a 128-page book on the mineral deposit at Tsumeb, Southwest Africa. This being one of the most important and prolific mineral localities in the world, new developments and research worth reporting continue to occur. **Tsumeb Notes** carries articles, abstracts, letters, and notes pertaining to Tsumeb in a format that can be photocopied and inserted at the end of the original Tsumeb book in order to keep the reference up to date. The pages are here numbered in accordance with the original 128-page work. **Tsumeb Notes** in the January–February 1978 issue of the **Record** carried pages 129–131. Contributions are invited.*

OLIVENITE, ADAMITE (and "CUPROADAMITE")(Ref. p. 18,28)

Ordering in olivenite-adamite solid solutions.

(by TOMAN, K. (1978) *Acta Crystallographica*, **B34**, 715–721.)

ABSTRACT

Two of the central questions surrounding the adamite-olivenite series are (1) is there ordering of the Cu and Zn for intermediate compositions; and (2) at what composition in the series does the monoclinic olivenite structure change to the orthorhombic adamite structure? It appears that ordering does exist, with Cu ions in tetragonal dipyramidal coordination and Zn ions in trigonal dipyramidal coordination. It also appears that only 20 mol% of adamite in solid solution is required to cause the olivenite structure to give way to the adamite structure.

Discussion

The status, definition or validity of the term "cuproadamite" is not mentioned in the paper, nor is a suggestion made regarding the composition that should represent the nomenclatural boundary between olivenite and adamite. The range possibly in question is Olivenite_{80} –Olivenite_{50}, where the composition is more olivenite but the structure is adamite. (This range would be referred to simply as zincian olivenite according to the rules of Schaller.) Current convention places the division at 50%, regardless of structure. In either case there appears little possiblity that the term "cuproadamite" will be elevated to species status, although it is moderately entrenched as the ill-defined term for the green, cuprian variety of adamite, having been introduced by Lacroix in 1910.

W.E.W.

ARSENBRACKEBUSCHITE (Ref. p. 19)

Strukturelle untersuchungen an arsenbrackebuschit.

(by HOFMEISTER, W., and TILLMANNS, E. (1978) *Tschermaks mineralogische und petrographische Mitteilungen*, **25**, 153–163.)

ABSTRACT

Single-crystal X-ray studies of arsenbrackebuschite indicate a space group of $P2_1/m$. Three-dimensional Fourier synthesis and least-squares refinement show that arsenbrackebuschite belongs to the tsumebite-vauquelinite-brackebuschite group, and that a structural relationship to tsumcorite exists.

W.E.W.

PYRITE (Ref. p. 29)

Rhythmical banded arsenic- and copper-bearing "gelpyrite" from the Tsumeb ore deposit, S. W. A.

(by OTTEMAN, V. J. (1978) *Neues Jahrbuch für Mineralogie Monatsheft*, **7**, 330–336.)

ABSTRACT

"Gelpyrite" is the term used to refer to colloform pyrite having a variable content of arsenic and copper expressed as rhythmic banding. Origin, occurrence, paragenesis and chemical compositions are described. The origin of the texture is tentatively ascribed to colloidal-chemical processes.

W.E.W.

STRANSKIITE (Ref. p. 33)

New data on stranskiite from Tsumeb, Southwest Africa.

(by HÄNNI, H. A., STERN, W. B., and GLOR, M. (1978) *American Mineralogist*, **63**, 213–215.)

ABSTRACT

Recently found inclusions of intergrown stranskiite, $Zn_2Cu(AsO_4)_2$, and schultenite, $PbHAsO_4$, in massive tennantite from Tsumeb have been investigated, resulting in refined unit-cell parameters and indexed powder data previously lacking in the literature. The stranskiite analyzed has a lower Zn:Cu ratio than the original (type) specimen. It was found in the lower oxidation zone 950 m below the surface, 31st level, E 9 pillar, in 1976. Considering the chemical analysis, the formula now recommended is $\mathbf{(Zn,Cu)_3(AsO_4)_2}$.

W.E.W

RECENT SPECIMEN DISCOVERIES

During the past year many interesting new specimens have come to light, although the overall output of fine specimens has decreased considerably. Fine dioptase has become particularly scarce; an auction held recently by the Tsumeb Corporation in order to sell dioptase specimens (recently collected on behalf of the company) brought remarkably high prices for remarkably mediocre specimens, according to many attending dealers. The auction of so much mediocre material was expected by many dealers to depress the market value of dioptase, but in fact had the opposite effect.

Large crystals of sphalerite (Fig. 1) found between the 28 and 29 levels exhibit a complex habit not previously reported. Also not previously reported is the association of cuprite and wulfenite crystals (Fig. 2).

Several new types of specimens were available at the 1978 Detroit Show. A relatively large amount of cerussite crystals (colorless, transparent, relatively equant, to 2 or 3 cm, badly etched) on duftite-covered dolomite matrix have been found which have a powdery drusy coating of pale yellow mimetite. Interesting crust-like specimens of pink *Co-dolomite* have been found up to about 20 cm in size and less than 1 cm thick. The crusts appear to have formed over a layer of larger crystals of another mineral, probably calcite, now absent. The host crystals over which the *Co-dolomite* formed were low-angle (flattish) rhombohedrons to several cm in size; the *Co-dolomite* formed an overgrowth of epitaxially oriented crystals to 2 or 3 mm each, forming a crust 3 to 5 mm thick. After the host mineral was dissolved away, colorless transparent crystals of wulfenite to 1 cm (thick) by 2 cm (diagonally) formed on the underside of the crusts. These specimens of Co-dolomite were also available last February at the Tucson Show. More recent discoveries include a pale green calcite which occurs as attractive groups of frosty crystals. Wet chemical analyses (Ed Ruggiero, pers. comm.) indicate very minor amounts of Zn and Cu, the latter most likely responsible for the color. Whether the Zn and Cu are present in sufficient quantity to call this calcite a Zn–Cu variety has not been determined. Perhaps the most striking specimens found recently consist of tetrahedral tennantite crystals to 2 cm on matrix; the tennantite crystals are coated by small, thin, gemmy, yellow crystals of mimetite to 1 cm in length, but the matrix carries virtually no mimetite. It appears possible that the mimetite growth drew arsenic from the tennantite. Also recently seen were bright orange, near-gemmy cerussite crystals to several cm; yet another habit of thin, transparent, sharp-edged, gray wulfenite to several cm; attractive, near-gemmy blue-green crystals of smithsonite to 1 cm (though most crystals were about 5 mm) on matrix; large groups of calcite to 20 or 30 cm, in crystals to 5 cm, containing inclusions of a dull green mineral most likely duftite; and long prismatic crystals of transparent, colorless smithsonite to 13 cm in length on a spongy blackish matrix.

These are most certainly not the only new items to emerge recently from Tsumeb. The continuing variety of new specimens on the market makes it possible even today to build an interesting collection of recently mined Tsumeb minerals. Careful examination of dealer stocks will reveal a wide variety of older Tsumeb material also available. It is notable that Tsumeb, even at the current low ebb in specimen production, still provides more fine specimens and species for collectors per year than most other contemporary producing localities.

PHOTOS FROM READERS

Readers owning or knowing of Tsumeb specimens unlike those that have thus far been illustrated in the *Record* are invited to submit photos of them (glossy black and white) for future publication in Tsumeb Notes. Our thanks to Bob Tichelman and John Hepker for submitting several of the photos shown here.

W.E.W.

Figure 1. **Large, twinned sphalerite crystals found in the De Wet shaft of the Tsumeb mine between the 28 and 29 levels. The crystal group, measuring 4 by 6 cm, was washed out of a mud-filled pocket in which it had been suspended in the mud. Several other such specimens were found at the same time. Free-growing pseudorhombohedral crystals of sphalerite have been found previously at Tsumeb but are extremely rare. The sample pictured here represents a new habit for Tsumeb sphalerite as well as remarkable crystal size. Specimen and photo: John Hepker (Silver Hills Mining, Pretoria, South Africa).**

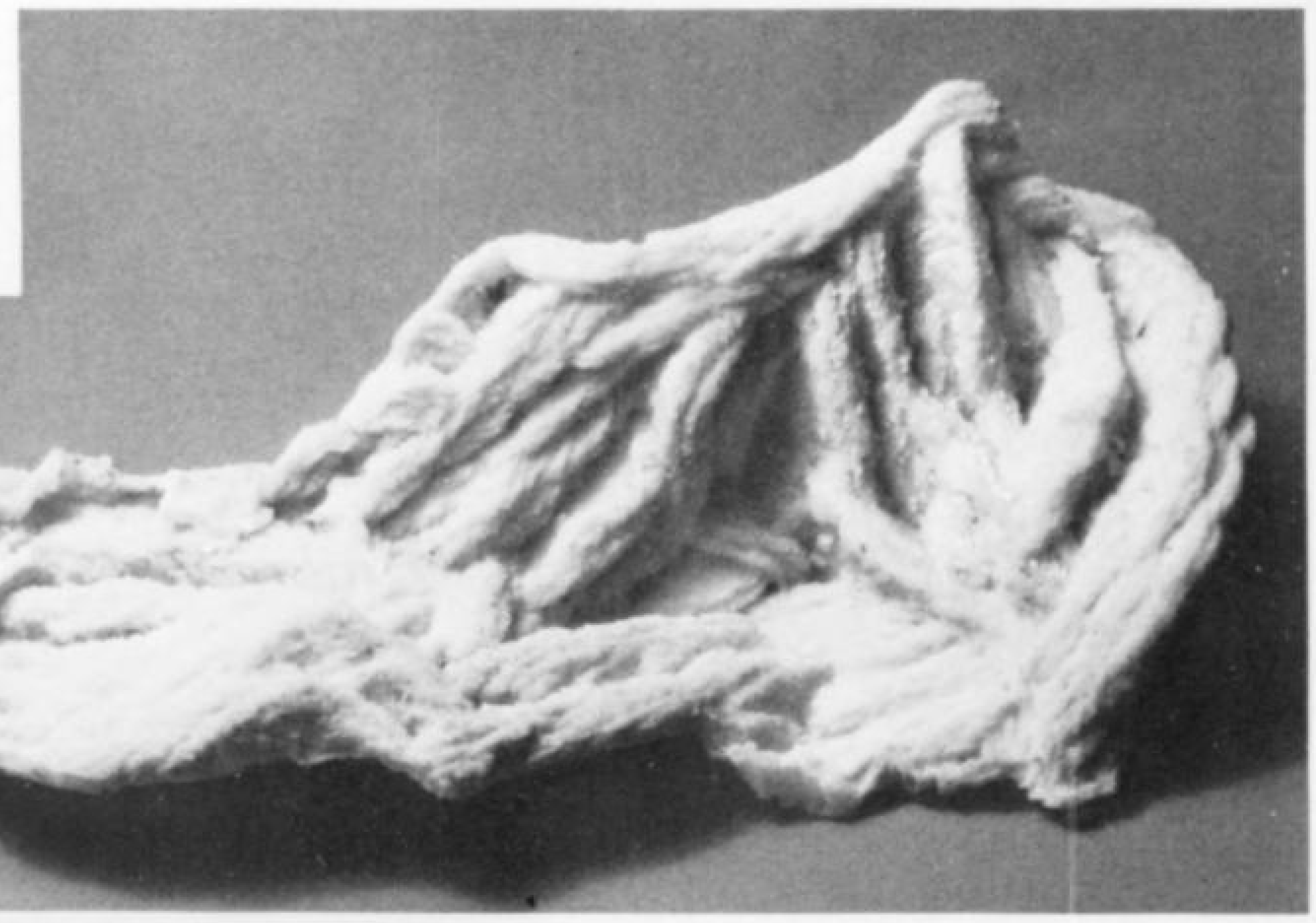


Figure 3. **Pink Co-dolomite 10 cm in length. The dolomite formed a plate or crust which crystallized over a layer of earlier crystals (probably calcite) now gone. The back of the specimen is a mold of the earlier crystals, and also carries a 1.8-cm crystal of colorless wulfenite which formed after the calcite (?) was dissolved away, and a discontinuous coating of minute (less than 1 mm) rhombs of colorless dolomite which appears to have formed last. The Co-dolomite crust is composed of innumerable tiny rhombs in parallel arrangement which appear to have formed in epitaxial orientation over the host crystals. Specimen: Miriam and Julius Zweibel. Photo: Wendell Wilson.**

