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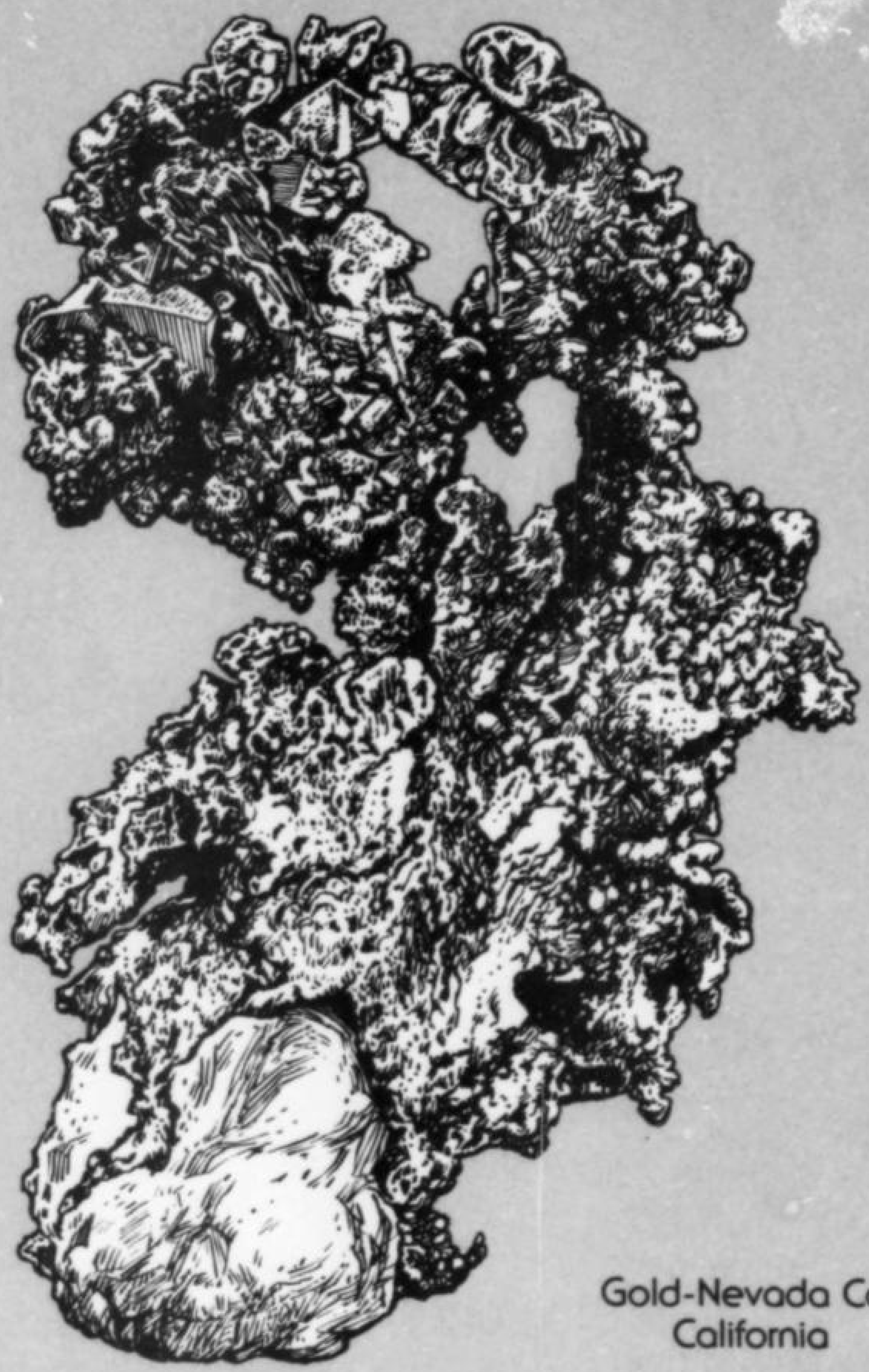

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notes from the EDITOR

THE *RECORD* MOVES TO TUCSON!

Tucson, Arizona, a major western focal point for mining and mineral collecting activity, not to mention the sunny home of the world's foremost mineral show, is now the editing and circulation headquarters for the *Mineralogical Record* as well! Effective immediately, our new address is:

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John White, publisher and president of the Mineralogical Record Inc., will continue in Washington, DC, as curator of minerals at the Smithsonian Institution (Department of Mineral Sciences, Washington, DC 20560).

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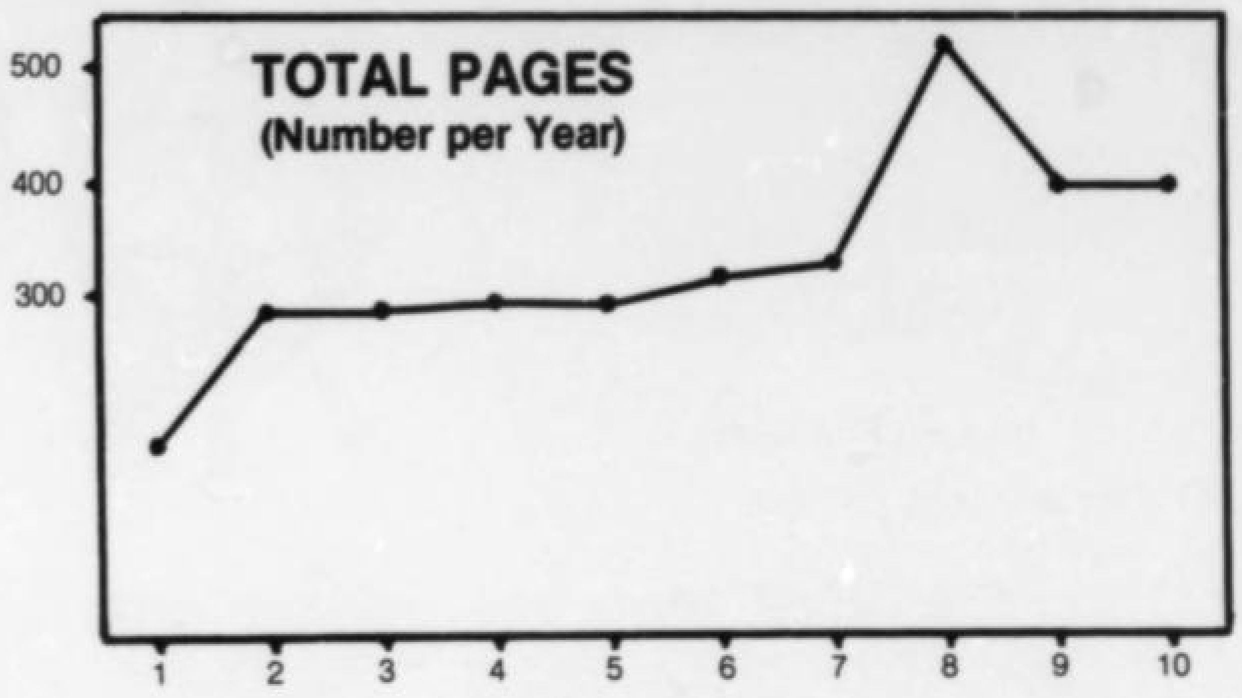
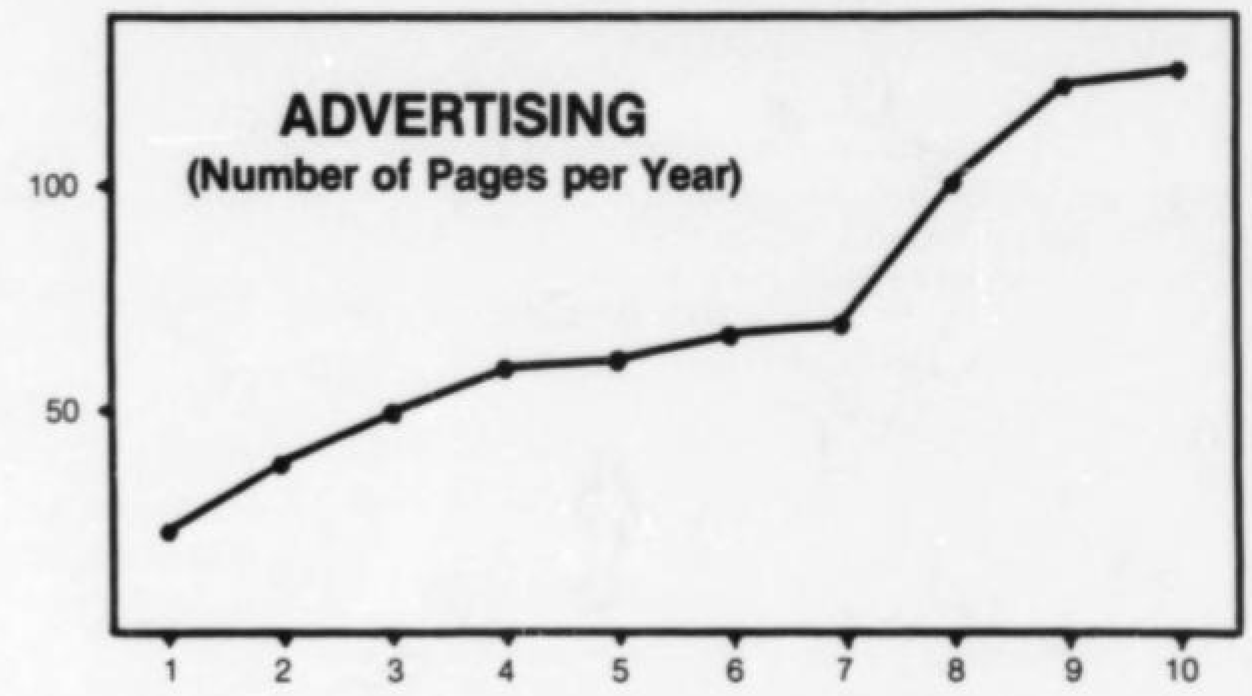
LOOKING BACK ON A DECADE

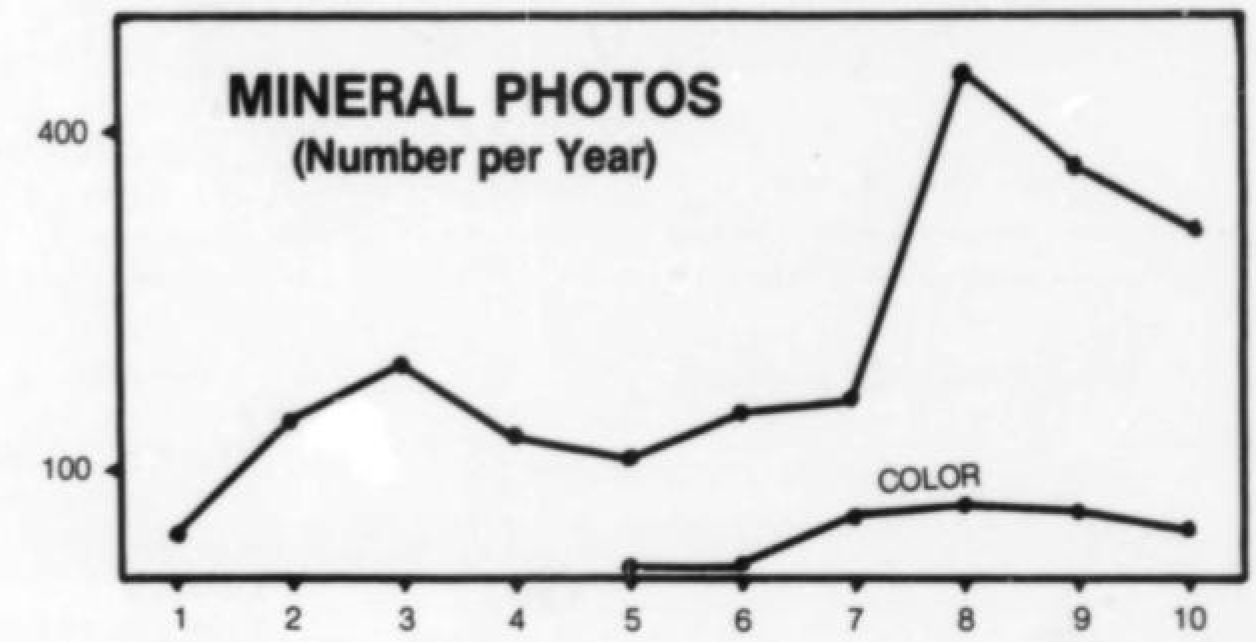
This, our tenth anniversary issue, is a convenient vantage point from which to look back over the first ten volumes (1970–1979). Subjective aspects, such as the frequency of favorite types of articles, can be judged only by individual readers. However, several objective criteria can be plotted to show the general trend of the *Record* over the last decade.

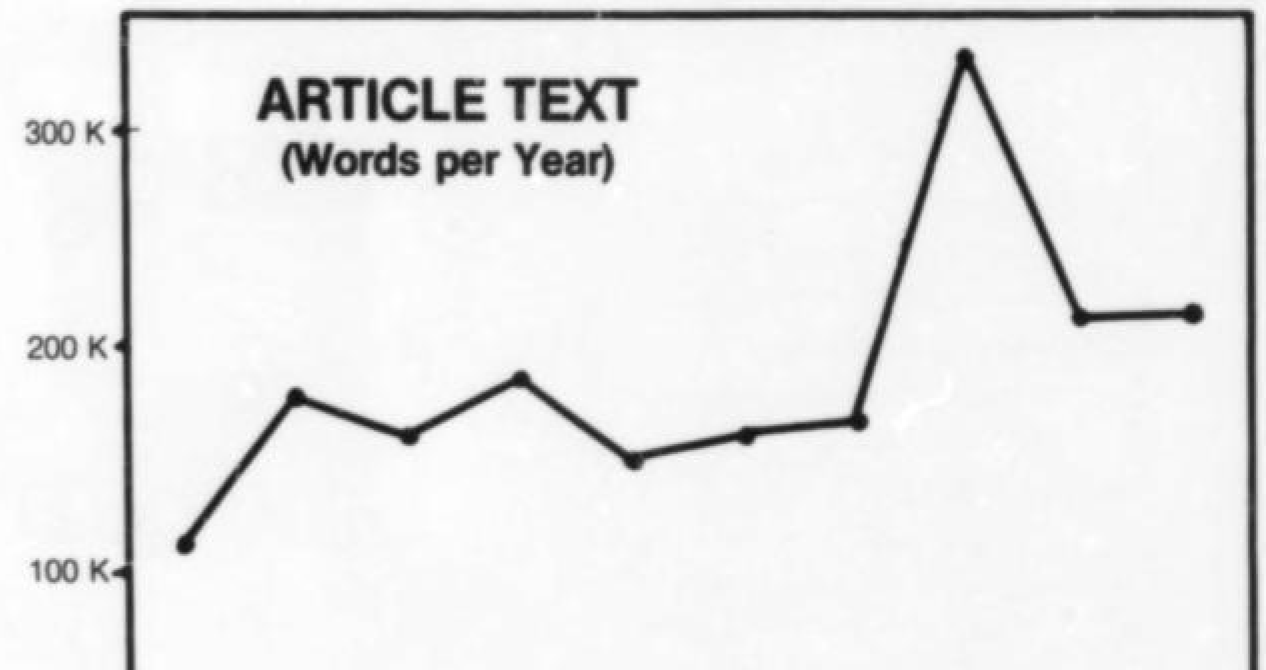
In general the basic specifications of the magazine have all risen gratifyingly, with a volume 8 peak largely due to the Tsumeb issue. The amount of advertising and the number of mineral photographs per year are trending upward, though not at the expense of article text, which is also rising. Increasing numbers of pages per year coupled with more efficient use of space have allowed these parameters to rise together.

Increases in circulation and advertising have allowed the subscription price to remain more or less constant relative to the inflation-corrected value of the dollar. In terms of constant 1970 dollars, the subscription price began at $6 and has remained below $8 (it is currently at about $7.79). This means that subscribers are getting more value for their money now than they did in the earlier years of the magazine . . . we're proud of that.









HELP!