Figure 2. **A wulfenite crystal with cuprite crystals, one of three specimens known, from Tsumeb. The specimen, 2 by 3 cm, represents a rare association not previously reported. Specimen and photo: John Hepker.**

TSUMEB NOTES

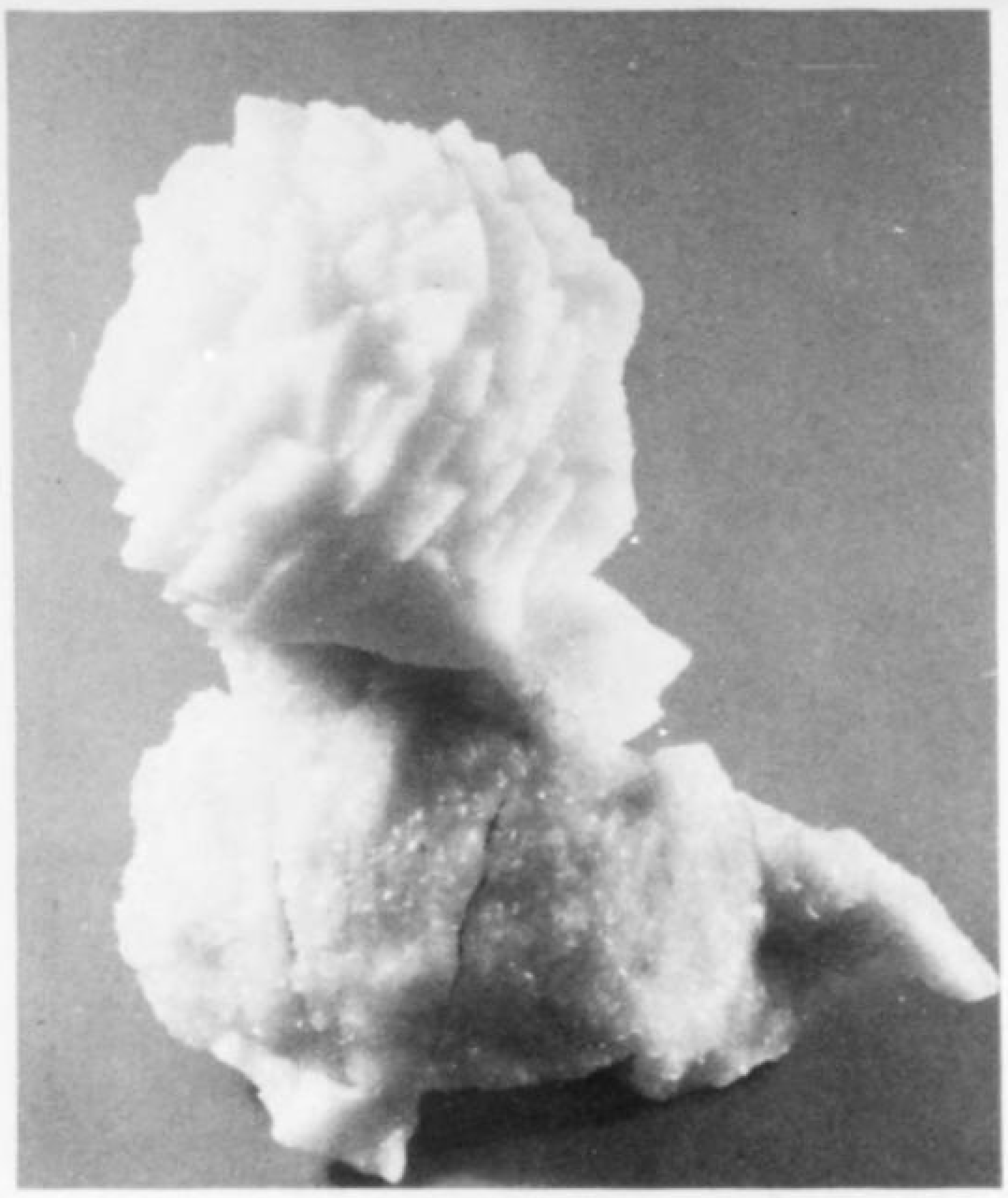


Figure 4. **Calcite, pale green, 8 cm tall, from Tsumeb. The green color is probably due to minor amounts of Cu which have been identified chemically. Specimen: Miriam and Julius Zweibel. Photo: Wendell Wilson.**

Figure 5. **An unusual specimen of tennantite tetrahedrons coated by minute, acicular crystals of clear yellow mimetite. It appears that the mimetite may have drawn arsenic from the tennantite substrate because the mimetite has formed exclusively on the tennantite crystals. The white mineral is quartz; the specimen is 14 cm wide. John and Pat Carlon specimen; photo by Wendell Wilson.**

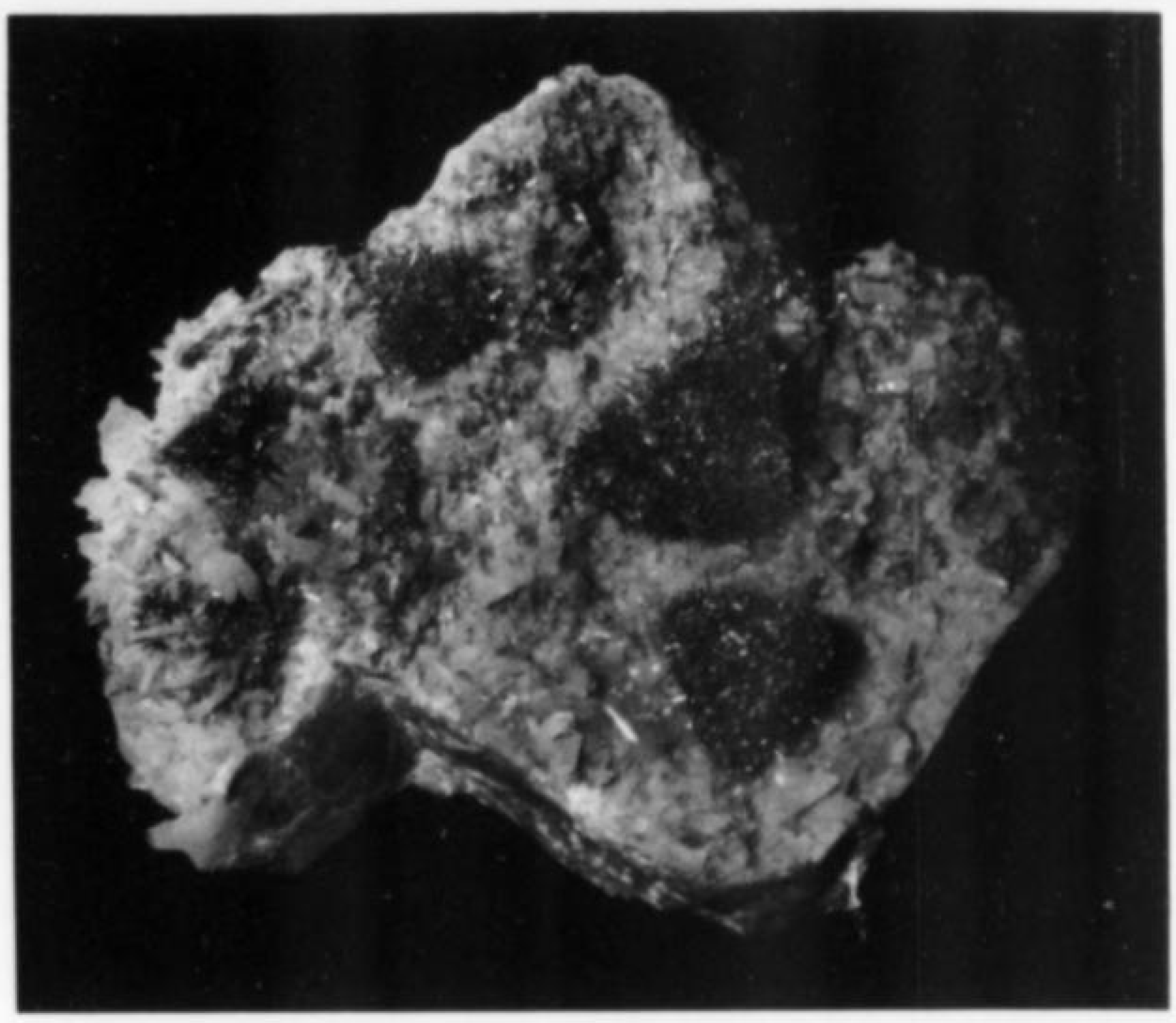


Figure 6. **Very large, pale gray wulfenite crystals from the De Wet shaft, 28 level, East 95 stope, of the Tsumeb mine. The specimen is 11 cm wide. Specimen and photo: John Hepker.**