Peter Bancroft, who is writing a book on famous mineral localities eventually to be published by the *Record* (see vol. 10, no. 3, p. 131), still could use some help from anyone having information about mining or good photos of underground and surface miners at work at the following mines:

Wan-Shan-Tchiang, China, cinnabar mines
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N'Chwaning mine, Kuruman, South Africa
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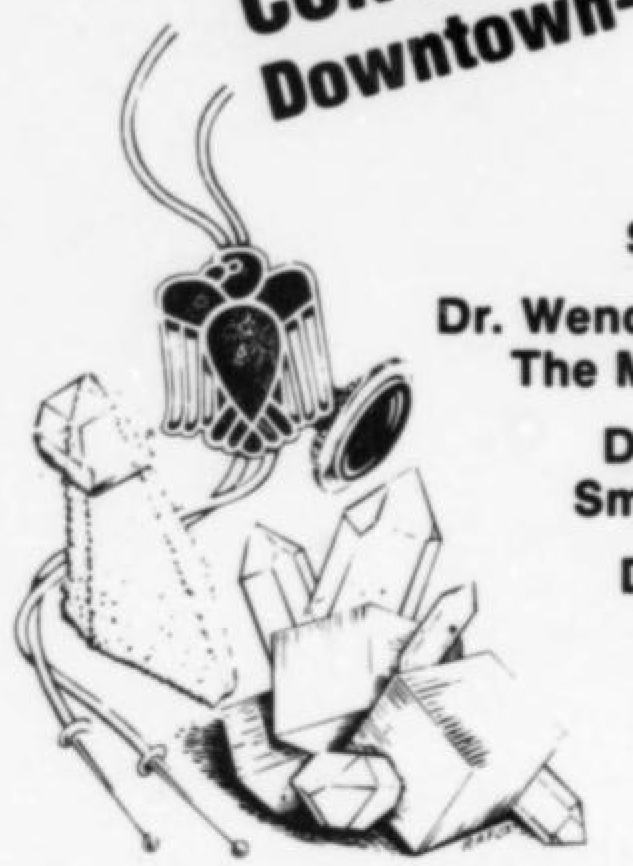

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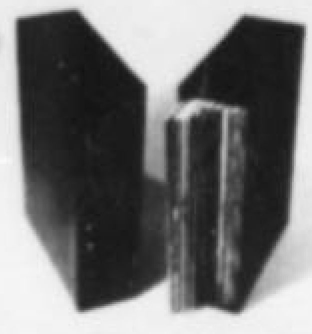

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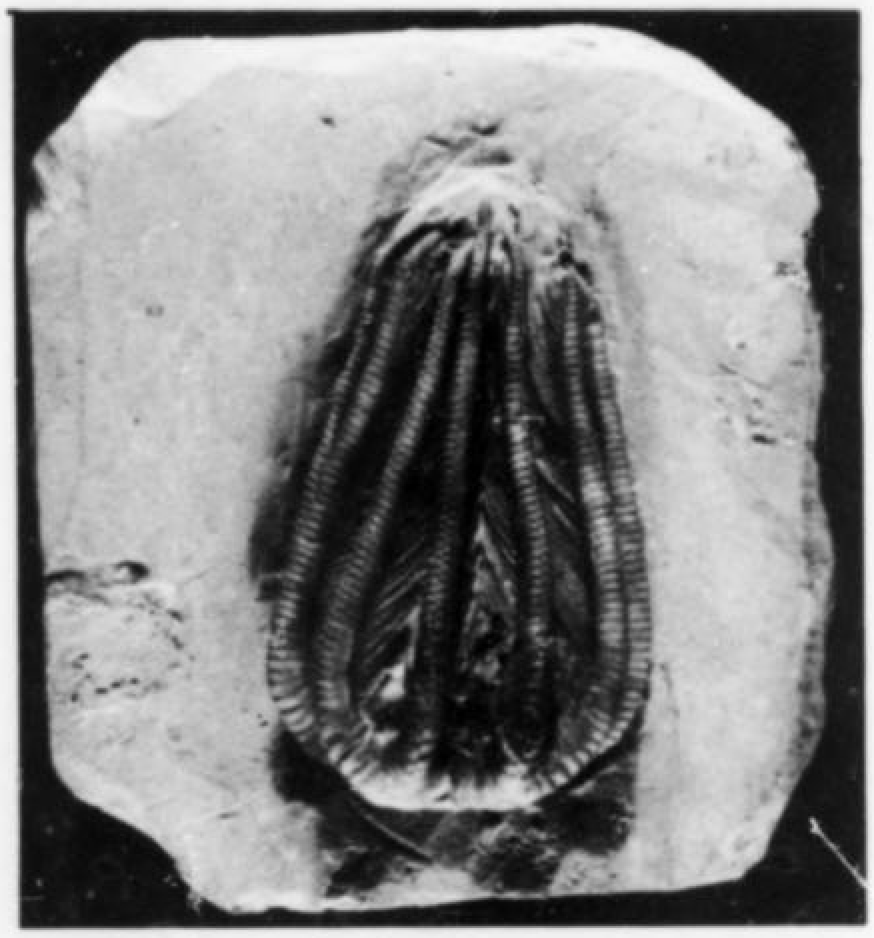

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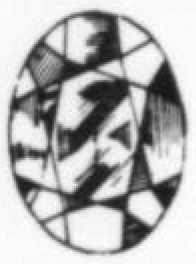

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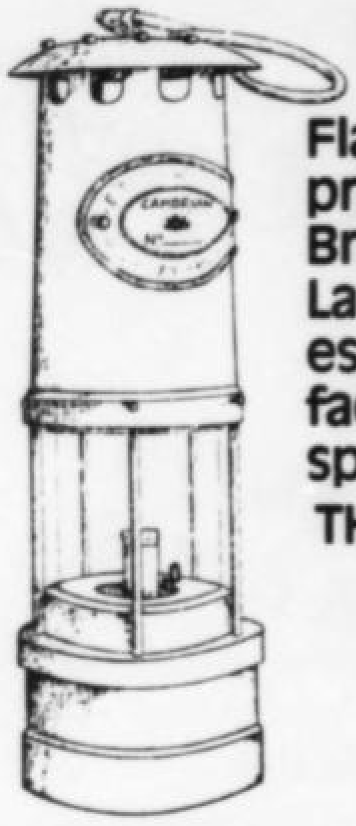

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TOXIC Minerals

by **John H. Puffer**
Department of Geology
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At least 200 mineral species are known or suspected to be either very poisonous or cancer-causing. Mineral collectors and mineralogists should be aware of the hazards associated with these naturally occurring chemicals, and take common-sense precautions when collecting, labeling, and storing them.

INTRODUCTION

It is not the intention of this report to cause undue alarm among mineral collectors. Nevertheless, responsible collectors should be aware of all the dangers involved in their hobby or profession, and the dangers of poisonous minerals should be kept in their proper perspective. Copper, for instance, is required for good health (about 0.002 grams per day for adults), but an excessive amount of copper sulfate pentahydrite (chalcanthite) can definitely be poisonous. In fact, virtually any mineral will most likely be poisonous if taken in sufficient quantity.

The dangers of minerals depend on a complex interrelationship between dose, sensitivity, and toxicity. For a given toxin it is commonly not known whether the development of a toxemic symptom is determined primarily by the amount of the toxin (dose) or by a person's biologic susceptibility. Experiments on animals and epidemiologic data on man suggest that both are important (Hatch, 1968). For example, less than a tablespoon dose of common table salt (halite) can severely poison an infant (Deichmann and Gerarde, 1969) whereas most (but not all) adults are less susceptible. In general, susceptibility is a function of body weight, state of health, and complex allergenic factors.

Some of the factors involved in mineral toxicity are:

Chemical composition. Many minerals containing elements known to be toxic—such as antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, tantalum, thallium, thorium, vanadium and zinc—are dangerous.

Solubility. Some minerals containing toxic elements may be virtually harmless when ingested if the mineral is insoluble in water, stomach acids or intestinal bases. For example, insoluble barium minerals such as barite are only slightly toxic but soluble barium minerals such as witherite are highly toxic.

Grain Size. Grains of fine clay-size quartz are more likely to become deeply imbedded in the lungs than are coarse grain sizes, thus influencing the likelihood of the development of chronic lung disease (silicosis) or lung cancer (NIOSH, 1976). Finely ground toxic minerals are also more readily dissolved when ingested orally than coarse grains.

Grain Shape. In the case of asbestos it is suspected that its fibrous shape contributes to its carcinogenicity. Timbrell and Skidmore (1970) suggest that the small fiber diameter of crocidolite permits greater penetration into the lung than most other asbestos minerals. This may be one reason why crocidolite is considered the most dangerous of the asbestos minerals (Wagner *et al.*, 1971).

Radioactivity. Prolonged exposure to radiation generated by radioactive isotopes contained within or released by minerals may also be dangerous.

THE HAZARDS OF TOXIC-ELEMENT-BEARING MINERALS

Fortunately, most toxic minerals are not common rock-forming minerals, but the rarity of these minerals makes them all the more attractive to mineral collectors. Since mineral collectors may encounter some of the most toxic of minerals they should consider the potential hazards involved and take common-sense precautions. Collectors in search of minerals that are toxic should clearly refrain from eating, drinking, or smoking at sample locations until after they have washed their hands. I have seen fellow "rockhounds" eat lunch in quarries without washing after successfully sampling beautiful orpiment specimens. I have also seen toxic minerals displayed in homes where small children could easily pick them up and play with them. Obviously, toxic minerals should be kept away from food and out of reach of children. The effects of accidental poisoning in some cases may be severe.

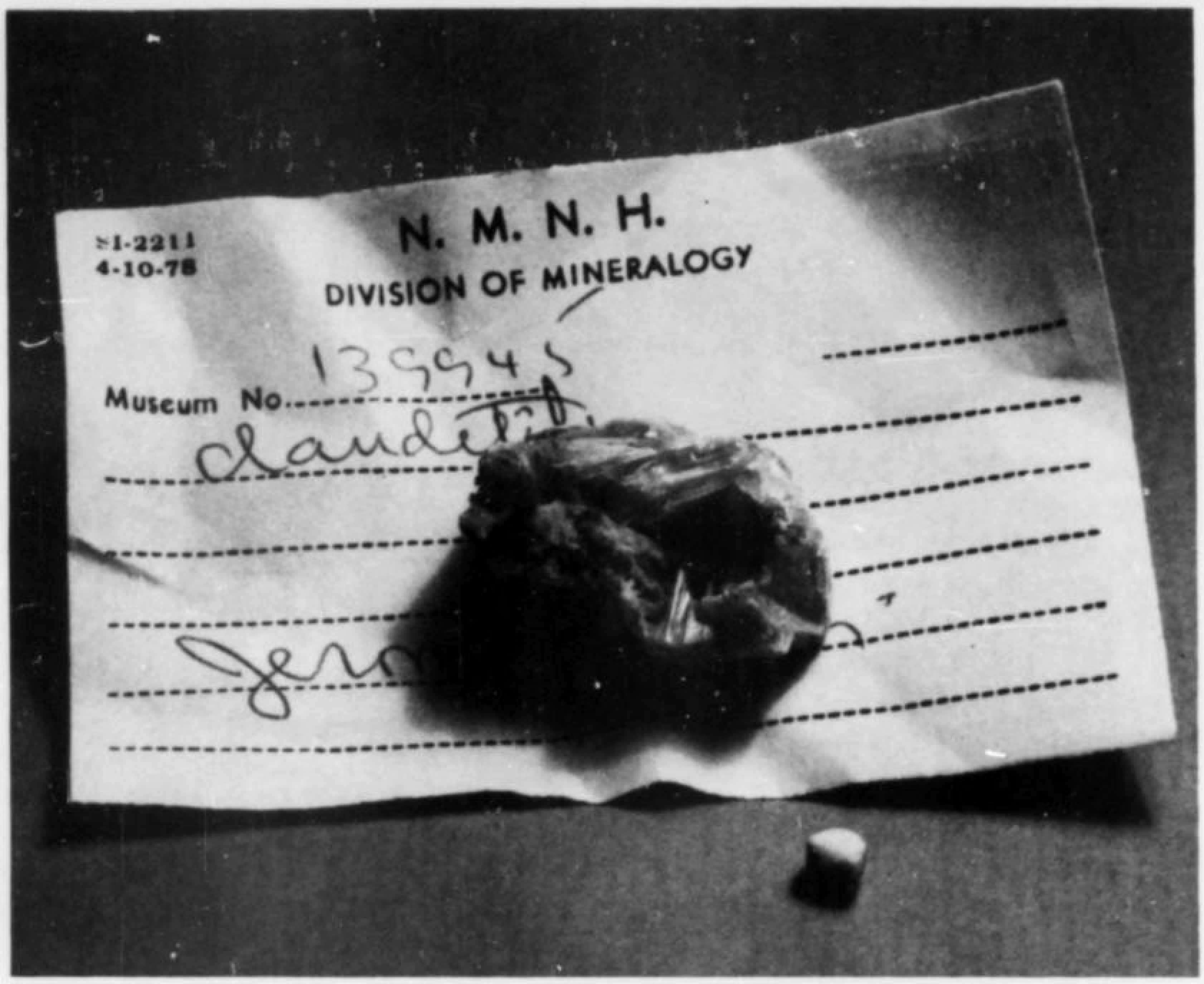

Figure 1. **Claudetite (As_2O_3) from Jerome, Arizona. Near the 25-mm specimen is a 3-mm reference cube representing the adult lethal dose of claudetite.**

Table 1 is a list of the minerals and the chemical compounds analogous to certain minerals that are included in the toxic substances list of The National Institute for Occupational Safety and Health (NIOSH, 1977). There is a very wide range in the toxicity and in the toxic effects of the minerals listed in Table 1.

Antimony and arsenic minerals. Although most antimony compounds are somewhat less toxic than arsenic compounds the symptoms of antimony and arsenic poisoning are similar (Beliles, 1975). Arsenic minerals are among the most toxic of the minerals listed in Table 1. Claudetite and arsenolite (Table 1) are rated as supertoxic (1 on a scale of 1 to 6) by Gosselin, *et al.*, (1976), with a lethal dose for a 70-kg (154-pound) person of only 0.1 to 0.5 grams. Other arsenic-bearing minerals including orpiment and several calcium, copper, lead and zinc arsenates are rated as extremely toxic (5 on a scale of 1 to 6). The trivalent arsenic minerals are more toxic than the pentavalent (Frost, 1967).

The symptoms of acute arsenic poisoning may be delayed for up to a few hours but eventually burning and dryness of the mouth and nose, gastrointestinal disturbances and muscular spasms, vertigo, delirium, and coma may occur (Beliles, 1975, and NIOSH, 1975).

Barium minerals. Accidental poisoning from ingestion of soluble barium compounds has resulted in gastroenteritis, muscular paralysis, and a digitalis-like action on the heart (Beliles, 1975; and Diechmann and Gerarde, 1969). The soluble barium minerals (witherite, frankdicksonite, and nitrobarite) are much more toxic than insoluble barium minerals such as barite.

Boron minerals. The probable lethal oral dose of borax for an adult is 5 to 15 grams (Diechmann and Gerarde, 1969) and about 3 grams (about 1 teaspoon) for a child (Young, *et al.*, 1947). Fatalities have resulted from skin absorption of borax when used as dusting powder on diapers and from its application on burns and cuts. Central nervous system depression and gastrointestinal irritation are the most serious symptons (Beliles, 1975).

In addition to three sodium borates (equivalent to borax, ezcurrite and kernite) and two calcium borates (equivalent to uralborite and colemanite) listed as toxic compounds by NIOSH (1977), there are at least 4 additional sodium borate minerals and 13 additional calcium borate and borite minerals that are not specifically listed. Although the toxicity of the unlisted borates has not been evaluated by NIOSH they should not be presumed to be safe. There are also at least 10 magnesium borate minerals (Fleischer, 1975) that are not listed by NIOSH. But since the octahydrate magnesium salt of boric acid is listed other magnesium borohydrates are implicated.

Calcium minerals. A few soluble calcium minerals such as antarcticite, hydrophilite and nitrocalcite produce an irritating acid solution when dissolved in water and are therefore toxic. Calcium carbonate (calcite) is also listed as toxic by NIOSH but its level of toxicity is very low. The minimum published lethal oral dose of calcium carbonate is equilavent to 350 grams of calcite (three-fourths of a pound) for a 70-kg person (NIOSH, 1977). The likelihood of such a large amount being consumed accidentally seems remote, but such poisoning has occurred.

Chromium minerals. The probable lethal oral dose of soluble Cr^{6+} salts such as lopezite for an adult is only 5 grams or less (Diechmann and Gerarde, 1969). Potassium dichromate is a very commonly used chemical reagent but its mineral equivalent (lopezite, Table 1) is very rare and not likely to be encountered by most collectors. The trivalent salts of chromium such as tarapacaite and chromatite have a relatively low order of toxicity.

Cobalt minerals. Acute intoxication by salts of cobalt is rare (Diechmann and Gerarde, 1969) but polyeythemia is the characteristic response (Beliles, 1975). High levels of cobalt ingestion may also result in the production of goiter. Epidemiologic studies suggest that the incidence of goiter is higher in regions containing high levels of cobalt in water and soils (Wells, 1966). Gosselin, *et al.*, (1976) rate cobalt compounds as very toxic with a lethal dose for a 70-kg person estimated at 3.5 to 35 grams (1 teaspoon to 1 ounce).

Copper and zinc minerals. Oral ingestion of soluble minerals containing copper and zinc is also rated as very toxic by Gosselin, *et al.*, (1976). Large doses of such minerals (Table 1) cause assorted signs of gastrointestinal distress (Beliles, 1975).