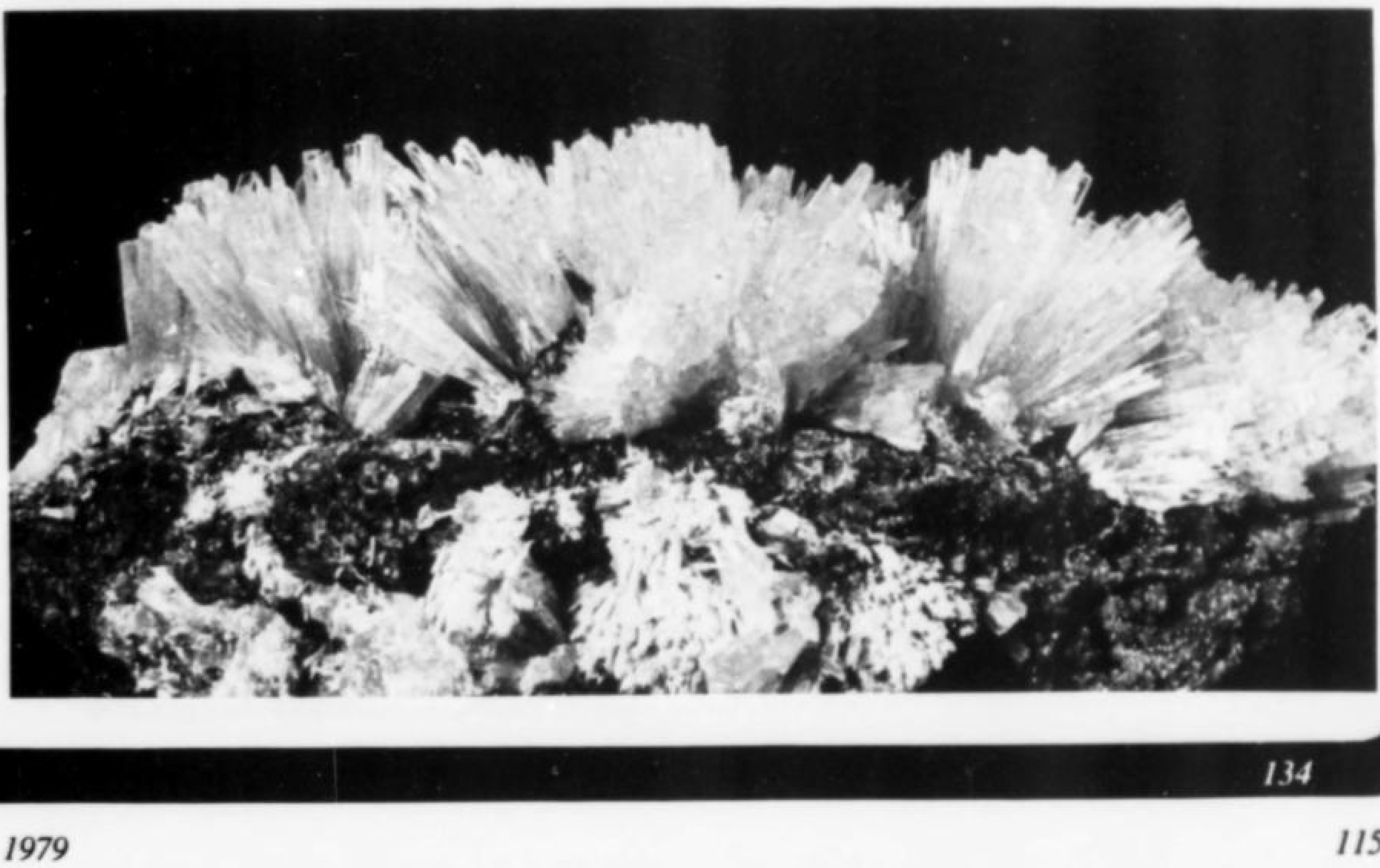


Figure 7. **Aragonite crystals, emerald-green in color, up to 3.5 cm in length, on sulfide matrix from the Tsumeb mine. The full width of the specimen is 13 cm. A similar specimen, sky-blue in color, is in the Harvard collection. The specimen pictured here is from the collection of J. Tichelman, of den Helder, Netherlands; photo by van Loon, den Helder.**

TSUMEB NOTES

Figure 8. Copper crystals on calcite; the specimen is 3.5 cm wide. Collection of J. Tichelman; photo by van Loon.

Figure 9. Intergrown crystals of anglesite from the Tsumeb mine. The group measures 8 by 8 cm. The tabular, translucent crystals are covered by a second generation of frosty anglesite. Collection of J. Tichelman; photo by van Loon.

A MUSEUM FOR TSUMEB

by **Wilfried Schlosser**
Nusswaldgasse 22A/2/1/8
A–1190 Vienna, Austria

Tsumeb's first museum was opened on April 5th, 1975, to commemorate the 75th anniversary of the town of Tsumeb. In addition to an interesting historical and ethnological department, the museum has a comprehensive collection of minerals of rare quality on exhibit.

It was Ilse Schatz who, with the help of members of the Scientific Society of Southwest Africa (Otavi Bergland branch), made it possible for the Tsumeb Museum to become a reality. Mr. and Mrs. Schatz had the good fortune to inherit valuable documents regarding the history and minerals of the Tsumeb mine. These were the papers of G. Schatz, who worked for OMEG (operators of the Tsumeb and Otavi mines) from 1907 to 1947. In 1947 the Tsumeb Corporation Limited (TCL) took over operation of the Tsumeb mine.

Mrs. Schatz originally intended to set up a family museum on the Otjinguinas farm north of Tsumeb, but Dr. Rust, president of the Scientific Society of Southwest Africa (at Windhoek), offered financial aid and persuaded her to find a suitable home for the museum in Tsumeb itself. The next step was to get the TCL management interested in the project. Negotiations resulted in the Schatz family acquiring the lease on the old German school building owned by the TCL.

Figure 10. The Tsumeb Museum; standing outside is the steam engine (Dampfmobile) which was hauled to Tsumeb from the coast in 1925 by 16 oxen. Manufactured in Ipswich, England, the steam engine never saw use underground but was used in connection with a wood saw to cut tamboeti trees for fuel purposes. (All Tsumeb Museum photos courtesy of I. Schatz.)

A local branch of the Scientific Society of Southwest Africa (i.e. the Otavi Bergland branch) was formed by a group of interested and active people including H. Ernst, F. Kasdorf, Mr. and Mrs. Schatz, S. Leimküler, myself and others in order to assist with the project. The school was renovated and remodeled to meet the needs of the new museum. This was achieved through much financial aid from the residents of Tsumeb, and also through the Tsumeb Town Council and Town Secretary A. Krüger.

***Figure 11.* Memorial plaque hanging in the Tsumeb Museum. The motto reads: "May the pine become green, may the ore grow, May God grant us all a happy heart." The words "Glück auf" are a very old German miners' greeting, often found inscribed above the entrance to German mines, which means "good fortune (in finding ore)."**

***Figure 12.* Mining displays in the Tsumeb Museum.**

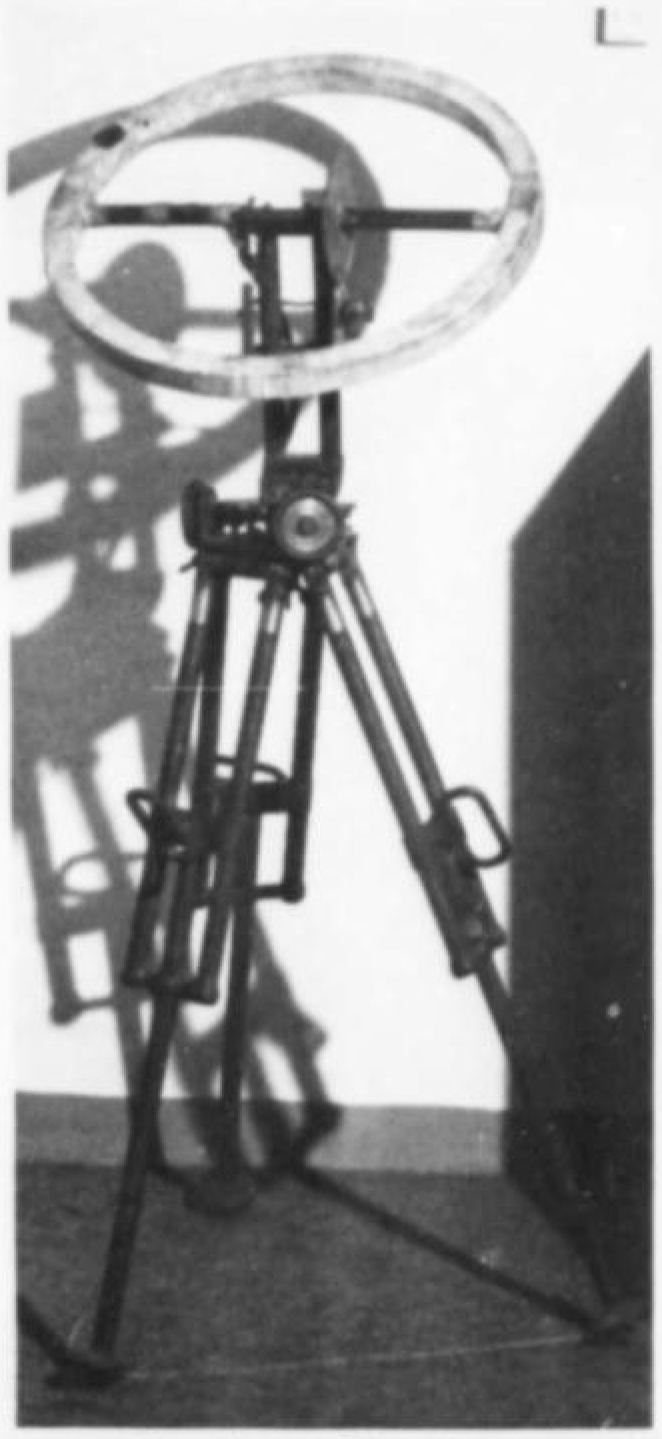


***Figure 13.* An old plane table (surveyor's device) in the Tsumeb Museum.**

Mrs. Schatz still carried the greatest load, but with the assistance of F. Kasdorf, who took care of technical problems such as lighting and burglar alarm systems, other members of the scientific society and myself. I held the position of Town Engineer at the time, and was able to arrange for the civil engineering work to be done.

Then came the time when showcases, curtains, desks, and other accouterments could be purchased to furnish the museum. Mrs. Schatz now had to number and record every item in the museum, while I had the task of arranging and classifying the minerals, and compiling a ledger of specimen descriptions. It was my pleasure to add specimens from my own collection, which are now on display as part of the Schatz collection. Many nights of hard work passed, and Mrs. Schatz even slept at the museum during that period. When all was ready, members of the male choral society of Tsumeb gave a concert in honor of Mrs. Schatz.

Then at last the great day arrived, and on April 5th, 1975, the festive opening of the Tsumeb Museum was declared by H. Ernst, chairman of the local branch of the scientific society. In attendance were the Lord Mayor of Tsumeb, Mr. van Wyck, representatives of the TCL and the scientific society, and many of the residents of Tsumeb.

In addition to very interesting historical and ethnological material, the Tsumeb Museum is also the proud home of two mineral collections of rare quality, the Schatz collection and the collection of the mineralogical department of the Tsumeb Corporation Limited. Both collections are of great scientific value, and include specimens of superb beauty and rarity.

The mineral world is indebted to all of the people who enthusiastically helped found the Tsumeb Museum, and it is my privilege and pleasure to thank especially Mrs. Ilse Schatz who, as initiator, gave all her devotion to this marvelous project. It is hoped that many people interested in minerals will be able to visit the Tsumeb Museum and admire the fine collections, as well as the many other items of historical interest.

Figure 14. A magnificent azurite group, 11.1 cm tall, from Tsumeb, owned by the Tsumeb Museum. It is said that this group fits together at the base with the similar group in the Smithsonian (see photo in vol. 8, no. 1, p. 40, of the *Record*) to form an incredible "bow-tie" specimen.

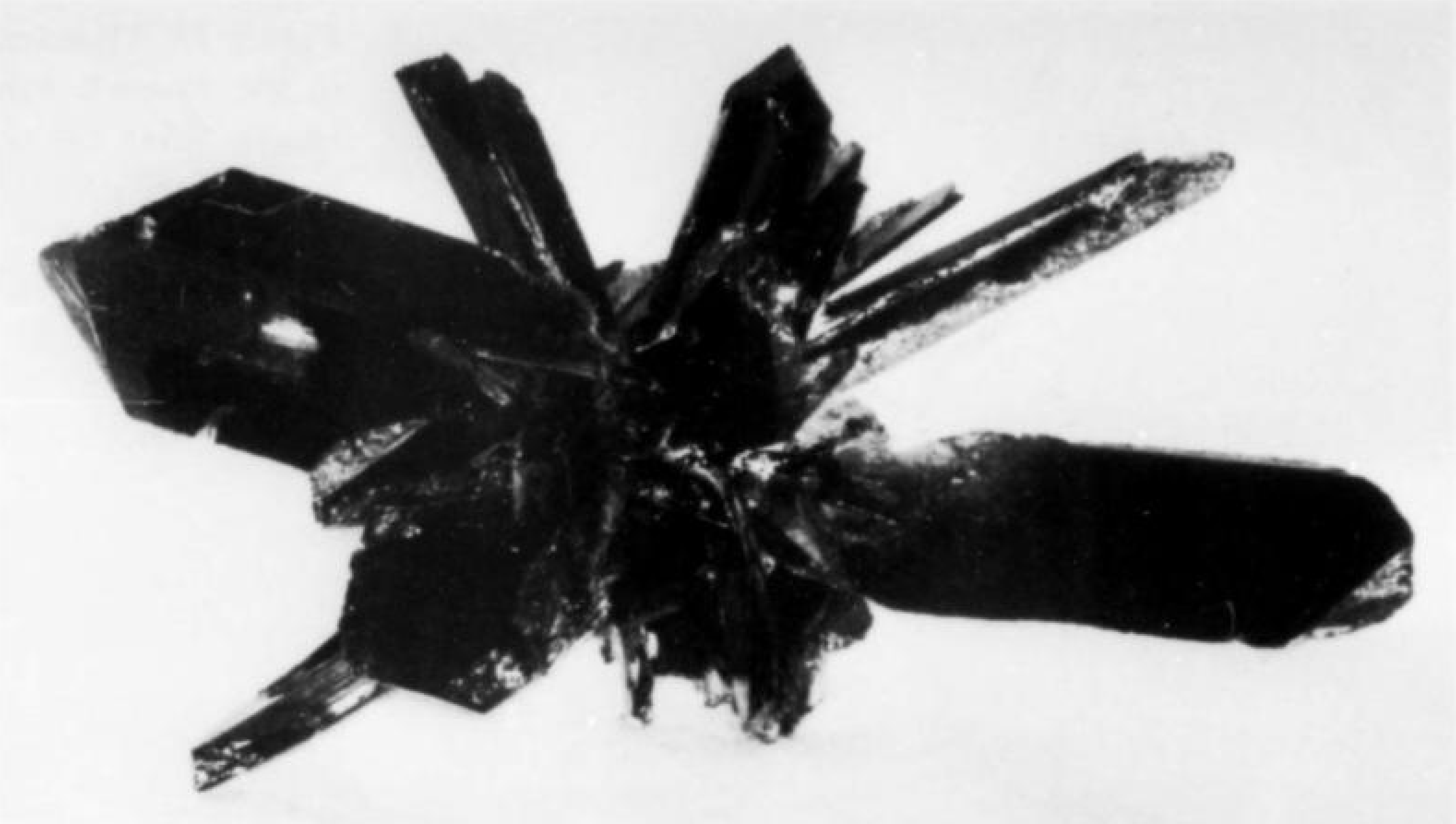
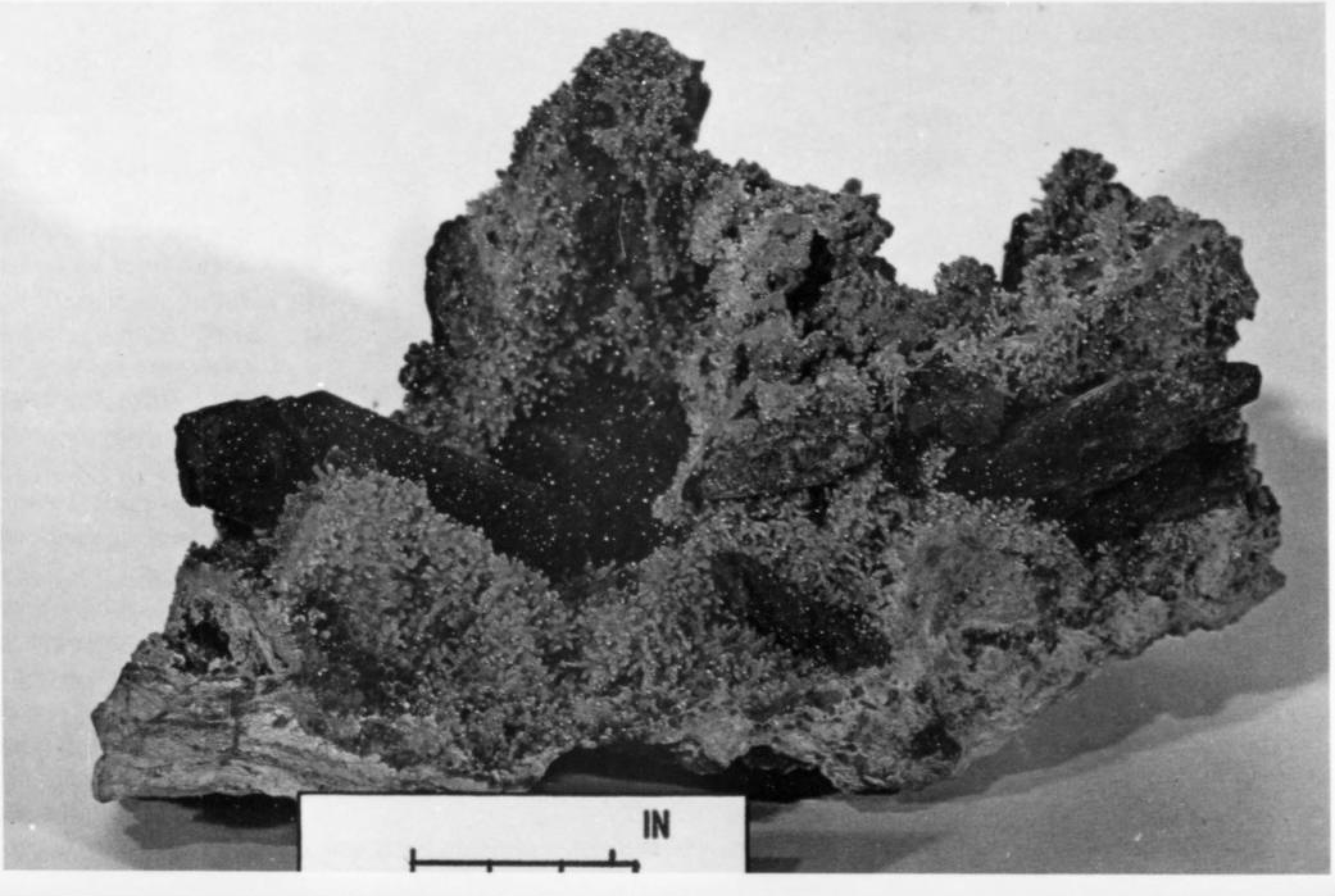
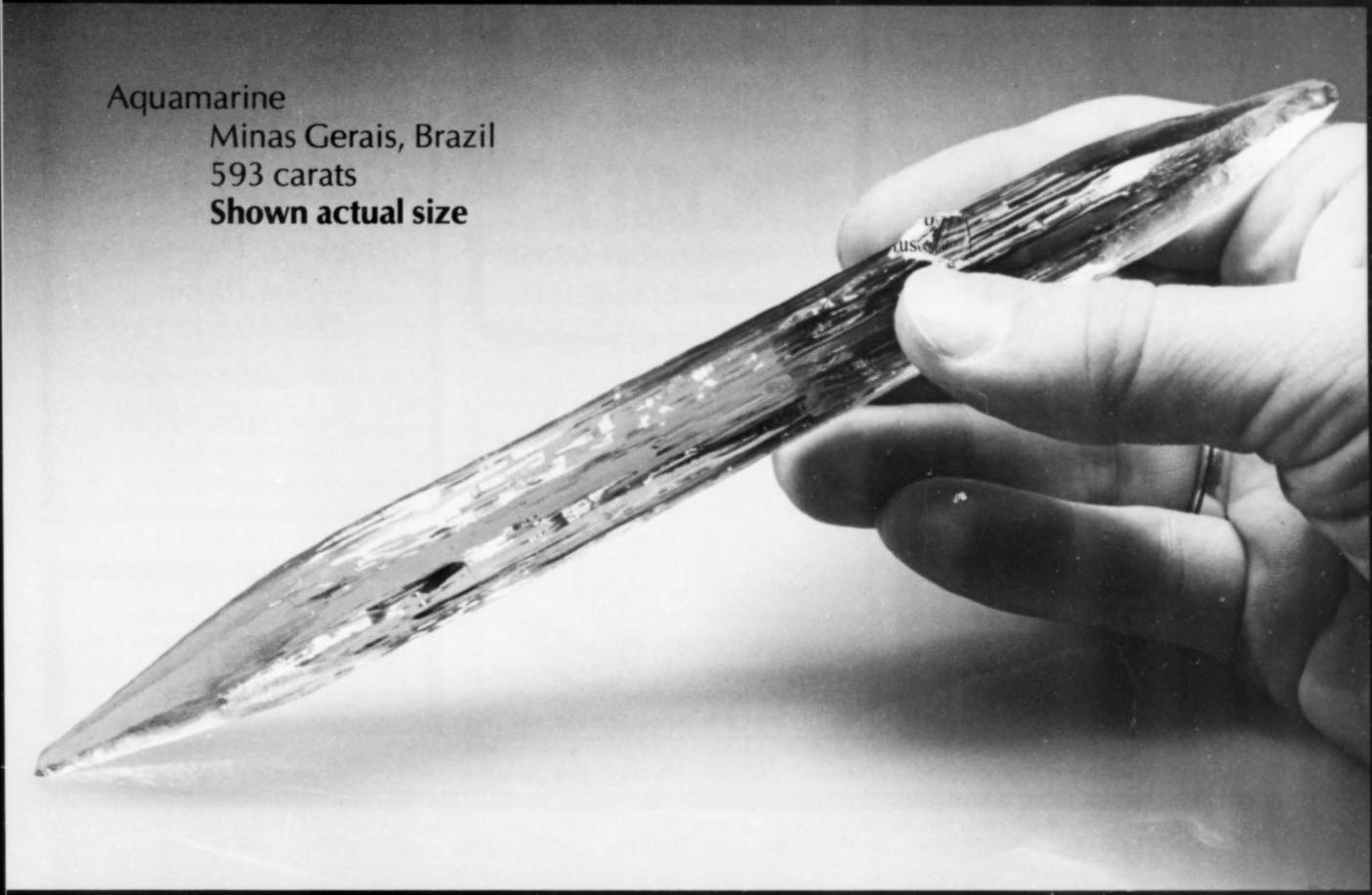


Figure 15. Another azurite from the Tsumeb Museum, this one measuring about 7 cm across.