Iron minerals. Acute poisoning from accidental ingestion of ferrous sulfate (equivalent to melanterite) is very common particularly among children (Spencer, 1951). Severe poisoning and fatalities have been produced in small children who ingested quantities ranging from 0.4 to 1.5 grams. Greengard and McEnery (1968) report that about 2000 such cases occur annually, ranking in fourth place after aspirin, other unknown medication, and phenobarbital as the leading causes of acute intoxication. Ferrous sulfate toxicity is due

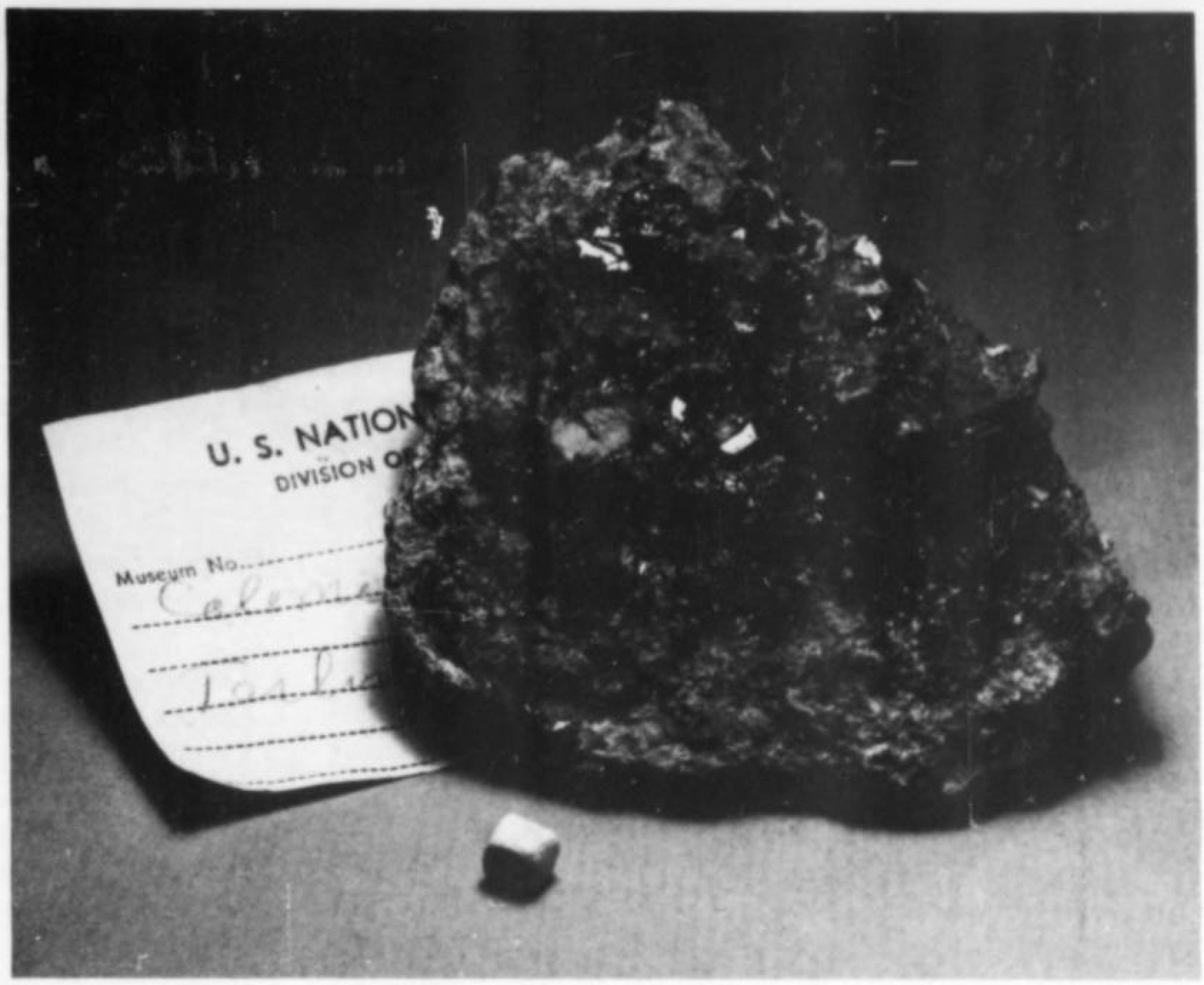

Figure 2. **Calomel (Hg_2Cl_2) in matrix from Terlingua, Texas. Near the 8-cm specimen is a 3.7-mm reference cube representing the adult lethal dose of calomel. Native mercury, also on the specimen, gives off toxic mercury vapor continuously and constitites a separate hazard.**

to its irritation of the gastrointestinal tract. Vomiting may be the first sign followed by gastrointestinal bleeding (Beliles, 1975). There are also several iron sulfate minerals that are not listed by NIOSH but they should not be presumed safe.

Lead minerals. Only a few of the many lead-bearing minerals or their chemical equivalents are listed as toxic by NIOSH, (1977). The soluble arsenates, carbonates, chlorides, oxides, phosphates, and sulfates (Table 1) are more dangerous than relatively insoluble lead minerals, but lead is poisonous in all forms (Fairhall and Sayers, 1940). Following ingestion of a large amount of any of the soluble lead minerals pain, leg cramps, muscle weakness, depression, coma and even death may occur within one or two days (Gosselin, *et al.*, 1976). Children are particularly susceptible to chronic lead poisoning. It affects their central nervous system, leading to permanent cerebral damage in severe cases (Norton, 1975).

Magnesium and zirconium minerals. Most of the magnesium and zirconium minerals listed in Table 1 have a low order of oral toxicity. Magnesium chloride (bischofite) and magnesium nitrate (nitromagnesite), however, produce irritating acid solutions when dissolved in water and prolonged use of magnesium sulfate (epsom salt or hexahydrate) will cause dehydration and weight loss (Beliles, 1975).

Mercury minerals. Ingestion of any of several mercury-bearing minerals may lead to severe kidney poisoning (Clarkson, 1972). In particular, acute calomel intoxication causes irritation and corrosion of the contacted tissues (Bedstrup, 1964). The minimum published lethal oral dose of calomel is equivalent to only 0.35 grams for a 70-kg person (NIOSH, 1977). Chronic exposure to mercury vapors, that may be produced by evaporation from mercury ore, result in central nervous system effects including psychic and emotional disturbances and tremor (Joselow, *et al.*, 1972).

Selenium minerals. Native selenium and selenium dioxide (selenolite) are the only selenium compounds with a mineral equivalent that are listed as toxic by NIOSH (1977) but many other selenium-bearing minerals are known to exist. Oral ingestion of large doses of selenium compounds produce central nervous system effects which include nervousness, drowsiness, and sometimes convulsions (Beliles, 1975). Selenium ingestion may also cause fatal toxicity in humans (Robertson, 1970).

Thallium minerals. Most thallium minerals including those listed in Table 1 are very rare. There are no thallium minerals listed by NIOSH (1977) but those included in Table 1 are toxic nevertheless. Radtke and Dickson (1975) report that the hazard of carlinite (Tl_2S) is due in part to the rapidity with which it oxidizes to relatively highly soluble compounds such as Tl_2O. The estimated lethal dose of thallium for a 70-kg person is 0.6 to 0.8 grams (Beliles, 1975). The symptoms of acute thallium poisoning are gastrointestinal irritation, paralysis, and psychic disturbances (Diechmann and Gerarde, 1969; and Beliles, 1975).

Other toxic minerals. Uranium minerals and their chemical equivalents are surprising omissions from the NIOSH toxic substances list. Uranium minerals such as uraninite are toxic because of the damaging chemical effect of uranium on the kidney (Hobbs and McClellan, 1975) but not because of the radioactivity of uranium. A high incidence of lung cancer has been observed in uranium miners typically after a latent period of 17 years (Archer and Wagoner, 1973; and Doyle, 1953), but the probable carcinogens involved are radon (Rn^{222}) and xenon (X^{133}). The radon and xenon isotopes attached to dust particles, are inhaled, and result in alpha radiation in the lungs (Hobbs and McClellan, 1975). No evidence of toxicity, however, was observed during a five year inhalation study involving monkeys, dogs, and rats exposed to uranium dioxide (uraninite) dust (Leach, *et al.*, 1970).

Acute intoxication due to cadmium or vanadium compounds such as those listed in Table 1 may produce gastrointestinal distress and nickel sulfate ingestion causes myocardial and liver damage (Beliles, 1975) but most cadmium, vanadium and nickel minerals are realistically more hazardous in the form of dusts. Acute intoxication by ingestion of silver, gold, or inorganic compounds equivalent to minerals composed of either aluminum, beryllium, manganese, molybdenum, silicon, titanium or tungsten is not common. Such minerals are also more likely to be hazardous as dusts.

Together with each of the toxic minerals listed by NIOSH (1977) are references to the published basis for its toxic designation. More complete information on specific toxic minerals listed in Table 1 is therefore available through the references appearing in NIOSH (1977).

MINERAL DUST HAZARDS

There are several minerals listed in Table 1 that are either suspected or proven carcinogens (cancer-causing agents), partic-

***Table 1.* Minerals and chemical compounds analogous to minerals described by NIOSH* (1977) as suspected or proven toxins.**

Aluminium chloride, (Chloraluminite), $AlCl_3 \cdot 6H_2O$
Aluminium hydroxide, (Bayerite), $Al(OH)_3$
(Gibbsite), $Al(OH)_3$
(Nordstrandite), $Al(OH)_3$
Aluminium (111) silicate (2:1), (Andalusite), Al_2SiO_5
(Sillimanite) Al_2SiO_5
(Kyanite), Al_2SiO_5
Aluminium sulfate (2:3), (Alunogen), $Al_2(SO_4)_3 \cdot 18H_2O$
Aluminium trioxide (Corundum), Al_2O_3
Ammonium bicarbonate, (Teschemacherite), $(NH_4)HCO_3$
Ammonium chloride, (Salammoniac), $(NH_4)Cl$
Ammonium sulfate, (Mascagnite), $(NH_4)_2SO_4$
Antimony, (Native Antimony), Sb
Antimony oxide, (Cervantite), Sb_2O_4
(Senarmontite) Sb_2O_4
(Valentinite), Sb_2O_3
Antimony trisulfide, (Metastibnite), Sb_2S_3
(Stibnite), Sb_2S_3
Arsenic, (Native Arsenic), As
Arsenic acid, Calcium salt (3:2), Rauenthalite), $Ca_3(AsO_4)_2 \cdot 10H_2O$
Arsenic acid, Magnesium salt, (Hoernesite), $Mg_3(AsO_4)_2 \cdot 8H_2O$
Arsenic sulfide, (Dimorphite), As_4S_3
(Duranusite), As_4S
(Orpiment), As_2S_3
(Realgar), AsS
Arsenic trioxide, (Arsenolite), As_2O_3
(Claudetite), As_2O_3
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  Amesite, $(Mg_2Al)(Al,Si)O_5(OH)_4$
  Anthophyllite, $(Mg,Fe)_7Si_8O_{22}(OH)_2$
  Chrysotile, $Mg_3Si_2O_5(OH)_4$
  Crocidolite, a variety of Riebeckite,
    $Na_2(Fe^{2+},Mg,Fe^{3+})_5Si_8O_{22}(OH)_2$
  Tremolite, $Ca_2Mg_5Si_8O_{22}(OH)_2$
Barium carbonate, (Witherite), $BaCO_3$
Barium fluoride, (Frankdicksonite), BaF_2
Barium nitrate, (Nitrobarite), $Ba(NO_3)_2$
Barium sulfate, (Barite), $BaSO_4$
Beryl, $Be_3Al_2Si_6O_{18}$
Beryllium hydroxide, (Behoite), $Be(OH)_2$
Beryllium oxide, (Bromellite), BeO
Beryllium silicate, (Phenakite), Be_2SiO_4
Bismuth chloride oxide, (Bismoclite), BiOCl
Boric acid, (Sassolite), H_3BO_3
Calcium borate, (Colemanite), $Ca_2B_6O_{11} \cdot H_2O$
(Uralborite), $CaB_2O_4 \cdot 2H_2O$
Calcium carbonate, (Calcite), $CaCO_3$
(Aragonite), $CaCO_3$
(Vaterite), $CaCO_3$
Calcium chloride, (Antarcticite), $CaCl_2 \cdot 6H_2O$
(Hydrophilite), $CaCl_2$
Calcium fluoride, (Fluorite), CaF_2
Calcium hydroxide, (Portlandite), $Ca(OH)_2$
Calcium nitrate, (Nitrocalcite), $Ca(NO_3)_2 \cdot 4H_2O$
Calcium oxide, (Lime), CaO
Calcium sulfate dihydrate, (Gypsum), $CaSO_4 \cdot 2H_2O$
Cadmium oxide, (Monteponite), CdO
Cadmium sulfide, (Greenockite), CdS
(Hawleyite), CdS
Chlorite, $(Mg,Fe,Ni,Mn,Al,Cr,Li)_{5-6}(Al,Si)_4O_{10}(OH)_2$
Chromate of calcium, (Chromatite), $CaCrO_4$
Chromic acid, Dipotassium salt, (Tarapacaite), K_2CrO_4
Chromite, $FeCr_2O_4$
Chromium (111) oxide, (Eskolaite), Cr_2O_3
Cobalt carbonate, (Spherocobaltite), $CoCO_3$
Cobalt sulfate, (Bieberite), $CoSO_4 \cdot 7H_2O$
Cobalt sulfide, (Cattierite), CoS_2
(Linnaeite), Co_3S_4
Copper, (Native Copper), Cu
Copper arsenate hydroxide, (Olivenite), $Cu_2(AsO_4)(OH)$
Copper carbonate hydroxide, (Azurite), $Cu_3(CO_3)_2(OH)_2$
(Malachite), $Cu_2(CO_3)(OH)_2$
Copper chloride, (Eriochalcite), $CuCl_2 \cdot 2H_2O$
(Nantokite), CuCl
Copper nitrate, (Gerhardtite), $Cu_2(NO_3)(OH)_3$
Copper oxide, (Cuprite), Cu_2O
(Tenorite), CuO
Copper sulfate, (Chalcocyanite), $CuSO_4$
Copper sulfate pentahydrite, (Chalcanthite), $CuSO_4 \cdot 5H_2O$
Cryolite, Na_3AlF_6
Cryptohalite, $(NH_4)_2SiF_6$
  (Bararite), $(NH_4)_2SiF_6$
Dichromic acid, Dipotassium salt, (Lopezite), $K_2Cr_2O_7$
Ferric chloride, (Molysite), $FeCl_3$
Forsterite, Mg_2SiO_4
Gold, (Native Gold), Au
Hematite, Fe_2O_3
Hoelite, $C_{14}H_8O_2$
Indium, (Native Indium), In
Iron (11) arsenate (3:2), (Symplesite), $Fe_3(AsO_4)_2 \cdot 8H_2O$
Iron (111) arsenate (1:1), (Scorodite), $Fe(AsO_4) \cdot 2H_2O$
Iron disulfide, (Marcasite), FeS_2
(Pyrite), FeS_2
Iron (11) sulfate (1:1) heptahydrate, (Melanterite), $FeSO_4 \cdot 7H_2O$
Lead, (Native Lead), Pb
Lead arsenate, (Georgiadesite*), $Pb_3(AsO_4)Cl$
(Heliophyllite*), $Pb_6As_2O_7Cl_4$ (?)
(Mimetite*), $Pb_5(AsO_4)_3Cl$
(Schultenite*), $PbHAsO_4$
Lead arsenite, (Finnemanite*), $Pb_5(AsO_3)_3Cl$
Lead chromate, (Crocoite), $PbCrO_4$
(Iranite), $PbCrO_4 \cdot H_2O$
Lead chromate oxide, (Phoenicochroite), $Pb_2(CrO_4)O$
Lead carbonate, (Cerussite), $PbCO_3$
(Hydrocerussite*), $Pb(CO_3)_2(OH)_2$
Lead chloride, (Cotunnite), $PbCl_2$
(Fiedlerite*), $Pb_3Cl_4(OH)_2$
(Penfieldite*), $Pb_2Cl_3(OH)$
(Phosgenite*), $Pb_2(CO_3)Cl_2$
Lead dioxide, (Plattnerite), PbO_2
Lead monoxide, (Litharge), PbO
(Massicot), PbO
Lead phosphate, (Pyromorphite), $Pb_5(PO_4)_3Cl$
Lead silicate, (Alamosite), $PbSiO_3$
Lead sulfate, (Anglesite), $PbSO_4$
Lead sulfide, (Galena), PbS
Lead tetraoxide, (Minium), Pb_3O_4
Lead titanate, (Macedonite), $PbTiO_3$
Lithium aluminium silicate, (Spodumene), $LiAlSi_2O_6$
Limonite, hydrous iron oxides
Magnesium carbonate, (Magnesite), $MgCO_3$
Magnesium chloride, (Bischofite), $MgCl_2 \cdot 6H_2O$
Magnesium fluoride, (Sellaite), MgF_2
Magnesium hydroxide, (Brucite), $Mg(OH)_2$
Magnesium nitrate, (Nitromagnesite), $Mg(NO_3)_2 \cdot 6H_2O$
Magnesium oxide, (Periclase), MgO

- Magnesium sulfate monohydrate, (Kieserite), $MgSO_4 \cdot H_2O$
- Magnetite, Fe_3O_4
- Manganese chloride, (Sacchite), $MnCl_2$
- Manganese dioxide, (Pyrolusite), MnO_2
  - (Ramsdellite), MnO_2
  - (Nsutite), MnO_2
- Manganese sulfate hydrate, (Szmikite), $MnSO_4 \cdot H_2O$
- Mercury, (Native Mercury), Hg
- Mercury chloride, (Calomel), Hg_2Cl_2
- Mercury oxide, (Montroydite), HgO
- Mercury oxide sulfate, (Schuetteite), $Hg_3(SO_4)O_2$
- Molybdenite, MoS_2
- Molybdenum trioxide, (Molybdite), MoO_3
- Nickel, (Native Nickel), Ni
- Nickel carbonate, (Hellyerite), $NiCO_3 \cdot 6H_2O$
- Nickel iron sulfide, (Godlevskite), $(Ni,Fe)_7S_6$
  - (Mackinawite), $(FeNi)_9S_8$
  - (Pentlandite), $(Fe,Ni)_9S_8$
  - (Smythite), $(Fe,Ni)_9S_{11}$
  - (Violarite), Ni_2FeS_4
- Nickel oxide, (Bunsenite), NiO
- Nickel sulfate hexahydrate, (Retgersite), $NiSO_4 \cdot 6H_2O$
- Nickel sulfide (3:2), (Heazlewoodite), Ni_3S_2
- Olivine, $(Mg,Fe)_2SiO_4$
- Potassium bisulfate, (Mercallite), $KHSO_4$
- Potassium chloride, (Sylvite), KCl
- Potassium fluoride, (Carobbiite), KF
- Potassium nitrate, (Niter), $K(NO_3)$
- Potassium sulfate, (Arcanite), K_2SO_4
- Selenium, (Native Selenium), Se
- Selenium dioxide, (Selenolite), SeO_2
- Silica, (Coesite), SiO_2
  - (Cristobalite), SiO_2
  - (Quartz), SiO_2
  - (Stishovite), SiO_2
  - (Tridymite), SiO_2
- Silver, (Native Silver), Ag
- Sodium borate, (Borax), $Na_2B_4O_7 \cdot 10H_2O$
- Sodium borate heptahydrate, (Ezcurrite), $Na_4B_{10}O_{17} \cdot 7H_2O$
- Sodium borate tetrahydrate, (Kernite), $Na_2B_4O_7 \cdot 4H_2O$
- Sodium carbonate, (Natron), $Na_2CO_3 \cdot 10H_2O$
  - (Thermonatrite), $Na_2CO_3 \cdot H_2O$
- Sodium chloride, (Halite), NaCl
- Sodium fluoride, (Villiaumite), NaF
- Sodium nitrate, (Soda-niter), $NaNO_3$
- Sodium sulfate, (Mirabilite), $Na_2SO_4 \cdot H_2O$
  - (Thenardite), Na_2SO_4
- Sulfur, (Native Sulfur), S
- Talc, $Mg_3Si_4O_{10}(OH)_2$
- Tantalum, (Native Tantalum), Ta
- Tellurium, (Native Tellurium), Te
- Tellurium dioxide, (Paratellurite), TeO_2
  - (Tellurite), TeO_2
- Thallium sulfide*, (Carlinite), Tl_2S
  - (Lorandite), $TlAsS_2$
  - (Routhierite), $TlHgAsS_3$
  - (Pierrotite), $Tl_2(Sb,As)_{10}S_{17}$
- Thallium sesquioxide*, (Avicennite), Tl_2O_3
- Thorium dioxide, (Thorianite), ThO_2
- Titanium dioxide, (Anatase), TiO_2
  - (Brookite), TiO_2
  - (Hongquiite), TiO_2
  - (Rutile), TiO_2
- Topaz, $Al_2(SiO_4)(F,OH)_2$
- Tungsten trioxide, (Tungstite), $WO_3 \cdot H_2O$
- Urea, $CO(NH_2)_2$
- Vanadium pentoxide, (Shcherbinaite), V_2O_5
- Vanadium sesquioxide, (Karelianite), V_2O_3
- Zinc, (Native Zinc), Zn
- Zinc arsenate, (Koettigite), $Zn_3(AsO_4)_2 \cdot 8H_2O$
- Zinc oxide, (Zincite), (Zn,Mn)O
- Zinc sulfate, (Goslarite), $ZnSO_4 \cdot 7H_2O$
- Zirconium silicate, (Zircon), $ZrSiO_4$
- Zirconium sulfate, (Zircosulfate), $Zr(SO_4)_2 \cdot 4H_2O$

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*Some toxic lead and thallium minerals not specifically listed by NIOSH (1977) are included in Table 1.

†Mineral names in parentheses are mineral equivalents of chemical substances listed by NIOSH (1977).

ularly in the form of dusts inhaled over prolonged periods of time. These minerals include some of the most common minerals in the earth's crust, such as quartz, olivine and magnetite, and some of the most popular precious and semiprecious gem minerals such as quartz, olivine, beryl and hematite. There are other minerals listed in Table 1 that may cause non-malignent lung distress, skin irritation or other problems as dusts.

Collectors who intend to cut and polish crystals of such minerals should be warned to take precautions against the inhalation of dust that is generated. Dust should be kept to a minimum, ventilation should be adequate and, if much polishing is to be done, a face mask filter approved by NIOSH (Pritchard, 1976) should be worn.

Asbestos dust. Asbestos (fibrous chrysotile, crocidolite, amesite, anthophyllite, or tremolite) is particularly hazardous. Collectors of any of the asbestos minerals should avoid digging through dusty asbestos quarries or underground workings without a face mask filter. Many samples of beautiful, gem-quality serpentine that I have collected from the State Line serpentine belt of Pennsylvania and Maryland and from Montville, New Jersey, appear to be non-fibrous in hand specimen, but upon careful examination under a scanning electron microscope can be seen to be rich in chrysotile asbestos fibers. Most serpentine rock contains some asbestos fibers even if they can't be seen with the unaided eye. Some marbles, amphibolites, gneisses, schists and other rock types may also contain asbestos.

NIOSH (1976) has reported that: "Available studies provide conclusive evidence that exposure to asbestos fibers causes cancer and asbestosis in man." They also report that: "Although the data show that the lower the exposure the lower the risk, evidence of all available human data provide no evidence for a threshold or for a 'safe' level of asbestos exposure." The United States Department of Health, Education and Welfare (Division of Cancer Control, 1978) reports that: "The evidence that asbestos is a cause of lung cancer is overwhelming." Doll (1955), for example, found 11 of 113 workers employed in an asbestos textile factory in the United Kingdom for at least 20 years were found to have died from lung cancer. This is a ten-fold increase in lung cancer over that of the general population. A seven-fold increase was found in a group of insulation workers exposed to chrysotile and amosite but not crocidolite (Selikoff, *et al.*, 1973). Crocidolite, however, may be the most dangerous form of asbestos. Wagner (1960) found asbestos-induced tumors in the non-mining population living in the vicinity of the crocidolite mining areas of South Africa as well as among men working in the mines and mills.

Some studies (Selikoff, 1975 and Seidman, *et al.*, 1978) indicate symptoms of asbestosis and asbestos-induced cancer among individuals having as little as one day of exposure to asbestos. People who do not smoke cigarettes, however, are much less susceptible. Hammond and Selikoff (1973) found that the risk of lung cancer in people exposed to asbestos is greatly increased by smoking cigarettes.

Beryllium mineral dust. Inhalation of high levels of beryllium minerals (Table 1) may result in acute lung distress with a possible latent period of only one day to three weeks. Lower levels of exposure may cause berylliosis after a latent period of 5 to 9 years (Beliles, 1975).

Cadmium mineral dust. Inhalation exposure to approximately 50 mg of CdO (monteponite) dust per m^3 for one hour is lethal (Friberg, *et al.*, 1971). Chronic inhalation exposure to cadmium may result in proteinuria and emphysema (Beliles, 1975).

Iron oxide dust. Prolonged exposure to iron oxide dust (particularly hematite) may cause siderosis (mottling of the lungs) and even lung cancer. The death rate due to lung cancer among iron ore workers is 50 to 70 percent higher than the general population (Boyd, *et al.*, 1970) but the influence of smoking, silica dust, and radioactivity in the mine may be complicating factors.

Manganese mineral dust. Perhaps the most serious result of chronic inhalation of MnO_2 (pvrolusite) dust, generally over a period of more than two years, involves the central nervous system. Chronic manganese poisoning may cause psychiatric disorders such as irritability, difficulty in walking, speech disturbances, and compulsive behavior (Beliles, 1975).

Quartz, talc and other silicate dusts. Silicosis is a nodular pulmonary fibrosis caused by inhalation and deposition of particles of crystalline silica in the lungs. It is similar in many respects to pleural schlerosis caused by talc dust and to respiratory problems caused by other non-fibrous silicate dusts. Silicosis is frequently associated with tuberculosis and symptoms include presence of cough and wheezes. The most extensive environmental and medical data pertaining to silicosis is based on the Vermont granite industry. Theriault, *et al.*, (1974 a and b) found that 50 percent of the workers at Vermont granite quarries had radiographic evidence of silicosis after 46 years of exposure at a dust level equivalent to about 50 ug/m^3 of free silica and functional evidence at over 32 dust-years.

Vanadium mineral dust. Of the many vanadium oxide minerals only the pentoxide (shcherbinaite) and the sesquioxide (karelianite) are described as toxic by NIOSH (1977). Bronchitis and bronchopneumonia are more frequent in workers exposed to vanadium oxide dust than in the general population (Beliles, 1975, and Diechmann and Gerarde, 1969).

Other mineral dusts. Chromium and nickel mineral dusts may cause lung cancer (NIOSH, 1977) and should be avoided. In addition, direct contact with chromium, nickel, gold and even silver may cause dermatitis or a variety of allergenic responses. A dermatitis (nickel itch), for example, is a common effect of exposure to nickel. Industrial exposure to ZnO fumes causes toxic effects (metal fume fever) but only the freshly formed material is potent (Diechmann and Gerarde, 1969) so there should ordinarily be no danger to collectors of crystalline ZnO (zincite). Prolonged exposure to extremely high levels of calcium sulfate dihydrate (gypsum) dust is also dangerous (NIOSH, 1977) but again should ordinarily be of little danger to mineralogists.

CONCLUSIONS

Some minerals are toxic and, therefore, dangerous if mishandled. Collecting toxic minerals can be made safer if commond-sense precautions are taken. All minerals should obviously be kept away from food and out of reach of children; and toxic mineral dusts should be avoided. Samples of particularly toxic minerals such as claudetite should be sealed in labeled containers and treated with the same precautions that would be used with any other deadly poison.

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Magnesioaxinite from Luning, Nevada, and some Nomenclature Designations for the Axinite Group

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HISTORY OF THE NOMENCLATURE

The mineral group we know today as axinite was thought to be a variety of schorl when it was first mentioned by Schreiber (1781) from the famous deposit at Le Bourg d'Oisans, France. De Lisle referred to it as *violet schorl* in 1785, and Delamétherie called it *yanolite* (which means "violet stone") in 1792.

Werner apparently did not agree that it was a variety of schorl, for he named it *thumerstein* after the German locality at Thum near Ehrenfriedersdorf, in 1788. The anglicized version, *thumite,* was also in use. Blumenbach named it *glasschorl* in 1791.

The name *axinite* was first applied by Haüy in 1799, in reference to the common axe-like shape of the crystals. This name was preferred over the earlier *yanolite* because the mineral was not always violet but did always seem to form axe-shaped crystals.

Subsequent research demonstrated that the composition of axinite varies systematically, and the species name became a group name instead, covering several species of axinite. The axinite group has, until recently, consisted of three species:
ferroaxinite, $Ca_2Fe^{2+}Al_2BSi_4O_{15}(OH)$;
manganaxinite, $Ca_2Mn^{2+}Al_2BSi_4O_{15}(OH)$;
and *tinzenite,* $(Ca,Mn,Fe)_3Al_2BSi_4O_{15}(OH)$
(Sanero and Gottardi, 1968). The recent discovery of *magnesioaxinite* by Jobbins *et al.* (1975) has expanded the group to four end-members. The magnesioaxinite reported by Jobbins *et al.* (1975) is a gemstone.

LUNING, NEVADA, AXINITE

We wondered if there might be magnesioaxinite samples among the as yet undescribed axinites from localities known to produce magnesium minerals. Vallance (1966) had reported a magnesium axinite at London Bridge, near Queanbeyan, New South Wales, Australia, associated with epidote, tremolite and calcite, but we knew of no others. Analysis of a large number of samples of the axinite group revealed a third locality for magnesioaxinite.

This new occurrence is near Luning, Nevada. The locality was briefly described by Melhase (1935) in accounts of his travels to western mineral localities. Artinite from this area was the subject of a study by Hurlbut (1946). The magnesioaxinite occurs as light brown to light pink crystals up to 1.0 cm in size associated with prehnite, epidote, actinolite and vesuvianite. There is nothing notable about the morphology of magnesioaxinite which would assist the collector in verifying the species; the morphology is similar to that of axinite-group minerals from many other localities.

Chemistry

Seventeen specimens of axinite from Luning, Nevada, were analyzed using an ARL-SEMQ electron microprobe utilizing an operating voltage of 15 kV and a beam current of 0.15 μA. The standards used were manganite for manganese, synthetic ZnO for zinc, and hornblende for silicon, aluminum, iron, magnesium, calcium and titanium. The data were corrected with a computer

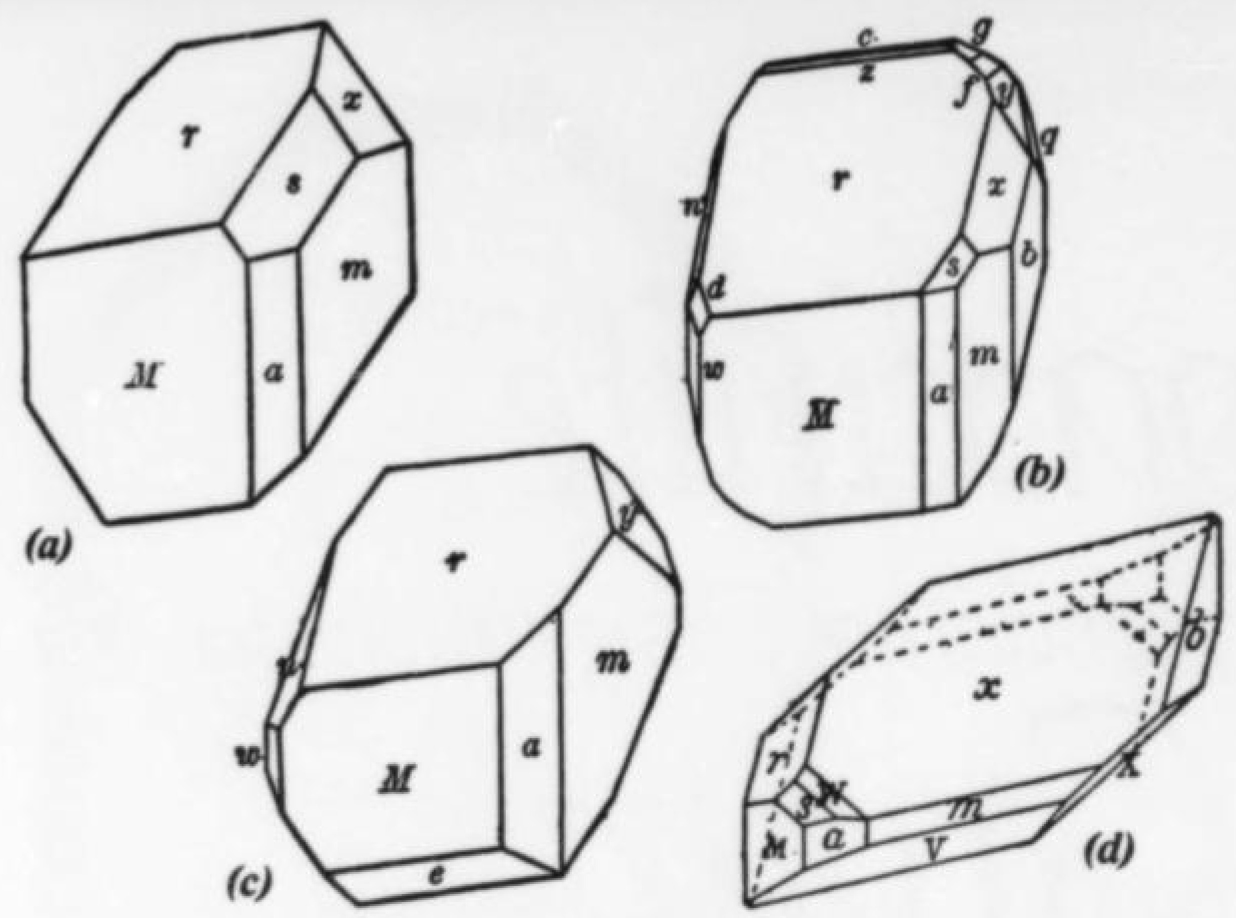

Figure 1. **Axinite crystal forms.** ***(a, b) Ferroaxinite*, Le Bourg d'Oisans, France; $r=\{1\bar{1}1\}$, $s=\{201\}$, $x=\{111\}$, $m=\{110\}$, $M=\{1\bar{1}0\}$, $a=\{100\}$, $c=\{001\}$, $g=\{023\}$, $y=\{021\}$, $f=\{011\}$, $z=\{1\bar{1}2\}$, $b=\{010\}$, $n=\{1\bar{3}1\}$, $d=\{2\bar{4}1\}$, $w=\{1\bar{3}0\}$, $k=\{2\bar{6}1\}$, $t=\{3\bar{7}1\}$, $\delta=\{1\bar{3}2\}$, $e=\{\bar{1}11\}$, $h=\{3\bar{1}0\}$, $\beta=\{510\}$, $\alpha=\{210\}$, $i=\{3\bar{1}1\}$. *(c) Ferroaxinite*, Botallach mine, St. Just, Cornwall, England; $q=\{\bar{1}51\}$. *(d) Manganaxinite*, Franklin, Sussex County, New Jersey; $W=\{312\}$, $X=\{0\bar{2}1\}$, $V=\{\bar{1}\bar{1}2\}$. (Dana, 1892.)**

program employing Bence-Albee factors.

Of the 17 Luning, Nevada, samples analyzed, 12 have magnesium greater than iron or manganese and are thus magnesioaxinite. Analysis of the most magnesium-rich sample (NMNH 94407-7) gave: SiO_2 = 43.14%, Al_2O_3 = 17.47%, FeO = 2.77%, MnO = 3.24%, MgO = 3.92%, CaO = 20.74%, Sum = 91.28%. The analysis is in good agreement with the theoretical composition of a magnesioaxinite with Mg:Fe:Mn = 54:21:25 which requires B_2O_3 = 6.31% and H_2O = 1.61%. The Mg:Fe:Mn ratio of all examined Luning, Nevada, axinite samples varied from 54:21:25 for a magnesioaxinite to 13:47:40 for a ferroaxinite.

Since most Luning, Nevada, axinite is magnesioaxinite, it is probably best to label all unanalyzed Luning axinite magnesioaxinite.

Indices of refraction were determined for the most magnesian specimen analyzed (NMNH 94407-7). The determinations were made on duplicate grains using sodium light and the spindle stage described by Jones (1968). The indices agreed within 0.001. The 2V angle was determined on a centered BXA figure by the method of Kamb (1958). The resultant values are α = 1.667, β = 1.673, γ = 1.678, optically negative, 2V = 82(2)°, dispersion is $r > v$ strong, approximately horizontal.

A recent study by Lumpkin and Ribbe (1979) has given regression equations for the estimation of chemical composition of axinites based on their refractive indices. Calculation of mole fraction magnesium, for this axinite, using their formula, gives 50 mole percent magnesium, somewhat lower than the measured value.

ADDITIONAL NOMENCLATURE/ LOCALITY INFORMATION

Microprobe analyses of axinite samples from a large number of localities resulted in additional information regarding the composition of some samples from these localities. The results are presented in Table 1. The number in parentheses after each locality name is the number of analyses performed on material from that locality. The species designations of Sanero and Gottardi (1968), approved by the I.M.A., were used in defining all the axinite species.

Samples from any one locality may vary widely in composition due to extensive solid solution in axinite; a good example of which is the foregoing range of composition for samples from Luning, Nevada. Hence, one should be aware that the species names given in Table 1, for certain localities, are but guidelines which may not apply to all samples from that locality. Such guidelines may prove useful to the collector and curator and likely do reflect the general composition of samples from a given locality where the designation of species is based on a number of analyses. It is important to remember that many of the mineral names for members of solid solution series are based on but one or two analyses in the literature.

It is hoped that the information given in this paper will be of use to collectors and curators alike. However, it is neither desirable nor practical for the authors to examine axinite specimens for collectors to ascertain their correct identities.