Figure 16. A large specimen of malachite after azurite in the Tsumeb Museum.





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BOB SULLIVAN'S

LETTER from EUROPE

It seems that if I don't tell you about "that blood red gemmy anatase" I mentioned sometime back (vol.9, no.5, p.318) I'm going to have to cut off the mail and tear out the telephone. Incidentally, even our esteemed editor failed to pick up the error that 20 mm is not equal to "½ inch" but rather to 0.787 inch if you must visualize in the inch scale as I usually do. Since the anatase crystal was actually a hair under 20 mm, think of it as about ¾ inch long; whether metric or English it is a big one for anatase. The crystal is from Norway and when I held it in my hand during my last visit to Oslo, I couldn't believe it, particularly its color, which was a vibrant, deep, gemmy red and truly a magnificent specimen. The doubly terminated crystal was the largest of less than 20 found by a National Museum (Norway) approved team of amateur mineralogists who spent an extended period of time during the summer of 1977 researching and collecting in the National Preserve in the Hardangervidda area of western Norway. Many of the crystals were doubly terminated and ranged in size from 5 to 12 mm, plus the giant described above. Unfortunately none of them were on matrix but it is speculated that most were probably originally attached to quartz similar to their blue brothers from the same area (see the article in vol.8, no.4, p.266). They were found scattered by a stream bed and the team surmised that they had probably been washed down over a period of time from higher elevations where perhaps the original pocket or pockets could be located. A brief search of the higher elevations failed to produce any clues and since time was running out the hunt was temporarily abandoned. It was hoped that this year a more complete search could be made but to date, unfortunately, no additional crystals have been found. Due to the remoteness and high altitude of the area, much of it being snow-covered for a good part of the year, it will be next summer before any further efforts can be made. Meanwhile some interesting questions have been raised. Has red anatase ever been found before? Apparently not. What is it that makes the anatase red? Perhaps in a future column I will be able to give you this answer and show a photo of one of these remarkable anatase crystals. A note of caution for those who have the desire to visit this area. It is State property, closed to all collecting and Norway's Mineralogisk-Geologisk Museum in Oslo exercises virtually complete control over access to the area.

News from "down under" has come via Australia's enthusiastic mineral collector Al Chapman, a frequent visitor to the European and American mineral scenes. Principal exposure of mostly Australian minerals was made at their National Show held at Glen Waverley, Victoria, early this fall. The hit of the show was a large number of gold specimens and nuggets brought by one dealer from Western Australia. In spite of the fact that gold was at nearly record prices there were many takers. According to Al, "one exceptional piece shown was a thick crystallized wire gold, in appearance somewhat like the 'catherine wheel,' with a small amount of calcite adhering to the wires. This specimen came from the once-famous Gympie mine in Queensland. Though only a little over one ounce of gold was present in this piece, its aesthetic crystallized form made it, weight for weight, many times more valuable than nuggets much heavier." There was not much "new" at the show but a good selection of minerals was available including those fine huebnerite and rhodocrosite specimens from Peru, some exceptional South African rhodocrosites (they seem to be everywhere!), excellent Tasmanian crocoite (large crystals and more brilliant than ever from what I've seen lately) and sapphire-blue, prismatic apatite in galena from Broken Hill, a truly "drooly" sounding mineral! According to Al, a new promising apatite locality was recently discovered at Lake Bogan in Victoria where the apatite occurs along with smoky quartz in a granite pegmatite. This one certainly sounds promising for some super specimens—let's hope the development is successful. Australia is one of the places I'd love to go to one day, and the National Show at Waverley sounds like a good excuse to go there and add number 45 to my list of countries visited.

Speaking of Australian minerals there is one that has been seen occasionally at various European bourses which I find most interesting but nowhere have I seen it written up. These are uniquely shaped crystallized azurite nodules that range in size from 2 to 25 cm in diameter and from 1 to 3 cm in thickness. They are roughly discoidal in shape but the rare ones are figure-8 shaped, this the result of 2 discs having intergrown on their edges. The largest that I know of weighs over 2.5 kgs (5.6 lbs.) and is a figure 8 nearly a foot in diameter. (It is a prized member of my own collection.) Colors vary from an attractive sky to marine-blue and the more unusual ones show sharp-edged, roughly tabular, 2 to 15 mm crystals growing radially on the surfaces and particularly the outer edges. Rather strangely, some of the discs are convex while others are concave and oftentimes the outer edges are razor-thin and very sharp. Good undamaged specimens command fancy prices in Europe, but scientifically speaking they still remain a mineral curiosity. I have written a number of letters to Australia but I have been unable to pin down all the facts on them as they have apparently not been researched. The locality is certain: white clay banks on the Aryonga Aboriginal Mission area, 160 miles west of Alice Springs, Northern Territory. Several experts have expressed the opinion that they are azurite replacements of a form of marine life or algae, but I would appreciate hearing from anyone who can shed some factual light on the evolution of these unusual azurite specimens. By the way, these nodules should not be confused with the somewhat similar appearing ones from the Sir Domenic mine in the Flinders Range of South Australia, which incidentally are also very attractive. The Sir Domenic ones are usually smaller in size, more ball shaped, and generally have larger crystals covering most of the surfaces. They are sometimes pure malachite or more often a mixture of malachite and azurite wherein the malachite has formed as a pseudomorph after azurite.

More on that exciting "cranberry" tourmaline from the Itatiaia mine near Conselheiro Pena, Minas Gerais, Brazil—the story seems to have no end! As briefly mentioned in the previous issue, the mine has been blown up, this as a result of a dispute between the farmer landowner and the lessor Jonas. Jonas literally blew his stack when the farmer tried to increase the lease fee from $100 to $2000 per month, this following the discovery of the large pocket of rubellite in April (vol.9, no.5, p.298 and 327). With several cases of dynamite, strategically placed along the 60-meter adit, Jonas managed to bring down the roof along the adit's entire length. He is now off trying his luck in another area. The value of the largest specimen, the so-called *rocket* is not $1,000,000 as I reported in my last column, but *$30,000,000* and the two smaller ones a mere $10,000,000 for the pair. Repunching my calculator a bit I come up with a new carat price of the "rocket" at about $25 per carat, certainly not cheap as I previously commented. I am indebted to curator Peter Keller of Los Angeles for much of the above information.

Most of Europe's major bourses are now history as I write this and for those who must have something new and beautiful to whet their mineral appetite, disappointment was mostly the order of the day. Yet many fine minerals were offered, business was generally brisk and in some cases new attendance records were set. The hobby seems to be entering a new growth cycle in Europe and perhaps this "fire" will spread back to the U.S.A., from whence it first blew across the Atlantic some years back.

Altdorf, the traditional Swiss opener to the fall European mineral season, was crowded to the hilt on opening day and getting near a table was a problem particularly for those wanting a first crack at the Swiss strahlers' initial offerings from their summer in the alps. In reality there was nothing really new but there were some excellent minerals to be had. Outstanding were some very fine groups of long needle quartz from Val Bendretto near the Italian border. The long, slender crystals ranged up to an unusual length of 8 cm and plates of these available up to 20 cm or more in diameter were indeed striking. One of these larger plates was sold for over $2000 by the strahler who removed it. A few of the plates contained a pair of Japan-law twinned crystals, rarely seen from this region. The long, slender twins, unlike any I've seen from any other part of the world, are indeed beautiful, that is if you like such twins (as I do, being a Japan-law twin "nut").

Some very fine Swiss hematite *eisenrosen* (iron roses) were available, also the much rarer *ilmeniterosen* (ilmenite roses). The iron roses, though mostly thumbnail in size, were especially brilliant and came mostly from the Ritter Pass in the Binnatal near the Italian border. The ilmenite roses were from Piz Lucendro, in the Gotthard Massif area and the Maderanertal in the so-called northern calcareous Alps. *Tal* in German means "valley," by the way. It is sometimes difficult to tell the difference between the two types of "roses," particularly since alpine hematite (Fe_2O_3) always contains some titanium and will give a nearly black streak closely resembling the jet-black streak of ilmenite ($FeTiO_3$). For positive identification chemical or X-ray tests should be conducted but, generally speaking, the ilmenite tends to be a shiny black while the hematite is more of a silvery dark gray color. From what I have observed, the "roses" of the hematite seem to be generally more tightly formed, but both indeed are beautiful and are rare additions to any collection. Strangely enough it is Switzerland that has historically developed a reputation for the finest iron roses but the northern alpine regions of Italy also have produced some fine examples. Ironically "Switzerland's finest example," a magnificent hematite iron rose 10 cm in diameter and resting in the collection of the University of Bern, was found on the Italian side of the Ritter Pass in the Binnatal!

Very fine examples of clear window or skeletal quartz from Val d'Jittiez in the southern Valais region of Switzerland were offered at Altdorf by the one Swiss strahler who seems to have a corner on this market. They were mostly doubly terminated, highly skeletal examples from 2 to 5 cm long and represent one of the lesser known Swiss mineral "trademarks." The trick with these is to find them with relatively clean skeletalized areas, because the soft clay they are found in infiltrates them very deeply. Like their brothers from Herkimer County in New York, the Valais examples occasionally form together in crystal clusters making very fine miniature display specimens. However the Valais crystals are never clear like the "Herkimer diamonds."

Now that I have mentioned it I would like to point out that Europe too has its "Herkimers." One example is from Rémuzat in the province of Drôme, France, and they are called "Mirabeau diamonds" after the district in which they are found. They occur in septarian quartz geodes, from 5 to 15 cm in diameter, which when broken apart reveal the small but very bright "diamond" quartz crystals. The others are called "Carrara diamonds" and are indeed beautiful as they are contained in the crevasses and pockets of pure white marble from the quarry Michaelangelo made famous at Carrara, Italy. The Carrara crystals run a bit larger than the French ones, ranging up to 3 cm in length, but neither reach the size of their big brothers from Herkimer. The "Italian Herkimers" as they're sometimes called, must be sawed out of rejected marble blocks from the still-working Carrara quarry but nonetheless make extremely attractive as well as somewhat historical specimens. They are quite expensive, unlike the moderately priced French ones. Both occasionally show up at the European bourses, particularly those in France and Italy.

Altdorf did produce one new item, to me at least, in the form of good rhombohedral calcite crystals from the Churfirsten, a beautiful mountain range bordering the lake of Wallen (Wallensee) in the Swiss canton of St. Gallen. The crystals and groups are a translucent white to gray, from ½ to 4½ cm long, and some contain phantoms. They were eagerly scooped up by the Swiss who are enthusiastic calcite collectors almost to the last man (or woman). For the rare mineral collector, one Swiss strahler offered good examples of tinzenite, piemontite and sursassite from his own Tiefencastel area.

Perhaps the one big hit at Altdorf was a fine collection of yellow barite from the island of Sardinia, Italy, offered by (naturally) an Italian dealer. The attractive, well-formed, transparent to translucent, bladed crystals were up to 1 cm in thickness and from 3 to 10 cm in length. A few were on a rather clear fluorite matrix and in general all were showy specimens. Now that I think about it I believe this barite has been the best new material to appear on the European scene so far this fall. Unfortunately only a limited quantity has been available and they are expensive even by European standards. The only other yellow barite specimens from Europe that I have ever heard of came from Cavnic, Romania, about 5 to 6 years ago and were indeed also spectacular. Most were plates prolifically crystallized with 1 to 2 mm-thick, golden to yellow, gemmy, tabular crystals ranging to over 3 cm in length. Many of these were crystallized on both sides of the plate and the most stunning of all had jet black barite crystals on one side with the golden yellow crystals on the other. A few of these are still around at some of the European bourses and are on the expensive side.

The Stuttgart, Germany, bourse which took place on the same weekend as Altdorf had no real surprises mineralwise but did have several very fine displays by private collectors. Perhaps the finest display of Romanian minerals ever to be shown in a European bourse appeared at Stuttgart. The display consisted of seven 1½-meter glass cases chock full of some of the best minerals ever taken out of once prolific Romania. It was presented by a German collector-dealer who was one of the early "border runners" in the heyday of Romanian minerals some 5 to 10 years ago. Some of the stibnite specimens rivalled even the Japanese ones but, while there were many offers, none of the collection was for sale.

At Stuttgart there was an abundance of material offered by a fairly representative group of European dealers, and a few of the current standards were back in good quantity as a result of summer expeditions. They included a good collection of those unique floater octahedral pyrite crystals from Murgul, Anatolia, Turkey, fine thumbnails and micros of serpierite and cuproadamite from Laurium, Greece, and an unusually fine collection of Zambian minerals including the elusive torbernite and libethenite specimens. For the classic hunters one German strahler offered a selection of green pyromorphite from the very old Grube Johanette (Johanette mine) at Kransberg in Taunus near Frankfurt, Germany. Crystals were medium green in color and ranged from 1 to 8 mm in length on an attractive, constrasting tan matrix.

Europe's two biggest bourses, Munich and Zurich, both went over with a bang this year. Munich with over 18,000 visitors set a new bourse record and I suspect this could be the greatest attendance ever at a mineral show. I'll have to check my "Guinness" on this next year! Zurich took place two weeks later in mid-November and apparently gave a number of potential visitors a chance to recover from Munich, unlike last year. Attendance at Zurich was up more than 50% over last year's low and, generally speaking, business was good. Conspicuous by their absence were nearly a dozen Swiss strahlers who regularly do the bourse; the reasons were somewhat vague. I suspect that the general shortage of Swiss material plus the high expense of their participation in a major bourse like Zurich were the causes. Still, 280 dealers showed their wares in Zurich's huge Zuspahalle. At Munich 282 dealers from 32 different countries including 265 from western Europe and 13 from overseas offered a wide choice of material. All five continents were represented. The newly instituted auction was not all that successful, however, since only about 30% of the 150-plus items offered were sold. In addition to mineral specimens, the offerings included old mining stock certificates, books and a few faceted stones. The value of the pieces offered was from $50 up with several in the $15,000 and over class. They included a 32 by 22-cm specimen of "Congo" (Zaire) dioptase with individual crystals up to 2 cm, a 10 by 6-cm red "cranberry" tourmaline group from Brazil, and a huge 70 by 40 by 23-cm Sicilian sulfur on an aragonite matrix with the largest crystal measuring 6 by 5 cm, plus a good assortment of crystallized and nugget gold from the U.S.A. and Russia. A fine, rare, reticulated Tsumeb cerrusite from the Sid Pieters collection was sold but, primarily due to excessively high minimum bid prices, most of the better mineral specimens remained unsold. As one visiting Canadian put it "in Europe there appears to be a recognizable trend towards better quality but no acceptance of higher prices." I think the recent steep drop in the dollar plus the great strength of the German mark in Europe was also a factor, but also quite understandably a new venture always has growing pains.

An added attraction at Munich this year was a collection of minerals from the Smithsonian's Carl Bosch collection brought over by John White. Bosch's magnificent magnetite specimen from the Binnatal, Switzerland, was thought by many to be the best specimen of the show. In the competition (which naturally excluded the Bosch collection) first prize for the most beautiful mineral was again awarded to an American specimen, a fine example of two twinned orange-gold calcite crystals and a large deep violet fluorite crystal on a black matrix of sphalerite from Elmwood, Tennessee, displayed by Hans-Martin Udert of Berlin, Germany. First place for rarity went to an unnamed exhibitor for a large, deep green vivianite crystal on yellow amblygonite from Brazil. I suspect it was from Galilea near Governador Valadares, Minas Gerais, which has been producing a few beauties of late, but the exact locality was not stated.

Most of the dealers of Munich also attended Zurich with much the same stock so I shall mention some of the more interesting offerings at these bourses collectively. There is no doubt that one of the recent swings in minerals in Europe has been towards an increasing quantity of specimens from South America, particularly from Peru and Chile. A fine selection of Peruvian huebnerite, rhodocrosite, pyrite and quartz (some Japan twinned) was available from a number of dealers from both Europe and Peru. The beautifully colored, translucent, rhombic, red rhodocrosite crystal specimens from Pasto Bueno, Peru, were really in abundance and with the exception of those crystals in the 3-cm and up region were quite moderately priced. As an example, good 3-cm rhombs were priced at 10 times as much as a 1-cm rhomb, and a 5-cm rhomb 30 to 40 times a 1-cm crystal. Similarly, a good selection of Chilean atacamite and brochantite on chrysocolla from Copiapo was around but there was one item relatively new. This was a collection of wire-gold imbedded in blue chrysocolla from Inca de Oro near Copiapo, Chile. Most were thumbnail or miniature in size with the mm-size wires up to 10 to 12 mm in length, a few in an attractive dendritic form. There is promise of some top-class specimens from this locality as exploitation continues.

Inca de Oro is also producing a limited quantity of, of all things, dioptase. The crystals, however, are extremely small and their form is not even distinguishable with a 10-power glass. Color is a lively light blue-green and those I have seen appear as a very thin crystallized layer on top of a thicker crust of chrysocolla on what appears to be an ironstone matrix. They are of principal interest to locality collectors. This now adds a fifth country to my limited list of lands currently producing dioptase. They are now Chile, Russia, U.S.A. (Arizona), Southwest Africa (Tsumeb) and Zaire (which are usually marked "Reneville, Congo"). Perhaps there are others and if so I would appreciate being advised of them. Certainly the Tsumeb specimens are the world's most beautiful but my favorites are those much rarer specimens from Zaire with their huge crystals and esthetic geode form. The largest Zaire crystal I have seen was over 4 cm long, but I have heard of them exceeding 6 cm in length!

The gold specimens were offered by a Chilean dealer who also had a number of specimens of mm-size proustite crystals on matrix from Chanarcillo, this a rare one, plus a relatively recent find of rich brochantite from Potrerillos. The needle-like crystals of the latter run a bit thicker than brochantite from Copiapo and the attractive sprays are also a bit darker green against a similar bright blue chrysocolla background. They are at times difficult to visually distinguish from atacamite specimens from Copiapo. In the past, principally at the German bourses, I have seen an occasional specimen of black melanite garnet labeled simply "Chile." Now suddenly a fair number of very fine, large, crystallized melanite specimens on matrix have appeared in Europe labeled "Tierra Amarilla" which is near Copiapo. They are not quite as brilliant nor is the somewhat drab tannish-white matrix as attractive as the neat grayish-white on specimens from San Benito County, California, but the crystals are relatively huge. Average size of the sharply formed crystals runs from 1 to 2 cm and the larger ones exceeded 4 cm. There is some promise here for some really attractive specimens as exploitation is said to be in an early stage.

Azurite crystals from Kerroucher, Morocco, were offered by a couple of French and Belgian dealers and some of them were surprisingly good. They consisted of mostly well-terminated, large, blocky crystals up to 1 cm in thickness and to nearly 3 cm in length. In many respects they resembled their Southwest African brothers but lacked the rich blue color of some of the better Tsumeb crystals. Few were on matrix and many were somewhat damaged, but they were one of the few bargains around.

At Zurich a very large collection of clear, acicular crystal sprays of mesolite from Poona, India, were offered by a Swiss dealer and he was doing a land office business. It took him longer to package them than to sell them as the extremely delicate needle sprays, some of which exceeded 10 cm in length, are almost impossible to pack safely. Prices were moderate but virtually undamaged specimens of the larger crystal clusters were going for upwards of a thousand dollars, or about 1700 Swiss francs by today's exchange rate. Only a few years ago this would have been equivalent to less than $400—how things have changed!

For the first time in Zurich a good collection of Polish minerals was offered, these from Tarnobrzeg, a small town on the Wista River in southeastern Poland. Specimens from Eastern Europe tend to raise the eyebrows of most West European collectors and though they were nothing extraordinary, they were moderately priced and eagerly snatched up by a number of locality collectors. The best of them was crystallized "schwefel calcit" which when translated literally means "sulfur calcite." Actually they were crystals of calcite with included sulfur which gave them a pleasing yellow appearance. Clear barite and a light blue celestine, both nothing special, were two others available from Poland.

There was one rather unusual group of specimens which appeared at several bourses this fall: extremely lightweight, hollow quartz specimens from Brazil. They were somewhat weirdly shaped, 1 to 2-mm-thick, interconnected small plates of quartz which formed roughly hollow, distorted, boxlike structures up to 20 cm long. I find these most difficult to describe and think Maudine's name for them, "funny quartz," is most appropriate. Obviously they are quartz pseudomorphs after something and, after examining the interior of a broken specimen, I guessed calcite. The dealer professed his ignorance as to what they really were and guessed the locality to be "somewhere in Minas Gerais."

The Munich show is usually not complete without at least one good offering of tourmaline and this year it was a fine collection of those elusive crystals from Nepal in virtually all colors. Most of them were long and slender; some very fine, rather gemmy, lively pink crystals were available up to 5 cm long from the Sonquasawa mine, Bratnagar Site, Nepal. Some fine bicolor and tricolor varieties from Chainpur, Nepal, were also offered and included the rare and beautiful pink, yellow, light green tricolor crystals which to me have made Nepal tourmalines most famous. A few light colored "watermelon" crystals, also from

Chainpur, plus a variety of solid colors ranging mostly from pinky reds to various shades of green were available and all were, by U.S. standards, rather moderately priced. The reason I say "by U.S. standards" is that it seems to me that many American dealers tend to put too high a premium on the degree of gemminess in a tourmaline crystal. Faceting-grade crystals are exempted in this comment since those prices are relatively standardized worldwide. Since most dealers buying at the source purchase their tourmalines as a lot, sorting, grading and pricing is up to them—no simple task to be sure but, as I have seen it, the best buys in "semi-gemmy" tourmaline collector crystals are in Europe, and in particular in Germany and Switzerland. I am sure there are some who will disagree with me on this.