Table 1. **Nomenclature/locality information for axinite-group specimens studied.**

FERROAXINITE

Australia
Colebrook Hill, Rosebery district, Tasmania (1)*
Rosebery district, Tasmania (3)
Tasmania (1)

Austria
Knappenwand, Tirol (1)

Brazil
Vitoria da Conquista, Bahia (3)

California
near Coarse Gold, Madera Co. (1)
Stinson Beach, Marin Co. (1)
City quarry, Riverside, Riverside Co. (1)
North Hill, Riverside, Riverside Co. (1)
Bonsall, San Diego Co. (1)
Klamath River, near Yreka, Siskiyou Co. (1)

Canada
near Hope, British Columbia (1)
Moneta mine, Timmins, Ontario (1)

Czechoslovakia
Davle, near Praha, Čechy (1)
Zbraslav, near Praha, Čechy (1)

England
Botallach mine, St. Just, Cornwall (2)
Roscommon Cliff, St. Just, Cornwall (1)
Liskeard, Cornwall (1)
Cornwall (1)

France
St. Christophe-en-Oisans, Isère (2)
Le Bourg d'Oisans, Isère (4)
Cornille, NW of Le Bourg d'Oisans, Isère (1)
Maison Guignard la Balme, Commune d'Auris, near
  Le Bourg d'Oisans, Isère (1)
  (Isère was formerly Dauphine)

Germany
Thum, Sachsen (2)
Ehrenfriedersdorf, Sachsen (1)
Pferdekopf near Wormke, Harz Mtns. (1)
Freseburg, Harz Mtns. (1)
Harz Mtns. (1)

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*Numbers in parentheses indicate number of analyses performed for this study.

Italy
Monzoni, Trentino-Alto Adige (formerly Tyrol) (1)
Japan
Fuji near Kamakura, Honshu (2)
Hajikami, Hyugo, Miyazaki, Honshu (1)
Yamaura, Hyugo, Miyazaki, Honshu (1)
Toroku mine, Iwato, Nishiwouki-gora, Miyazaki, Honshu (2)
Iwatamura, Nishius, Oki gun, Hicoga (1)
Kuwanorizawa, Hikana, Okutama, Tokyo, Honshu (1)
Obira, Bungo, Oita, Hyushu (8)
Malaysia
(1)
Mexico
Trinidad, Baja California (2)
Montana
Elkhorn, near Boulder, Jefferson Co. (1)
North Carolina
Foote spodumene mine, Kings Mtn. (1)
Norway
Kongsberg, Buskerud (1)
Switzerland
(1)
Berg Sroyi, near Santa Maria Lukmanier (near Medels), Grisons (1)
Medels, Grisons (1)
Piz Vallatcha, near Scopi, Grisons (1)
Santa Maria, near Medels, Grisons (2)
Scopi, Mittelrheintal, Grisons (4)
Sankt Jakob, Uri (1)
USSR
Berkutshaja Sara Kreis, Zlatoust, Ural Mtns. (1)
Virginia
Luck quarry, Route 250 east of Charlottesville (1)

MANGANAXINITE

Arizona
Huachuca Mtns. (1)
California
Consummes Copper mine, Amador Co. (1)
Greystone claim, Genesee Valley, Plumas Co. (1)
near Taylorville, Genesee Valley, Plumas Co. (1)
Canada
Marmora Township, Ontario (1)
Chile
(1)
France
Pyrenees (1)
Japan
Takanosu mine, Kami Kasuo, Awano-machi, Kamitsugs-gun, Tachigi, Honshu (1)
Anawai mine, Kochi-ken, Shikoku (1)
New Jersey
Franklin, Sussex Co. (36)
North Carolina
McKinney mine, Mitchell Co. (1)
Pennsylvania
Avondale, Delaware Co. (1)
Cornog, Chester Co. (1)
near Camel's Hump, 3 mi. N. of Bethlehem (1)
near Easton, Northampton Co. (1)
USSR
Far East (1)
Central Urals (1)

TINZENITE

Italy
Cassagna mine, near Chiavari, Genoa (2)
Cassagna, Toscana (1)
Gambatesa, Campabasso (1)
Switzerland
Alpe Parsettens, Val d'Err, near Tinzen, Grisons (1)
Val d'Err, near Tinzen, Grisons (1)
near Tinzen, Grisons (1)

MAGNESIOAXINITE

Australia
London Bridge, near Queanbeyan, New South Wales (0)
Nevada
Near Luning (17)**
Tanzania
(type locality) (0)

**Twelve of the 17 analyses indicated magnesioaxinite, 5 indicated ferroaxinite.

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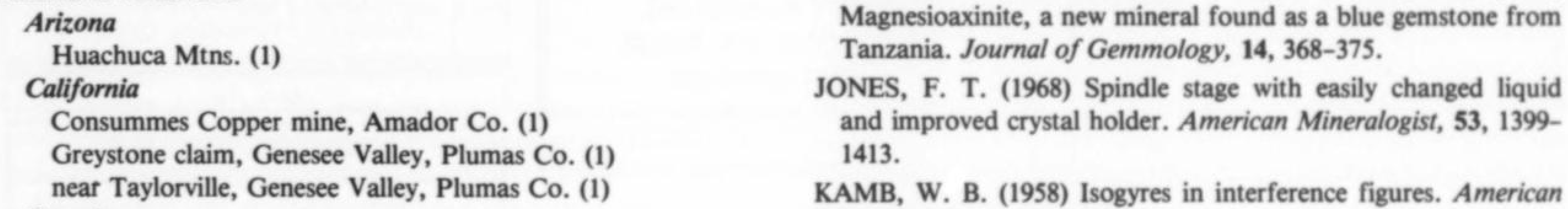

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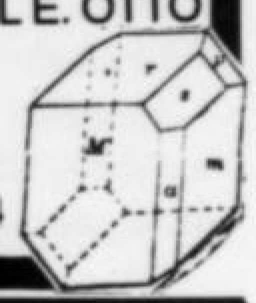

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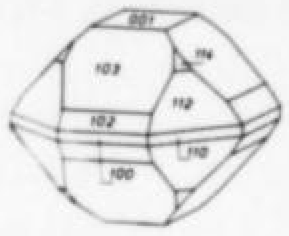

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Memoirs of a Mineral Collector

Fred W. Cassirer (1888–1979)

Photo by Lotta Jacobi

MEMOIRS OF A MINERAL COLLECTOR

by **Fred W. Cassirer**
with the assistance of Amanda Martin
#40 Waterside Plaza
New York, New York 10010

The Last of Three Parts

On February 15 of last year, Fred Cassirer passed away at the age of 90. Before doing so, however, he was able to put down, for publication in the Record, *many of the mineralogical memories he had accumulated over his long and interesting life.*

We continue here with the third and concluding part of his memoirs, illustrated with pictures of specimens from Fred's collection. (Part one appeared in vol. 10, no. 4, of the Record, *and part two appeared in vol. 10, no. 5). The mineral photographs are by Henry Janson.*

In Paris

Through my former visits to Paris I knew a number of people who had distinguished themselves in some way, in the field of mineralogy or simply as dealers in minerals. Over the years I had become a close friend of Dr. Boubée, the head of the Paris Boubée Natural History Supply Company, but when I visited him in 1937 his business in minerals had practically dropped to zero. Instead he had become a taxidermist, mounting deceased cats and dogs, the former darlings of old ladies; it was a lucrative job, but what had become of his once large stock of minerals? Dr. Boubée had owned a substantial private collection, of which he had sold the best pieces. What was left, minerals mostly from continental France and the former French colonies, was, at best, good school material, which was sitting in drawers, absolutely asleep and "unemployed." There was no demand for it. I immediately hatched a plan in my mind and Dr. Boubée was quick to agree to it. From my earlier contacts I knew a number of collectors in America who were not so much interested in high quality minerals as in acquiring pieces from Europe. So for a while I became a kind of mailing office for Dr. Boubée, sending a series of French mineral selections to the United States. The incoming money was divided equally between the two of us.

One of the most outstanding collectors of minerals in France was Colonel Vesignie. He had the largest private collection of minerals in Europe; every piece was recorded and was of the highest quality. Colonel Vesignie was always eager to add to his collection, commonly buying the same species of minerals from a different locality; that is to say if he had a fine French fluorite he would also want to have a fine fluorite from America. I had met the colonel during my earlier visits to Paris; we knew each other quite well, but a closer personal contact had never developed between us as is so often the case when meeting with other collectors. The people at the British Museum were also aware of this fine collection, partly through information which I had passed on, and they were keen to acquire it, should it one day become available. He was already a man in his eighties and the question of the disposition of his collection had arisen quite naturally. However, he never paid any attention to the inquiry from London and toward the end of his life he gave one-half of the collection to the Museum Jardin des Plantes and the other half to the Ecole des Mines, both in Paris.

I visited him on various occasions while I was in Paris and these visits always followed the same pattern. Whenever I offered a specimen, he would ask: "Do you have a second one of the same kind?" If I said yes he would say: "I'll take it" ("it" meaning both pieces). He was collecting for both of the above-named institutions. Colonel Vesignie never asked the price, he only said: "Monsieur, faites l'addition!" and with that he threw almost any amount of paper money on the table from which I could take whatever was due.

A situation completely opposite from the one just described occurred with another collector, a wealthy man in Paris who was at the same time an important figure in the city government. This man—I have lost his name—collected only very small specimens, but of finest quality. It was known that he was extremely selective and, moreover, liked to buy at a reduced price. At one time I owned a large collection of crystallized gold which I wanted to sell (obtained from Sir Arthur Russell). I showed it to him saying that I had already added 20% to my regular price, so that now he would have a chance to bargain with me. He bought all the gold and he never bargained again with me after that. As for myself, I wished I still had the collection and did not have to sell it.

With things going so much in my favor I now had the basis from which to work as a mineral dealer, so I ventured forth and wrote to my old friend, Boodle Lane of the Tri-state area, sending him $50 and asking him to send me some local minerals. (I have written about Boodle Lane in connection with my visit to the U.S. in 1911.) Boodle Lane's down-to-earth nature made an impression on me then, and he was now the man who came to my rescue. He responded generously and immediately to my request, sending me two large barrels full of American minerals: sphalerite, magnetite, calcite and so forth and so on. I was in business. Dr. Boubée was the first to offer to buy this selection, which he considered outstanding, probably just because American minerals were still a rarity in Europe at that time.

Feeling secure again in my new profession as a mineral dealer I also felt free again to follow my earlier habits, exploring the area around me and visiting mineral localities outside of Paris. Of these the one at Autun stands out most vividly in my mind. There I found autunite, berthierite, svanbergite, torbernite, and others.

In Paris, when not doing business, I worked for the Museum National d'Histoire Naturelle (Dept. of Mineralogy) in the Jardin des Plantes. I had succeeded in convincing the curator, Professor Orcell, that their collection, though an excellent one, was badly neglected and in a poor state because of the overcrowded display and also because of the overflowing dust under which the specimens slowly disappeared and went out of sight. There was no money in those days for such "improvements," as Professor Orcell explained to me, or rather for simply maintaining the collection. I told him I was willing to work for him without pay provided he could supply me with duplicates which the collection could spare. It turned out that I again had an almost endless supply of specimens without investing a penny.

Visiting Sir Arthur

In 1936 I got married in Prague, and we decided to go to Paris for our honeymoon and from there to London, since London and the British Museum had always been one of my favorite places to spend time. I took four boxes of minerals with me, mostly from Austria and the Harz Mountains. I went to see Dr. L. I. Spencer, the curator of the Mineralogical Department of the British Museum, and when I told him about the minerals which I had brought along, he expressed an interest and asked me to make arrangements with Dr. Smith, his assistant. Together with Mrs. Smith, I unpacked and arranged the material during the next two days so Dr. Spencer could examine it. The next day I met him in the hallway and he said to me: "I have looked over your minerals. They are all right and we might be interested in buying some." I knew enough English then to understand this to mean that they would buy something. But he continued: "The difficulty is with your prices." I explained that I had arranged the prices with Mrs. Smith, not knowing what prices I could expect to get. But he insisted again: "There is something wrong with them." I answered that we could probably come to another arrangement, if necessary. He said: "You must arrange something, because the prices are ridiculously low." The British way of doing it! But I replied: "Leave it the way it is set up; I am satisfied with these prices."

During the year I visited the British Museum I repeatedly met one of England's greatest collectors, especially of English minerals, Sir Arthur Russell. Sir Arthur spent a great deal of his time at the museum and was constantly involved with the museum's collection as well as with his own. His own collection was on display at the museum and he intended that it be incorporated into the museum's collection one day. Sir Arthur did not collect anything other than English minerals, and whatever I might show him occasionally, he would always give me the same answer: "I am only interested in local minerals." I replied that I did not mind that at all. I should, on the contrary, like to buy a representative British piece, especially one from Cumberland or Derbyshire, as they were on display. With this Sir Arthur's mineralogical patriotism promptly doubled and he declared: "I won't give you a single piece. British minerals are for the British Museum. I collect them at my expense, and it is to the British Museum where they will be going."

As I became better acquainted with Sir Arthur over our mutual interest, he one day made an invitation to my wife and myself to come out and visit him at his home near the town of Reading. When we arrived by local train I had imagined that an elegant carriage would meet us at the station and take us to our destination. Instead, Sir Arthur was standing there in his breeches, waiting for us with a tiny car. The three of us would hardly fit into the seats and, uncomfortable as we were, we drove off and went quite a distance until we came to a gate. The gate opened as if by magic and we drove another mile or so until we came to a second gate. Again the gate opened and we drove until we came to a third gate. I asked Sir Arthur: "Where are we *now?*" He mentioned something about "all this here" belonging to his family for hundreds of years, and with that we had arrived at his castle.

We were immediately shown to our rooms. Upon our request for some hot water, a butler came with a silver container, very small, very beautiful, but with hardly enough water to wash our hands in. Following that we were invited down to dinner, at which Sir Arthur's old father was also present and who was served by his own butler of equally advanced age. As they were both very unsteady there was another young butler who did the actual passing of the trays to the old man. Then I had a difficulty: we were not accustomed to having several sets of forks and spoons around our plates. I was not sure which one to use first, so I asked the lady of the house and she answered quite simply: "Just always take from the outside and you can't be wrong."

After dinner Sir Arthur took us to his picture gallery and showed us some of the most marvelous portraits of members of his own family, as well as of the British Royal Family, painted by famous English artists like Sargent, Reynolds and Gainsborough. The only drawback was that the gallery was not heated and we were quite

Figure 1. **A group of pyroxene crystals 9 cm tall from Nordmark, Sweden.**

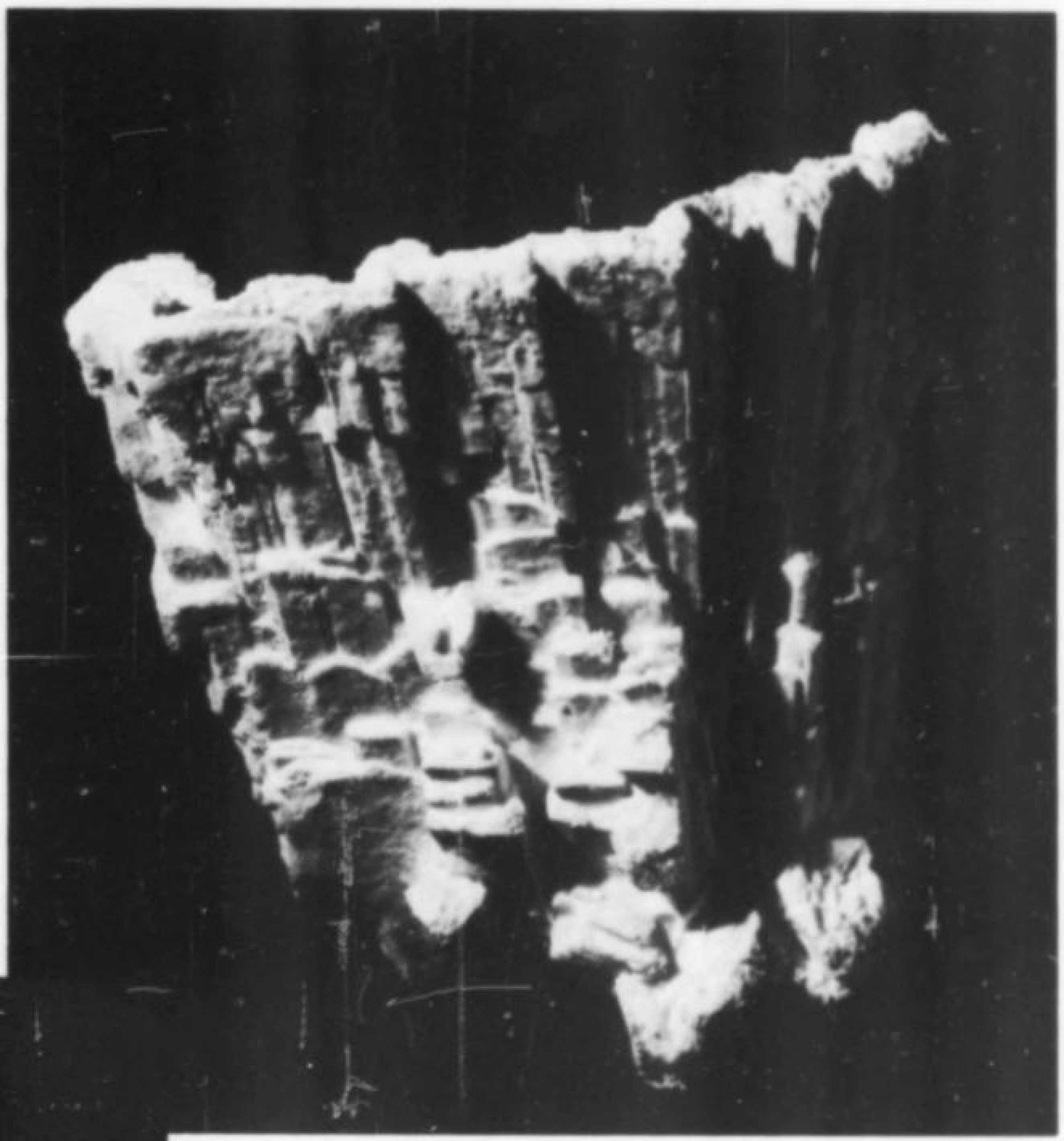

Figure 2. **A group of white epsomite crystals 8 cm tall from Neuhof, Hessen, Germany.**