European collectors were particularly delighted this year to see a fine array of those beautiful specimens of red beryl on rhyolite from the Wah Wah mountains, Beaver County, Utah, offered by Ed Harris, a visiting U.S. dealer at Munich. The display was enhanced with a series of colored photos showing the mine, examples of some of the finest specimens and faceted stones found or cut to date, and the prices were by European terms somewhat more moderate than at their first showing by an American in Zurich a year ago. The nearly 25% drop in the dollar since last fall was largely responsible for the price dip. To the many inquirers the facts were simply summarized. "Many of the beryls were found doubly terminated and the largest crystal to date is 13 by 26 mm. Because of poor adherence to the rhyolite, plus the blasting necessary to get them out, many of the crystals were off matrix but surprisingly few were damaged. Many of them do have natural 'defects' where varying size pieces of rhyolite had originally been attached to the crystals, giving them the appearance of having been 'eaten away'. The largest faceted stone cut so far is 3.63 carats but there are some inclusions in it. The largest of all gemmy cut stones was a rare 2.4 carat beauty valued at over $3,000 per carat. Other good faceted stones were valued in the $1,000 to $3,000 per carat range but quantities of them are extremely limited." Many visitors to Munich thought this offering the best of the show and, needless to say, the dealer did a brisk business.

For a couple of years now two German dealers have been exploiting the hinterlands of Turkey bringing back a variety of rare minerals plus occasionally various members of the borate group. This year's summer expedition, however, resulted in an extremely fine collection of colemanite from Bigadiç, a small mountain town on the Simav River on the eastern edge of the large province of Anatolia. It was offered at both Zurich and Munich. The very gemmy monoclinic crystals were extremely sharply formed and ranged to nearly 30 cm in length. They were attractively clustered in varying size euhedral crystals from ice-clear to those with varying tones of white, gray and tan. Some groups showed several color variations and were over a meter long! They have seldom been seen in the U.S.A. as the Boron, California, specimens are readily available at cheaper prices, but in my opinion the stark perfection of the thick, highly modified tabular crystals from Bigadiç make them exciting specimens to behold. Some of the rarer borates offered included probertite and ulexite. The probertite specimens were typically brownish in color similar to the California ones but the somewhat longer radial groups of needle crystals ranged up to 40 cm. The ulexite was not of the "TV stone" variety so popular in the U.S.A., but was similar in form to the probertite with fine white crystal fibers varying from 10 to 15 cm in length. Other specimens included hydroboracite, very good artinite and the rare cuproan melanterite and pizanite in the form of thin, fragile but showy, light to dark blue crusts.

As I write this the European mineral season is nearing an end with Basel and Paris the only two remaining major bourses. I have heard a couple of year-end surprises are expected to pop at the elite Swiss show in Basel and I hope to tell you about them next time. A special set of thanks goes to Beth Lesnick, Uli Burchard and Linda Kubler for each of their fine spotting jobs at several of the above-reported bourses.

"Tucson time" will soon be here and this year the greatest concentration of European dealers and collectors ever are expected to travel all the way to Arizona to help the Tucson Gem and Mineral Society make its silver anniversary show a memorable event. I know of at least three charter groups which are heading for Tucson, one from Germany, one from France and a third leaving Zurich, Switzerland, with a stop in London en route to pick up more mineral enthusiasts. We wouldn't miss it for the world!

A special *tack* (thanks) to Knut Eldjarn of Norway for pointing out that thalenite is not from the same locality as ktenasite as I reported previously (vol.9, no.5, p.318). As Knut put it, "finding thalenite in the same locality as ktenasite would be like finding rubellite at Bisbee! The thalenite comes from the only good crystal producing locality in the world, Hundholmen in Tysfjord." Tysfjord lies some 100 airline miles above the arctic circle in the area of Narvik, Norway, and is no place to dig minerals in the winter! The ktenasite is from Glomsrudkollen, Åmot, Modum, in southern Norway. I will tell you a bit more about these localities in a future column.

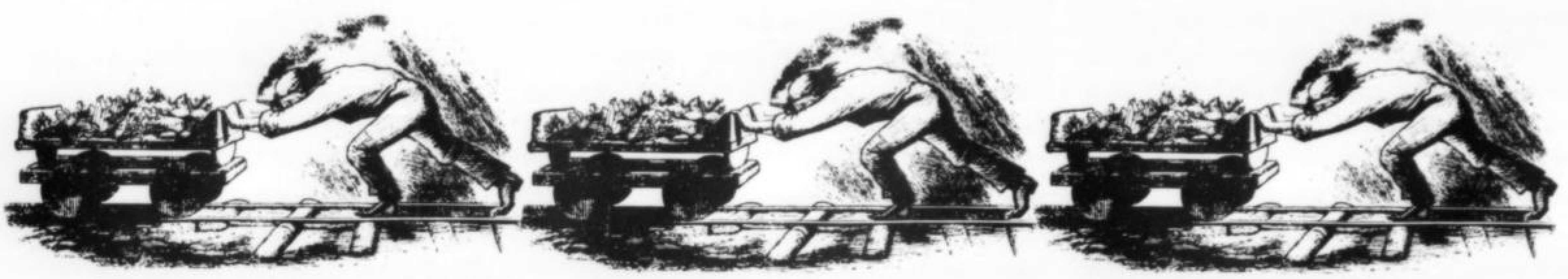
Incidentally the correct locality for the Chilean brochantite reported in a previous column (vol. 9, no.3, p.134) is Mina La Verde not Verde*n*—it means "the green mine."

For want of a better place to put it, I close with the note that a ten-sided pyrite crystal (for example) is called a scorahedron not a dodecahedron as many people think. A dodecahedral crystal has 12 sides—confusing isn't it? Thanks to Hans Wilke of Germany for this and other useful information.

With luck, in my next column I'll tell you about emeralds from Italy and several other surprising minerals we learned about during last year's trip through that delightful country.

Until then—stay young!

Cheers,
Bob Sullivan



an interesting flourite crystal from the Black Forest

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Only a very few gem and mineral clubs regularly incorporate crystallographic themes in their programs. The "secret" code of letters, the Miller index numbers, and the arcane names (such as "tetrahexahedron") applied to various types of crystal faces are often not well understood even by the advanced mineral collectors.

For the mineralogist, an idealized crystal drawing will present forms clearly and simply. Nevertheless, the ideal crystal itself is only rarely seen in nature. Overgrown, intergrown, damaged and distorted crystals are most commonly found instead.

There are, however, occasional exceptions that will delight both the professional and the amateur mineralogist. These exceptions are usually micromount-size crystals, or crystals of simple shape. Many collectors already have fine crystals of cubic halite, beautiful octahedral magnetite, or brilliant pyritohedrons of pyrite. But for most collectors these forms are too common to induce that special "Aha!" experience. I had such an experience a while ago when Dr. J. Arnoth (of the Museum of Natural History in Basle, Switzerland) showed me a specimen of fluorite from Wieden, Black Forest, Germany. The specimen consists of two fluorite crystals on pyrite; the smaller of the fluorite crystals is about 2.5 mm in diameter and water-clear. This crystal (Figure 1) is a combination of the cube and hexoctahedron faces..

Figure 1. **Fluorite crystal on pyrite from Wieden in the Black Forest, Germany. The large, 8-sided face in the center is a cube face and those surrounding it are hexoctahedron faces. The crystal, from the collection of the Natural History Museum of Basle, Switzerland, is about 2.5 mm in size.**

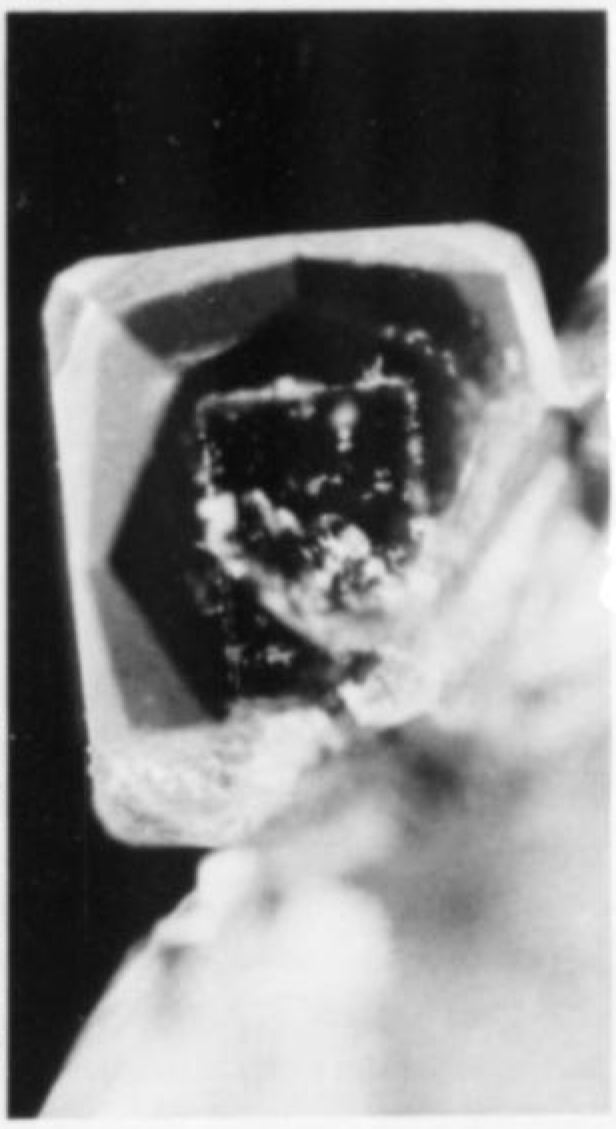

Figure 2. **The same fluorite crystal as shown in Figure 1, but viewed from an angle allowing the cubic phantom in the center to be seen. The focus in this photo has been placed at the phantom, causing the faces nearer the camera to be blurred. This helps to increase the three-dimensional impression necessary to show the phantom's location in the core of the crystal.**

To obtain a good photograph, even an experienced mineral photographer must first spend some time getting acquainted with such a crystal under the microscope, turning it and studying it, and then select the right approach from his bag of tricks. During this get-acquainted period I discovered a feature which had been overlooked by the museum. When the crystal is oriented correctly a phantom can be observed in the interior. The phantom, consisting only of the cube, could be seen from two different directions (as in Figure 2). But why a cube? I had previously understood that in crystal growth there is a tendency toward the simpler forms. Why would that rule be reversed in this case? I asked Dr. Arnoth, and his explanation is as follows:

The forms or combination of forms that develop on a particular crystal are dependent upon factors of the precipitating solution, such as degree of oversaturation, temperature, heat transmittance, diffusion, impurities and other compounds in the same solution, and so on. As long as all of these factors remain constant during crystal growth, the habit is not liable to change. But if these factors change, the growing crystal may begin to alter its form or combination of forms. This does not necessarily imply a change to simpler forms.

The fluorite crystal shown here grew as a cube in its early stage, as indicated by the phantom. During its growth some change in conditions allowed hexoctahedron faces to appear, beginning with the corners of the cube. The hexoctahedron faces are smooth whereas the cube faces are rougher (as can be seen on Figure 3). In this case it was probably the rougher-textured face that was growing most rapidly in the direction away from the center of the crystal, in other words, outward. The smoother face therefore becomes larger in total area by expanding in width at the expense of the outward-growing face. To give an analogy, suppose the Great Pyramid in Egypt was built layer-by-layer, from the ground up. As the first layers were built, there would be a large, square, level expanse in the middle whereas the sloping sides of the pyramid would yet be small. As more layers were added, however, the flat, square "face" would become smaller and smaller, while the pyramid faces grew larger and higher, until the pyramid reached its uppermost point and the square, flat "face" disappeared entirely. During this time, the sloping faces of the pyramid would not have been added to at all, but eventually came to eliminate the "faster-growing" square face entirely.