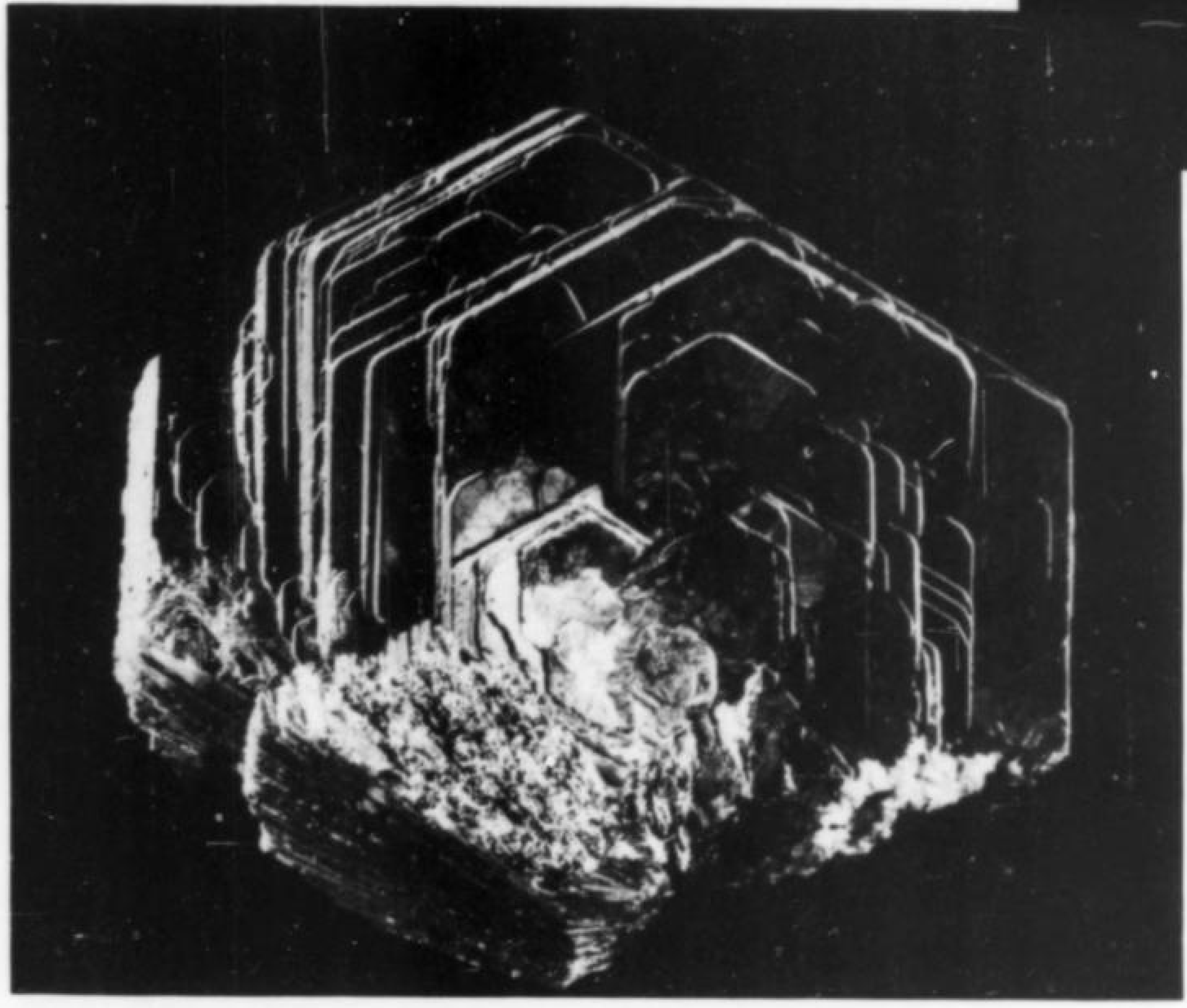

Figure 3. **A hematite "iron rose" from Lorraine, France.**

frozen, so we moved to the drawing room and sat around the fireplace. The dog lay closest to the warmth, and my wife, who felt especially frozen, asked whether the dog could move a bit to the side. Sir Arthur was clearly amazed at this question and said. "But Madam, this is the dog's place!"

We spent two days with his family. It was a very pleasant visit, but the aim of my visit (namely to obtain some first-class English or international specimens) was not fulfilled. At the time of our departure I expressed my disappointment in this respect, but Sir Arthur said that he would not change his principle not to give away English minerals, whether old or new, to other countries.

As he saw my disappointment he said he had one other mineral which somebody had given him years ago. It came from Transvaal and, if I was interested, he would dispose of it. I said I was interested but, of course, had no idea what he was going to show to me. After a few moments he came out with a very large tray filled with fine crystallized gold specimens from South African mines, very old mines from which no more specimens were available. He asked me whether I was interested in acquiring these specimens. Along with my enthusiastic "Yes!" I was already starting to write a check even before he had mentioned the price. I left open the amount for him to fill in. And so my disappointment very quickly changed into pleasure, but, as I have mentioned earlier, my financial position did not allow me to keep the collection. When I returned to Paris I had to sell the collection even faster than I had acquired it.

Meteorites

On one of my earlier visits to the British Museum I came across some single meteorite specimens which had fallen in Europe. Among these there were also two specimens which had fallen in Arizona (in the area of Tucson), and they were labeled as coming from a certain Mr. Nininger somewhere in Arizona. They immediately roused my special interest and I tried everything to find out Nininger's address. I wrote back and forth to Arizona and finally, through some chance, I was able to get the address. I wrote to him without any delay and asked him for more information regarding the collecting of meteorites. When later on I came upon the extraordinary collection of meteorites in the Museum of Natural History I had all the more reason to intensify my contact with Nininger because now I was authorized to offer him doubles from the museum collection in exchange for specimens from his own collection. Nininger was, by profession, a school teacher in an elementary school in a small village in Arizona. But his all-consuming passion, which later in his life became his only occupation, was collecting meteorites and establishing exact data about the apperance of these unexplained phenomena from space. To make sure he could collect to his heart's content he made an agreement with his local bank that allowed him to issue checks for certain amounts which he could repay later when the money was available. Nininger bought meteorites from anyone, anywhere, and any kind of specimen he could lay his hands on, regardless of whether similar pieces from the same fall already existed in his collection or not. In this way, over the years, he built up one of the largest and most complete American meteorite collections in existence. From time to time he would also send specimens to me at the museum and I exchanged them with different European museums.

Remarkably, the meteorite collection at the Museum National d'Histoire Naturelle in the Jardin des Plantes was in still worse condition than their mineral collection. It was a nearly impossible task to bring order into the mass of their material, in total disarray, without evident labels and buried under dust, let alone incorporating new pieces which I received from Arizona. It seemed to me that a solution to this problem was to go over each piece individually and thus try to catalog the entire collection as systematically as possible, a huge task to attempt single-handedly.

On one occasion I took several specimens from Mr. Nininger to London, as I wanted to find out whether the British Museum might have an interest in such pieces. Professor Spencer did indeed invite me to show these meteorites to members of his staff, hoping that more information about this still mysterious subject would come forth. But, alas, the meeting was only another proof of what little factual knowledge about meteorites was yet available. When Professor Spencer asked me to give at the same time a lecture about the specimens which I had brought along, I declined politely and made it quite clear that my sole purpose in coming to him was to acquaint the museum with these specimens in the hope of learning about them, in turn, from the museum. There were moments of embarrassment for everybody, but also the understanding on all sides that science was still very much in the dark about these "messengers" from space. Decades later it became known that the British Museum had decided to buy a large part of the Nininger Collection whereas the remaining part of his collection was acquired by the Center for Meteorite Studies in Tempe, Arizona—both were crowning events in recognition of Nininger's life-long efforts.

A Prisoner in France

One day in 1939 I was declared an *etranger ennemi* of France and sent to a prison camp. Professor Orcel of the Natural History Museum did not waste a moment. He wrote to the camp administration that I was indispensible to the work at the Museum and that therefore I should be released immediately. His request, however urgently worded, remained without a reply. The reason for its being ignored was simple and far from political. It was practical for the man who ran the camp to keep as many prisoners as he could because he made a business of selling the food supplies which he received for his prisoners from the new French Vichy Government. The prisoners who could afford it paid him a high price for their rations, he then bought cheap supplies for the less affluent. This turned out to be a very profitable arrangement for him and, understandably, each prisoner represented an asset to his business which he did not want to let go. However, he was out of luck with me, after a while.

As prescribed by international law, the prisoners' health has to be checked periodically by the Red Cross. The regulation also applied to us and after about four weeks of encampment we were ordered to be inspected by a French medical officer. We were called out by last name, stepped forward, and the doctor said: "All right! Next!" That was the inspection of our health.

Even without my glasses on, standing naked before the "examining" officer, I recognized a mineral specimen lying on his desk. In my naiveté I reached for the specimen, taking it in my hands without saying a single word: a fine piece of pyrite. The officer, seeing me do this, threw a fit and shouted: "Why, sir, are you touching things which do not belong to you?" I responded only by asking him where he had acquired this mineral. "What do you know about it?" he grumbled more quietly. "It so happens that I am a mineralogist," I said to him. "I can tell you a few things." The answer that I got then from the doctor who was raging at me until a few moments ago was: "Get dressed and see me at my hotel." From that day on I became a guest at the hotel, and had to show up at the camp only once a day in order to sign in, making sure, theoretically at least, that I was still there. At last Professor Orcel's letter produced my release and I traveled to rejoin my family on the Côte d'Azur.

Arriving in Nice, my first concern was to see to my papers, or I could be interned again, virtually at any moment. The situation was one of nearly total confusion. Nobody ever quite knew who it was that was in power; was it the French, the Vichy people, the Germans? The Germans certainly did have some influence on the coast for they picked up people from their homes who were never heard from again. This had happened to a nice young girl staying with us at the same boarding house. The situation was risky for me and therefore my wife decided to try to see the *Gouvernement Militaire* of the Côte d'Azur.

She was determined not to have me made a prisoner a second time, and set out to find someone to talk this question over with. She had one calling card from Paris left, and went straight to the Office of the Commandant, hoping to leave her card there. She was admitted, waited a while, was passed several times by an older officer who did not fail to notice the elegant lady waiting in his antechamber. On the contrary, he started talking to her and invited her into his office. She explained her problem and, as she told the story to me later, the officer frowned after she had finished and said: "I have never heard of a camp in this area of the Côte d'Azur, which is my district. What nonsense is this! What did your husband do to become a prisoner?" He seemed genuinely furious about this state of affairs and said: "Your husband is free from now on and if he wants to wear a French uniform, I will put him into the Army and he will be safe."

A real friendship developed between the Commandant, our "protector," and my wife to whom he sent flowers almost every day—a natural gift in Nice. He invited us to concerts and operas, always with great personal interest in the course of our lives and with the assurance that nothing could happen to us. But one day he called, informing us that his whole command had been transferred to North Africa and that, if we wanted to, we could go there with him. The war had not yet reached North Africa. Maybe we would have peace there yet. We decided against it and declined his most friendly offer although we had as yet no alternative and the situation in France had worsened. We put every effort into getting ready to leave France as quickly as possible, in order to go to America.

Back in New York

It is no exaggeration to say that we got away from Europe by the skin of our teeth in 1941, literally at the very last minute, escaping from the Germans in France by boat at a time which seemed to me to be my last hour. We got off that old ramshackle Spanish freighter, got off alive! Less fortunate fellow-passengers (and cattle on board) had died of disease during the voyage and been tossed into the sea. A feeling of immense relief came over me and, also, one of homecoming. After 30 years I was back in New York, back in America, back in the Free World. But: where to start now, how to go on? No freedom in the world, however great, can spell the answer to this question. You must find it yourself.

America was already in the war. There was definitely no call for either minerals or paper, the two items that had kept me going so far. I decided to visit Martin Ehrmann, *the* mineral dealer in the East, a long-standing American customer of mine and I of his in Europe. Ehrmann was a man of few words and quick decisions. He had visited me in France, looked at my showcases sort of dreamily, and suddenly come out with: "OK, I'll take it, all of it." On another occasion, he'd asked me: "What do you have in those drawers over there?" pointing to a little four-drawer cabinet in the corner. "My own collection," I said, and went to fetch us a drink. No sooner had I come back into the room when I saw that all interesting specimens had already been taken out of the drawers. Martin, with a sure smile on his face, handed me a signed check, and said: "Just fill in your valuation." "There is no valuation," was my answer, "this is my collection."

The day I visited Martin Ehrmann in New York he was just leaving for the army. "No mineral business now," he told me, "the war is on." But he did not hesitate to offer me his business, saying, "As I know you, you will make something out of it. Let's go fifty-fifty." What was I to make of it? And now there followed a chain of events and coincidences which I am hardly able to reconstruct.

What happened next was that Martin Ehrmann took me to a meeting of a mineral club in New Jersey where, first of all, I was presented as a kind of miracle-man who had escaped Nazi destruction for the third time. In the course of the evening I met a young engineer from RCA who talked with me for a bit and gave me his card before leaving. The next day I was back in Ehrmann's office. He was again very friendly, told me to relax, to feel at home, and for the moment do nothing but study the important journals in the field. "I'm sure you'll make it," he said with quiet confidence. I looked at one journal and noticed an ad about polished tourmaline. Since the advertiser had an office in the same building, Rockefeller Center, I went to see him. I had been interested in tourmaline when still in Paris, but there nobody wanted to buy any because it had gone out of fashion. The specimens displayed by the advertiser were not of good quality. I told the man so and he was not very happy to hear it. He even became annoyed when I picked up a beautiful water-clear quartz crystal which I saw sitting on his desk (a scene I had gone through before flashed in my mind) for I was told in the same rude manner not to touch things that weren't mine. But when I told the man that I knew something about quartz crystals—I had observed their wartime use in France in walky-talkies—his manner changed. He began telling me about his brother in Brazil—the source of the quartz—who had written him about the new big business interest in quartz which seemed to be in the offing. If I could supply him with customers, he said to me, I could start work now at a 25% commission. I took the elevator down for a telephone, called the RCA offices upstairs and asked for my acquaintance, the engineer with RCA whom I had met the evening before. He asked me to come up and I explained my ideas briefly. Within minutes he introduced me to the Director of RCA and, then and there, we drew up a contract for massive future imports of quartz crystals for wartime use. Ehrmann had been right after all. I returned to business faster than any of us could ever have suspected.

Summing Up

My luck did not desert me in New York. Here, on the contrary, it became more evident than anywhere else. Having started with nothing I was back on my feet overnight. Similar shifts had occurred before, but each time such a turn for the better became more tricky because of the age factor. How many times can a man begin anew?

Where could we immigrants who were over fifty find good work in America? Where today can immigrants of that age who come here find good work? It is not a new problem. I did not think about it too much, for I hoped—and it has been true to this day—that my endless wanderings had finally come to an end.

I was and I am self-taught in mineralogy and meteoritics. I have worked for the great museum collections in Berlin, Prague, Paris, London, in New York and Washington. Extensive field-work gave me my practical training. I traveled all over Europe and never neglected visiting a mine that was worth visiting. I learned my mineralogy by doing it: this is one way of getting close to your subject matter. I could not have ventured into the quartz business, for example, without my previous experience, without the special knowledge of quartz which I had gained in France, or without my business know-how. I had received a merchant's technical training and, last but not least, I come from an old merchant family. Wherever and whenever I had to start from scratch I always did it through the combination of paper, minerals and business acumen in both fields.

But it was minerals with which I stayed and which stayed with me. Business, economics, success—these were everyday matters, and I attended them as if in my sleep. Nature's world, on the other hand, remained the real world for me. I tried to advance in this world and made in it a sort of a name for myself wherever I was, in America, too. And there sprang up again the desire to be surrounded by beautiful minerals. So I slowly acquired my fifth collection of minerals, many exquisite specimens, so-called "old-timers" from mines which were closed long ago. On the other hand there is that great reward that always goes with being in love with minerals: the involvement with people through minerals, meeting new enthusiasts, comparing notes and always being in touch with those of old—none of this has ever left me, and as I know now, it never will.

— — —

I am almost ninety. I am standing at my desk, not sitting, because my knees creak and it is too hard to get up. There is a knock at the door. Before I have time to answer, an old friend, R.B., steps into the room, carrying a big box under his arm. "What are you bringing me?" I ask. "Specimens, of course, the most wonderful specimens . . ."