So it is that, according to a crystallographic rule, faces with rapid outward growth tend to become smaller, and those with slow outward growth tend to become larger. In the fluorite crystal pictured here the combination is an intermediate shape in the transition from cube to hexoctahedron and, had crystallization been allowed to continue, the cube faces might have vanished altogether, leaving only the hexoctahedron. Of course one cannot rule out complicating factors such as oscillatory growth or major changes in the crystallization environment, but it is interesting to speculate using whatever evidence is present.

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Let's let bygones be bygones...

Being a mineral fanatic provides one with heroes different from those of other people; no Napoleon, Lincoln or Picasso for me. My hero is Dr. John W. Webster.

I confess to sometimes browsing in literature other than mineralogical; I met Dr. Webster in a book on old and famous criminal cases . . . he's been my favorite ever since. It happens that Dr. John White Webster was professor of chemistry and mineralogy at Harvard from 1824 until 1849 when he passed away . . . due, as his judge instructed, to being "hung by the neck until dead."

Webster did not climb the scaffold for an ordinary murder. A certain colleague of his, Dr. Parkman, made trouble over Webster's mineral collection (*gasp!*) and received his quite understandable reward. We mineral lovers are a peaceable group as long as people don't go too far. Molestation of a mineral collection is liable to result in the offended collector pondering the fine legal distinctions between "aggravated homicide" and "justifiable homicide" . . . after the fact.

As far as I know, Webster is the only professor of mineralogy ever to be hanged, and his the only mineral collection a motive for murder. For bearing this distinction we owe him suitable homage and a place in the index of the *Mineralogical Record*; these are the facts:

Dr. Webster was an amiable fellow. As professor of chemistry and mineralogy he earned a meager $1200 a year, and was forever in financial straits. To raise money he eventually was forced to mortgage his mineral collection to a certain Dr. Parkman. Webster also borrowed elsewhere on the collection, behind Parkman's back. Parkman, upon learning this, was not amused, and may have attempted foreclosure. According to Julian Symons (*Crime and Detection,* 1966), "Parkman pressed Webster for his money at all sorts of inconvenient times, even attending his lectures and making disparaging remarks. One day Webster could bear it no more. He picked up a handy stick, struck Parkman on the head and killed him. They were in Webster's laboratory at the time. What better place could there be for disposing of the body? The professor of chemistry set about his task with care, making only one fatal, elementary mistake. He cut up the body, put the head and some organs into the furnace, and placed other parts in a dissection vault. He carefully washed away all blood, and from time to time disposed of other parts of the body in the furnace. His manner was as jaunty as usual, and the only person who suspected him was the college janitor. Webster's propitiatory gift of a Thanksgiving Day turkey reinforced instead of stilling these suspicions and, after some investigation which included peeping through keyholes and under doors, the janitor dug under an exterior wall into the dissecting vault and saw a pelvis and two pieces of leg. He went off immediately to tell the college authorities. In the ashes of the furnace there were found, and quite positively identified by the dentist who had made them, Dr. Parkman's new false teeth."

The Webster-Parkman murder case stands as a classic in the annals of criminology. As we subscribe to a *Mineralogical Record* and not a *Criminological Record*, I'll stifle my urge to treat you to a detailed recounting of the trial. Nevertheless, let it be said that the trial attracted attention all over the continent; a special booklet about the trial was issued afterwards and sold very well. The testimony of janitor Littlewood, the role of Chief Justice Shaw (severely criticized for impartiality against Webster), and the many other details of the proceedings make fine reading on a dark winter night. (For a full account of the investigation and trial I recommend *Fair Trial* by Richard B. Morris (Harper and Row), Chapter VI. Other chapters cover the trials of Aaron Burr, Alger Hiss and the famous Lincoln-almanac trial.)

Although Webster failed to get a fair trial and maintained his innocence to the last, modern criminologists do not doubt his being guilty. A wave of sympathy swept the country, but to no avail. After his appeal was denied, Webster was induced to confess to a charge of manslaughter rather than murder; he was hanged anyway on August 30, 1849 (so what good did the plea-bargaining do?).

Webster had his niche in criminal history, but I kept wondering about other things. Did Webster study, teach and collect minerals for decades only to be remembered as a common criminal? Surely he contributed something more to society than did Lizzie Borden, for instance. And after all, there was his mineral collection worth an apparently substantial mortgage! And yet, though I have quite a shelf of mineralogy books, I was unable to find Webster's name mentioned in any of them.

An inquiry to *Record* editor Wendell Wilson brought the suggestion that I contact Clifford Frondel, professor of mineralogy at Harvard. Quoting from Dr. Frondel's reply: "The Harvard mineral collection began in 1784 with Benjamin Waterhouse, a professor of chemistry and materia medica in the Harvard Medical School, as first curator. Waterhouse was the first to give formal instruction in mineralogy at Harvard, and acquired several mineral collections from England and France before 1800. The collection came under nominal control by others from 1809 to 1824, when J. W. Webster was appointed Professor of Chemistry, Mineralogy and Geology at the university. He was an excellent curator and the collection grew rapidly. We still have specimens dating back to Waterhouse and undoubtedly many from Webster, but it is impossible today to identify most of the older material in the collection as to source, primarily because of the many relabelings over the years. The older catalogs are not very informative, and those of Waterhouse and Webster are lost.

"It should be emphasized that the mineral collections in the United States and earlier [before the Revolution], especially in the colleges, were utilitarian in nature and consisted very largely of ordinary specimens of the common minerals, ores, clays, refractories, abrasives, building stones and the like. The old catalogs of Seybert, Troost, Cleaveland and others show this clearly, as do those few collections that have been preserved intact from those days. In the latter 1800's and early 1900's this sort of material began to drop out, with growing representation of scientific values, species representation, and esthetic values. Webster probably possessed very few specimens that would interest a present-day collector or museum.

"In Webster's time Harvard was a very Puritanical place, still essentially the theological school it had been since it was founded in 1636. When Webster was hung his name was dropped from the register, so to speak, and there are no contemporary memorials detailing his research and teaching activities. Actually he was a first rate chemist and mineralogist. His textbook on chemistry, published in 1826, was a standard American text for many years."

Although I was pleased to learn so much about Webster from Dr. Frondel, I was disappointed to hear that no original Webster labels or catalogs are known to exist. Let the label collectors among us search for them just the same and who knows . . . ?

More importantly, I think it is time to let bygones be bygones and give Dr. Webster a posthumous rehabilitation as a mineralogist of significance. And we should also remember to burn a candle on August 30 for the man who dropped, exactly 130 years ago, in defense of his mineral collection.

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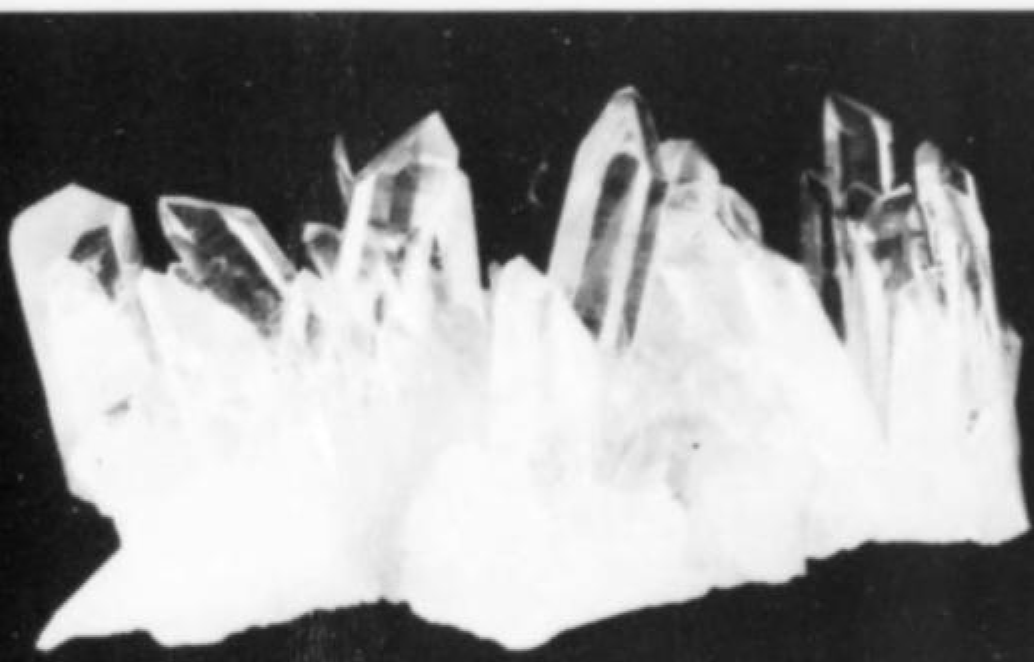

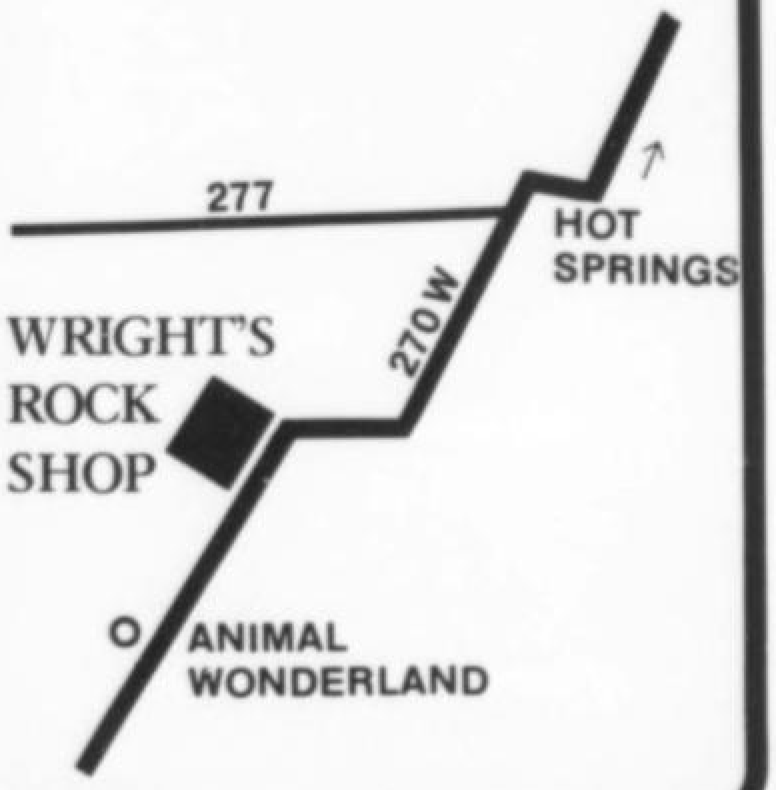
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