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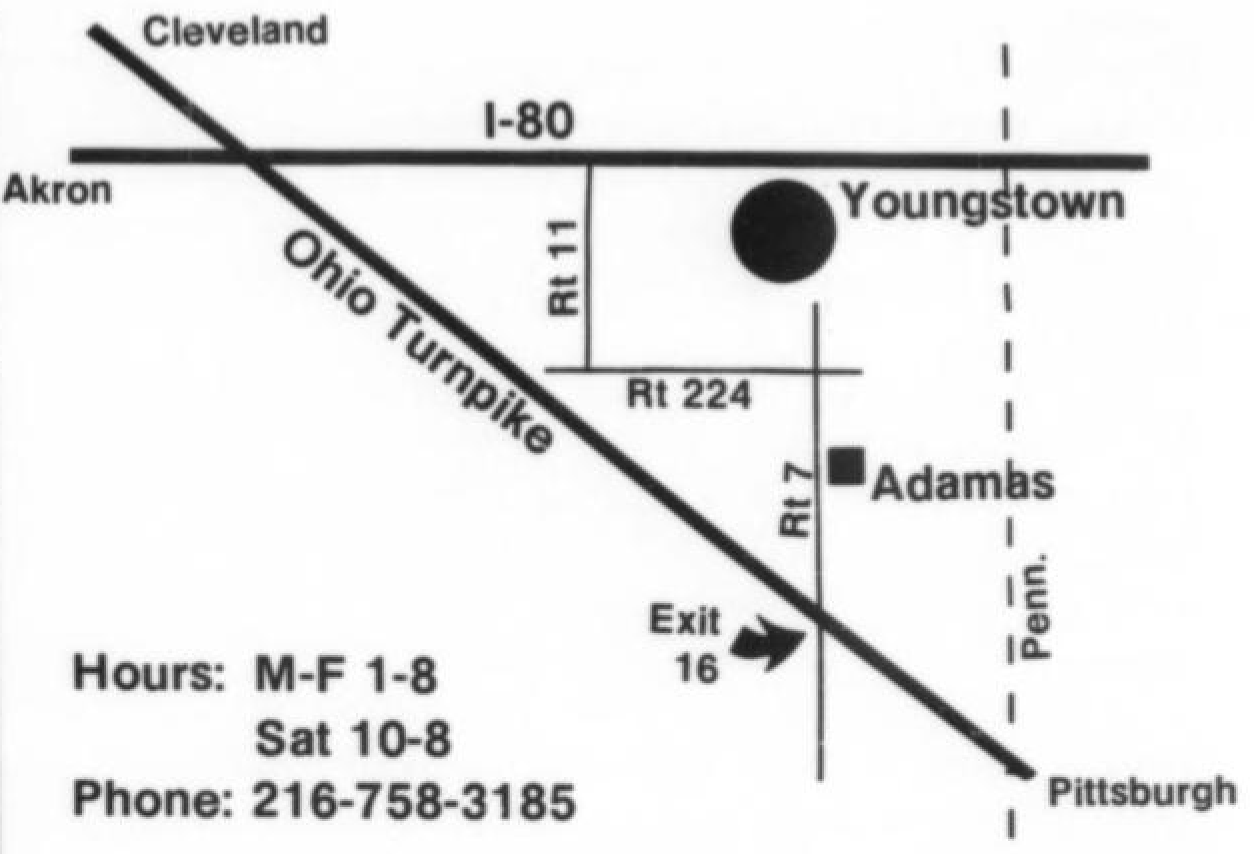

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An Occurrence of Barite at Hartsel, Colorado

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Although the Hartsel barite locality has been known since 1932 when it was placed under a claim, only limited collecting has been possible since the close of mining operations. After the expiration of a former claim, the area was reclaimed and serious collecting was initiated in the summer of 1979.

LOCATION

The Hartsel barite deposit is located approximately 3 kilometers southwest of the town of Hartsel, Colorado (SE 1/4, Sec. 18, T12S, R75W). It is located just off U.S. Highway 24 in Park County in southwestern Colorado (Pearl, 1958; Eckel, 1961).

The present claims (Figure 1) cover an extensive area of diggings and dumps left over from previous mining explorations and are located on the east slope of a hill overlooking South Park and the Park Range.

OCCURRENCE

From a report by Howland (1936) the following geologic description is taken.

"The stratigraphic horizon of the deposit is a limestone member of the Maroon formation (Permian). Because of rapid thinning of the formation by overlap toward the east, its exact position in the Maroon is unknown, but it is probably in the upper part of the section, and itself overlaps on to the granite about a mile farther east. At the barite locality the limestone dips northeastward from 5–12° and forms the southwestern side of a small structural basin, the northeastern side of which flanks a granite knob south of Hartsel. The surface of the ground is approximately a dip slope and the thickness of the limestone horizon is not determinable, but more than 9 feet is exposed in the deepest of the pits left by early exploration. The red soil and red staining of the limestone suggest that more typical red shales and sandstones of the Maroon formation formerly lay stratigraphically above this horizon. The limestone is white and fine-grained. Examination of thin sections and insoluble residues discloses a small amount of gypsum.

"The barite occurs in two ways, (1) as vertical veins from 1 to 2 feet thick, cutting across the beds, and (2) as irregular layers 6 inches to 3 feet thick, roughly parallel to the bedding. The borders of the barite bodies are sharp, but their replacing nature is well shown by a combination of the two types, in which a vein-like mass is enlarged along certain beds through selective replacement. The barite is a porous aggregate of crystals intermixed with limonite-stained clay, which is probably residual from the weathering and perhaps in part from the replacement of the limestone. In some places there are a few inches of porous brown limonite bordering the underside of the barite layers. Thin coatings of calcium carbonate encrust some of the crystals. No sulphides could be found."

We have observed that most of the veins and layers appear to be collapsed, with some resulting damage to a large amount of the barite. According to Howland (1936) the origin of the barite has been attributed either to hot rising solutions of magmatic origin or

***Figure 1.* A view of the area in which the barite is found near Hartsel. One of the older dumps is in the foreground. Photo by Dee Belsher.**

to concentration from surrounding rocks by meteoric water. Howland favors the meteoric theory because of the following observations:

"1. A reasonable source of barium is found in the saline waters of the red beds of the Maroon formation.

2. The position of the deposit corresponds with a synclinal structure, such as might control the flow of meteoric waters.

3. A precipitating agent in the form of gypsum is available in the limestone.

4. Sulfides or other minerals common in deposits formed by hypogene solutions and often associated with barite of possible deep-seated origin are conspicuously absent."

An analysis of the barite by Howland shows an absence of strontium which is noteworthy. A small amount of alkali sulfate may be present.

MINERALOGY

Howland gives the following description of the specimens:

"Many masses of the barite have a branching structure, but the ends of the masses, some of which are more than a foot long, show characteristic tabular crystals. Other groups of crystals do not show the branching development. The well developed forms are *c* {001}, *m* {110}, and *d* {102}. Measurements of several crystals on the reflecting goniometer showed the presence of the unit pyramid *z* {111} as a very narrow face. Crystals attain a maximum size of more than 1.5 inches in the direction of *c* and 5 inches along the *b* axis. The indices of refraction are $\alpha = 1.635 \pm 0.001$, $\beta = 1.637 \pm 0.001$, $\gamma = 1.646 \pm 0.001$. The specific gravity is 4.45."

Occasionally specimens occur having brownish inclusions on the {102} faces only. This gives a pleasing pattern and contrast to these specimens.

One striking feature of the barite is its tendency to change color upon exposure to sunlight. Before being exposed the color ranges from colorless to a greenish-yellow. The result of a few hours exposure to bright sunlight alters the color to a pronounced blue. The color is irregular in most crystals with the base tending to show a less pronounced color. The color change, although long lasting, is not permanent. This is evidenced by older specimens which show a very gradual loss of color. The specimens which have lost some of their color after a few years may be re-exposed and will become darker once again.

It is interesting to compare this color behavior with that described by Carlon and Winchell (1975) as well as with the barite found near Stoneham, Colorado, which occurs as blue crystals that lose their color completely in a few hours exposure to sunlight. Doelter (1929) found that an irregular blue color could be produced from some colorless barite by exposure to radium chloride.

COLLECTING

Initially, mining operations were conducted with hand tools followed later by excavation with bulldozers. The intent was to strip the 2 to 5 meters of overburden and thus expose the barite seams. Due to the current collecting activities of the present claimants, the area is temporarily closed to other collectors.

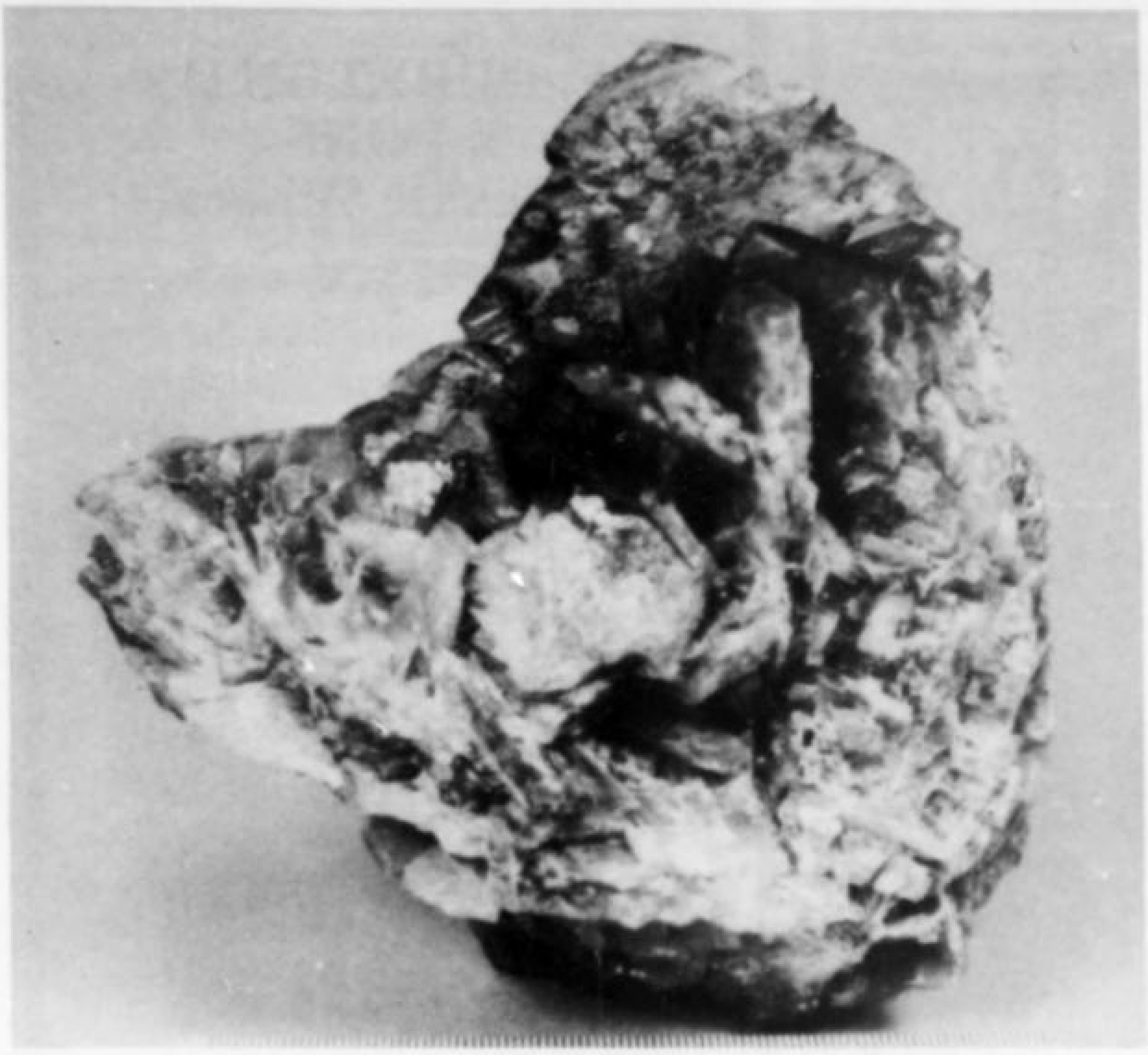

Figure 2. **Barite from Hartsel. The specimen is about 11 cm wide. Color is blue, tending toward brownish in the center, and shows brown inclusions on the {102} faces. Don and Dee Belsher specimen collected in 1979; photo by Don Belsher.**

Collecting specimens entails considerable effort to expose the barite seams since the overlying material is quite tough in most places. Once the barite seams are exposed, the crystals are removed with the use of picks and small tools. Because of settling and original intergrowth, one must remove a considerable amount of damaged crystals before recovering undamaged specimens. Though most of the crystals appear to be on top of each other in a horizontal fashion, occasionally a mud-filled pocket can be located yielding a few large, handsome single crystals and rarely fine matrix specimens. During recent collecting, we uncovered a pocket containing the fine single specimen and group shown in Figures 3 and 4.

The specimens can be easily cleaned in either oxalic or hydrochloric acid to remove the iron stain and carbonate coating. Some scrubbing is necessary beforehand to remove loose dirt and clay. Though both acids work effectively, personal experience suggests that oxalic acid be avoided since it has a tendency to diminish the luster of the specimens. Barite is temperature sensitive and will fracture if subjected to rapidly changing temperature. It is suggested that cleaning be done at room temperature to minimize thermal shock.

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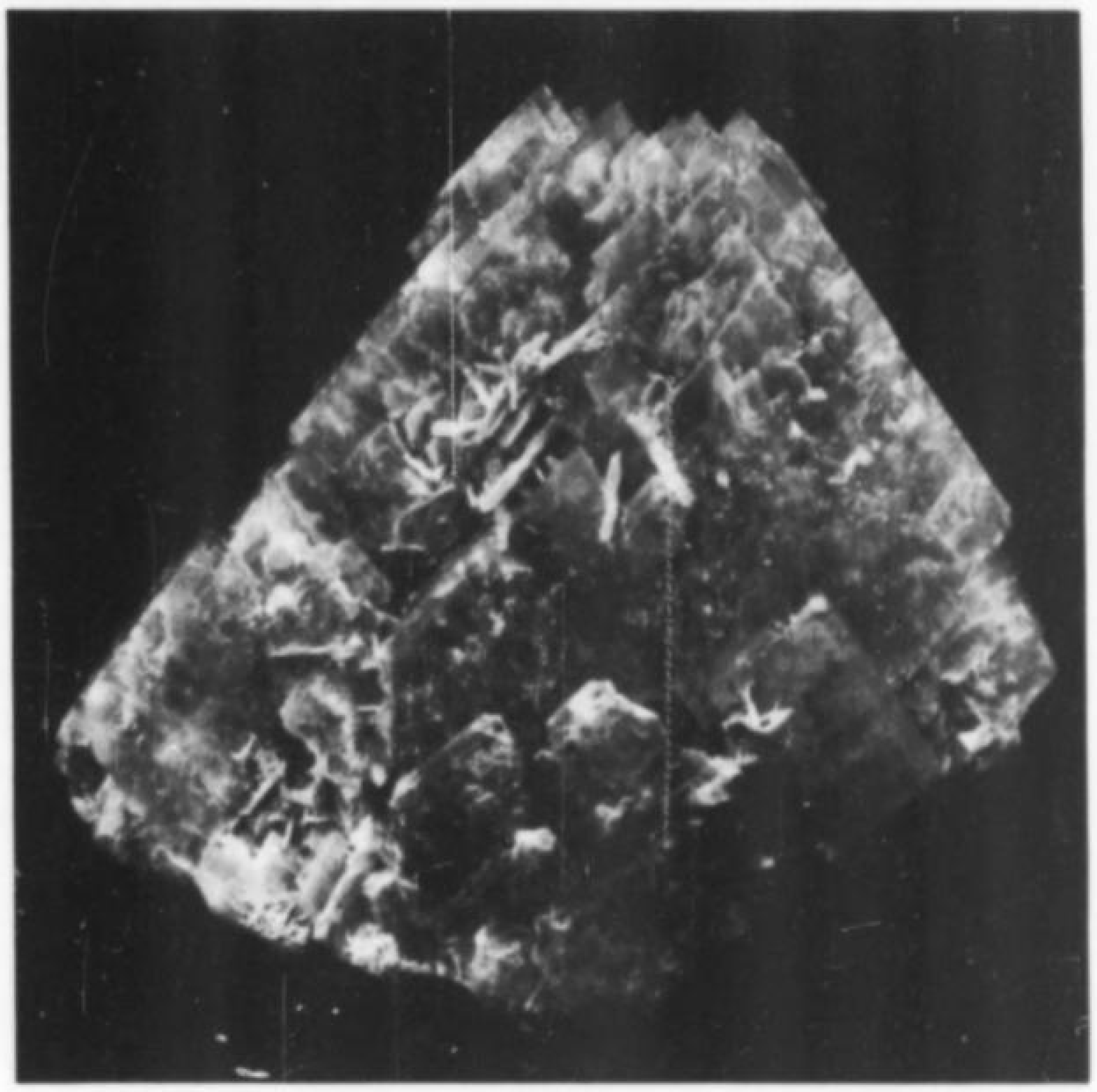

Figure 3. **Barite from Hartsel. A large single crystal with parallel growth. Specimen is about 8 cm wide. Charles Baldwin specimen; photo by Don Belsher.**

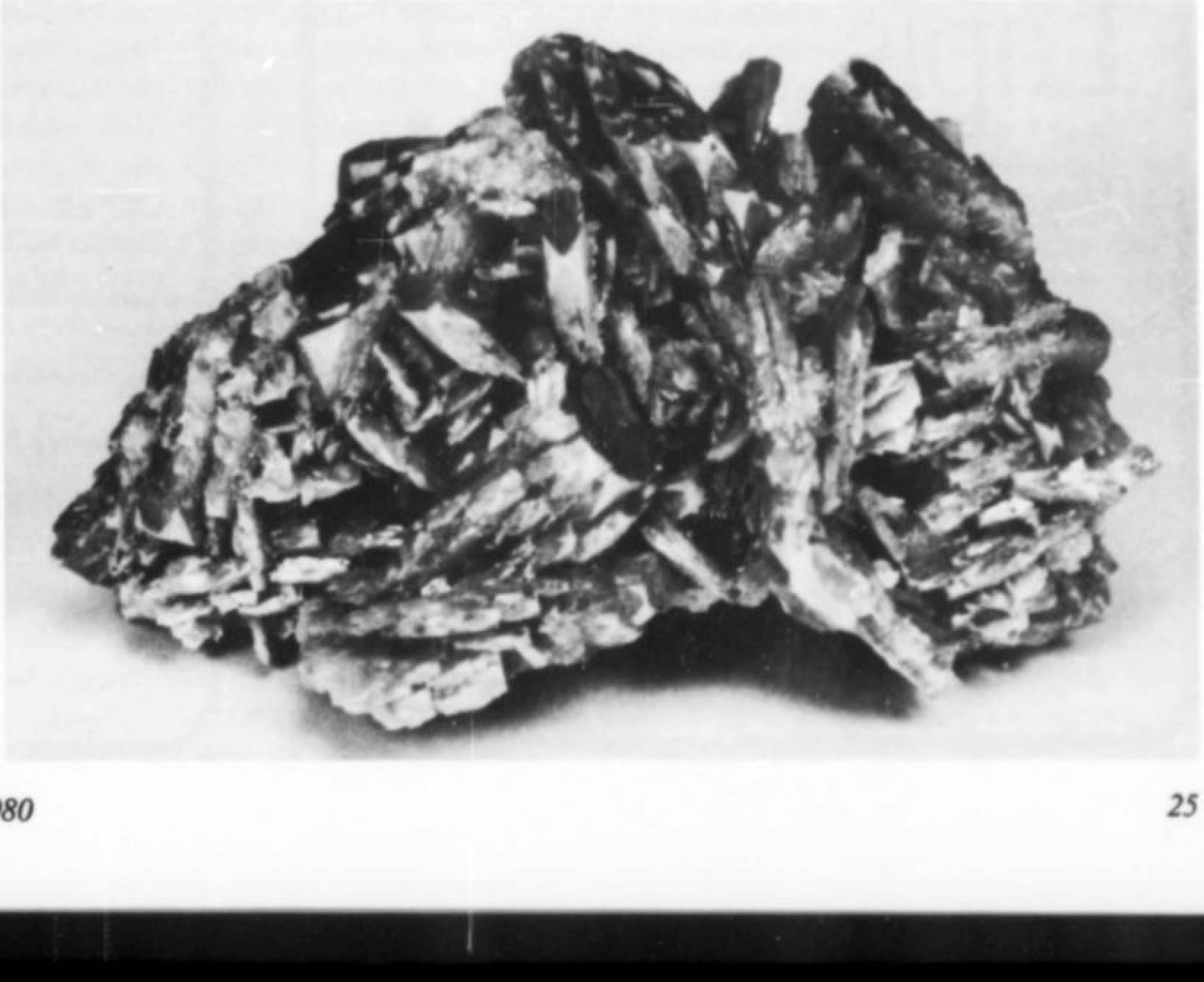

Figure 4. **Barite from Hartsel. A group of bluish crystals about 15 cm wide collected in the summer of 1979. Charles Baldwin specimen; photo by Don Belsher.**

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BOB SULLIVAN'S

LETTER from EUROPE

There was not much news from the European spring bourses or, since Tucson in February, from anywhere for that matter. There was one mineral find worthy of note however; in fact it is sufficiently interesting that preparation of a formal technical paper on it is being considered. This is a collection of native copper from Chile which I had the opportunity to study in detail this past May. The story behind this find, way back in 1968, is also quite interesting. The collection, which consists of about 100 major pieces plus a flock of thumbnails, was dug by a European amateur geologist, then a resident of Chile, from a series of small pockets lining a 15-meter-long area on the walls of one of the adits of a small underground copper mine near Coquimbo, Chile. The mine has since been absorbed by an adjacent open pit mine and for all practical purposes no longer exists. Eleven years ago the mine did offer some intriguing possibilities to this person (who prefers to remain anonymous), but in spite of repeated efforts he could not get the mining superintendent to let him enter the mine. He spent hours in conversation with him trying to gain his confidence and permission but to no avail. One day the superintendent confided to him that he had seen a UFO several nights before. He further confessed his deep interest and belief in UFO's and talked for hours on the subject. The next day our friend combed the bookstores of a nearby city for all the books on UFO's. Amazingly he managed to find six of them which he subsequently presented to the superintendent and shortly thereafter he received permission to go into the mine and collect.

His only significant find was the previously mentioned native copper which was collected over a period of several days in the upper level of the mine. A few of the specimens were given to friends as souvenirs but the bulk of the collection was packed away and subsequently shipped off to Germany where it remained for ten years, eventually finding its way to the U.S.A.

Several things make this collection unique. The specimens from one group of adjoining pockets consist mostly of multiple thin branches of very sharply formed and stacked up, cubic and octahedral crystals of copper ranging from 1.5 to 3.0 mm in diameter. The longest of the groups is over 10 cm, consisting of some dozen or more individual branches and resembling a small Christmas tree. The smaller groups are similarly formed down to even thumbnail size. Some of the branches are coated with a strangely bright secondary mineral initially thought to be silver. It is rather obvious that the coating had prevented the alteration of the copper crystals, for where it is not present the branches have fairly heavy coatings of rich brownish red cuprite. The appearance of these mixed coated and uncoated branches is indeed attractive with their sharply contrasting colors.

Bill Panczner and Art Rowe of the Arizona-Sonora Desert Museum tackled the difficult task of identifying the thin silvery coating and eventually came up with the surprising answer that it is gold—a most unusual occurrence.

The specimens from the second set of adjoining pockets are even more interesting. Crystal formation is similar: sharp and well formed cubes and variations of the cube, but they are entirely coated with the shiny brown-red cuprite. The groups tend to be more compact but the surprise is that most of them also show spear-like, elongated crystal blades, projecting through and out of the masses, which proved to be spinel twins of copper, indeed a very rare occurrence. Some of the miniature specimens are prolific with spinel twins, there being as many as 15 to 20 small twins piled amongst the branchy groups like jack-straws. The first and only popularly known occurrence of spinel twinning in copper was found at Ray, Arizona, a number of years ago and was well documented in the *Record* (vol. 6, no. 1, p. 40) in a note written by Bill Panczner. It would appear, therefore, that the Coquimbo, Chile, find of 1968 was in essence the first modern find of spinel twinning in copper even though it took over ten years for the collector world to become aware of it.

The spinel twins range from 1.2 to 5 cm and average about 2.5 cm in length. The Ray, Arizona, ones average somewhat longer than this and a few of them I understand exceed 10 cm. Unlike the Ray specimens, many of the Chilean spinel twins have generous second-generation deposits of small copper crystals on them resulting in a very pleasing effect. Some of the twins are twisted on the *c*-axis, as are some of those from Ray, and are real collector items.

Not since a small collection of thumbnail-sized specimens of crystallized copper from Elba, Italy, showed up at the Aosta, Italy, bourse about six years ago have I seen such well formed, multi-shaped, small copper crystals. Many of the thumbnails and miniatures are truly competitive copper specimens and with the bonus of a gold coating are certainly attractive. The crystals themselves, sharp and showing many variations of the cubic system, are indeed a delight to the micromounters.

This year's bourse at St. Marie aux Mines, France, must go down as one of the best for quite a few years. "St. Marie," as the French refer to it, took place the first weekend in July and we were fortunate enough to be there for the tenth time in the last eleven years. Sunny skies and warm weather, essential to the success of St. Marie, was the order of the weekend and those collectors who had to travel the many miles to this small mountain town in the heart of the Alsace wine region were not disappointed. I don't believe I have ever seen such a wide variety of minerals offered as this year and they ranged from the rare minerals to rare or difficult-to-obtain localities to several fine collections of minerals in the beautiful category.

Perhaps the showiest of all were extensive collections of marvelous, pyramidal, green apophyllite from Poona, India, offered by several French and one Italian dealer. Sizes varied from thumbnails to large museum specimens, many of them with beautiful sprays of white to clearish, long, needle crystals of mesolite perched atop the medium-green apophyllite. Although not of the deepest color, the size of the apophyllite crystals was exceptionally large, ranging to nearly 5 cm for the single-ended ones and to nearly 7.5 cm (three inches) for the larger of the double-ended ones. Many of the groups were intricate clusters of interconnected, singly and doubly terminated green apophyllite, very esthetic in form, in miniature to cabinet size. All of the specimens were very moderately priced for what they were. Matrix specimens were on the characteristic grey porous basalt of the Poona area, and some had a fine overcoating of small, pure white heulandite crystals which formed a very attractive background for the green apophyllite. White bladed stilbite crystals up to 2.5 cm (an inch) long could be seen dispersed among and on the apophyllite clusters on most of the groups.

I may sound a little prejudiced and actually I am, for green apophyllite happens to be one of my favorite minerals and was largely responsible for jolting me back into the mineral collecting hobby when I first visited India during the late sixties. At that time, and for quite a few years after, the original #1 quarry outside of Poona was operating for road building rock and producing those really deep green pyramidal apophyllite crystal groups which have never been equaled in color to this day. *"Kirche"* crystals (church crystals), so named because of the multi-spire-like crystal tips of the green apophyllite, are still available—and there were a number of them at St. Marie—but the rare Poona "cockscomb" formation of small deep green apophyllite needle crystals, usually on a white heulandite background, are now only seen in older collections. Apophyllite is indeed a multi-colored mineral and from India fine examples of not only facet-grade clear but occasionally pink and yellow pseudo-cubic forms are found in the area around Nasik. The rarest color of them all, however, is blue and in some dozen plus years I have seen only three such exmaples, pyramidal in form and each a beautiful turquoise blue from an unnamed quarry in the Bombay area. The crystals are small, 1.5 to 3 mm in diameter and 6.3 to 9.5 mm long, growing singly among small, curved, silvery white, tabular crystals of heulandite on a gray basalt matrix.

To me, easily the most outstanding collection offered at St. Marie was a table nearly covered with *chessylite,* the famous French azurite from Chessy les Mines, Chessy, France. It was offered by a French strahler who, with his three young, broad-shouldered, teenaged sons, had spent virtually all their spare time for nearly a year combing the dumps of this famous old mine, moving many many tons of waste in their search. The result, however, was the finest and largest collecting of *chessylite* I have ever seen. They had about 200 specimens, mostly in the thumbnail to miniature sizes, about one-third of which were in a very good to superb class. Almost every known form of chessylite was represented, mostly as bladed crystal aggregates, some spherical, including interconnected spheres, others football-shaped, and a few "bow ties." Virtually all of the specimens were floaters so typical of Chessy. Tiny yellowish quartz crystals could also be seen adhering to some of the azurite groups. Color was the usual rich, deep blue with little translucence characteristic of this locality, with some of the azurite so dark in color it appeared to be almost black. Many of the examples were unusually brilliant for *chessylite* and I suspect were dug from deep within the dumps, as they showed no signs of weathering.

The payoff, however, was about a dozen specimens with one or more malachite-coated octahedral cuprite crystals perched on the *chessylite* groups. The cuprite crystals varied from 3 mm up to one "giant" 1.2-cm (half-inch) crystal sitting nonchalantly in the middle of a 7.5 x 12.5-cm plate of crystallized *chessylite.* This was the largest and best specimen in the collection and I missed it, but Maudine settled for a mountain-shaped *chessylite* miniature with a perfect, 6-mm, malachite-coated, octahedral cuprite crystal perched right on the peak. The specimens were expensive but justifiably so, for I have known of some collectors who have dug on these dumps for a week and never found a single good specimen.

One always goes to St. Marie hoping to run across one of those famous axinite groups from Bourg D'Oisans, France, but in the past the pickings have been pretty slim. Not so this year as two young French strahlers showed up, each with a moderate-size collection of these elusive specimens. The collections were distinctly different from each other, both good, but were taken from two separate localities in the mountainous area around Bourg D'Oisans. One consisted of a group of 2 or 3 plates with palish brown, sharply formed, intergrown axinite crystals ranging from 6 to 20 mm in size. The finder assured me that he had recovered much better specimens from this pocket but had sold them prior to the bourse. I really got a kick out of his arm-waving description of the problem of collecting from this locality, a small, projecting, very narrow ledge overhanging a power plant over a hundred meters below. It was necessary to hang down to the ledge on ropes anchored at the top, and to not only carry back to the top the recovered specimens, but all debris as well, as there was simply no place to dispose of it. As he put it, running his finger knifelike across his throat, one rock landing on the power plant below and it was prison and no more mineral collecting!

The second collection of axinite was truly superb. Rich violet-brown, sharp, semi-gemmy crystals up to nearly 5 cm in length on matrix and a few doubly terminated floaters even larger. I held one of these floaters over 5 cm long (2 inches) in my hand and couldn't help but admire its beauty and perfection, but reluctantly I put it back as the price was just too high. In fact the prices of all the axinite specimens were very high but they are rare birds from this famous locality and the growing army of French collectors will pay a handsome price for one of their own classics, which include *chessylite* and Bourg D'Oisans axinite specimens. They are always in high demand.

The best buy of the bourse, in my opinion, was a collection of very fine clusters of sharp, spear-like marcasite crystals from Cap Gris Nez (Cape Gray Nose), Pommune D'Escalles near Calais, France. The crystals were exceptionally brilliant, razor-sharp and ranged from 6 to 13 mm in length. The clusters varied in shape from spherical formations to others in which the intergrown spear-like crystals were stacked up in long stalactitic formations. When recovered, these clusters normally show no point of attachment, as they grew in the soft chalkstone cliffs along the northern coast of France. Finding them is not easy, explained the two young French strahlers, and low tide is the best time to hunt them at the base of the chalk cliffs. Many times they have made the several-hundred-mile round trip from their homes in central France for a weekend of digging and returned with a zero for their efforts. This last trip was a fortunate one, as their table-full of beauties showed very well. Cap Gris Nez is the main cape projecting out from the mainland just southwest of Calais and Cap Blanc Nez (Cape White Nose), a previously reported locality for this marcasite, is a smaller cape jutting out from Cap Gris Nez. Incidentally, I have heard that similar marcasite specimens have been found in the chalk cliffs on the opposite shores of England but have not been able to confirm this. Perhaps some English reader could enlighten me on this subject? To me these French marcasite specimens are just about the best there is in Europe these days and unlike many, they do remain bright. While the Vinitrov, Czechoslovakia, specimens have quite a bit larger crystals, also spear-shaped, they mostly lack the sharpness and brilliance of the French ones which, most important to many of today's collectors, are mostly available in very fine thumbnails and miniatures. I can only describe them as very "sassy" marcasite specimens!

It was not possible to study in detail all of the offerings of nearly 200 dealers at St. Marie. They were spread throughout three different exhibition halls plus a newly added large red and white striped tent. With its end flaps open the tent was the coolest spot at the bourse. The main hall which housed most of the top dealers, including most of those from Germany, Italy, Austria plus several from the U.S.A. and of course France, was a beehive of activity for most of the two days. Oftentimes it was difficult to get to see some of the tables what with the crowded narrow aisles and dense packing of dealers who were restricted to half-meter-wide tables. I could not help but marvel at the ingenuity of particularly the French dealers who, being severely limited in table width, simply went up, building up layer after layer of glass shelving, mostly on specially constructed metal frameworks, to 1 or 2 meters above the table level.

A myriad of spotlights projecting down on the many glass-supported specimens gave the entire hall a sort of magical appearance, mostly bathed in a pinkish glow. The pink glow resulted from more than half the dealers using the relatively new Finnish-made *Eurolox* spotlights. They supposedly give a true daylight effect but many claim they give an unreal and overly beautiful color to many specimens, particularly those with red, blue and green minerals. Some clubs are currently debating the merit of allowing these lamps to be used by the dealers and conceivably there could be some bans in the future. Personally, I do not like them but took care of the problem by first checking any specimen I was considering under a normal white light or outdoors before buying it. There were some significant differences.

Poking my head into as many places as possible I could not help but note the wide variety of unusual minerals that were being offered. Many were not especially beautiful but there was a significant number of specimens from Hungary, Czechoslovakia, Poland, East Germany, Greece, a few from Russia and a good sampling of minerals from, of all places, Belgium. The minerals were generally an assortment of calcite, aragonite, celestine, quartz and others of the more common minerals. There were a few of the rarer ones, one of which was ardennite in matrix from Sahn Chateau, Belgium.

Most of the aforementioned minerals were available in good quantities and there was opportunity to choose in accordance with one's taste and pocketbook; there were, however, a number of other fine offerings in smaller quantities, most notable of which was a group of about 20 really good cabinet to museum-size crystallized rose quartz specimens from Taquaral, Minas Gerais, Brazil. The very deep rose color of these specimens, some of which had fine minor deposits of eosphorite, was about the richest I have ever seen. Most were on quartz crystal matrixes but some were beautifully crystallized on red and green, 3 to 6-mm tourmaline crystals piled up on each other like sticks. They were in the expensive bracket.

One French dealer had a fine collection of Madagascar tourmaline, mostly single crystals in virtually all the wanted colors including bi-color and tri-color varieties. Many had been slabbed and polished to show the very attractive triangular and other shaped patterns rather typical of the Madagascar pegmatite tourmalines. The slabs ranged to over 15 cm (six inches) in diameter and some were truly gorgeous. While all the specimens were labeled simply "tourmaline" I suspect that many of them were liddicoatite. As is typical of most all Madagascan minerals that I have seen, they were very expensive and they just don't seem to be competitive with similar tourmalines from Brazil.

I had a very interesting long talk with a young French couple who had been living and teaching in Madagascar for a number of years. They were both avid collectors and enthusiastic readers of the *Record* but had to rely upon magazines for most of their news, and upon annual trips home to France to build their collection. To them, being at St. Marie was like being a child left alone in a candy store! From them, plus a long letter just received from another Madagascan reader, I have learned a lot about this most intriguing island country, the rather difficult problems of collecting, present commercial exploitation, language barriers, etc. But the minerals are there, including all the classic pegmatite gem varieties, and one of these days when I can fit all the pieces of this unique puzzle together I shall devote some column space to this promising mineral country. Subsequent to the bourse I did obtain a fine, perfectly terminated 2.5 by 7.5-cm Madagascar aquamarine crystal, semi-gemmy and a rich deep blue color, this from a Swiss dealer and one of two in his possession. To be sure it shows there is promise there.

Ever since the phenomenal find of deep green pyromorphite from Mine des Farges, Ussel, France, about 1½ years ago (the *Record,* vol. 8, p. 404) the world has been hoping for more. There was plenty of pyromorphite around at St. Marie but none of that classic green color. Shades varied from a mustard-yellow-brown to a grayish green and one particular "new" color, a light apple-green, I found most pleasing. Crystals were on the smallish size but some of those with the brownish tones ranged to well over 1.5 cm. Prices on all of the pyromorphite specimens were exceptionally steep but the word is that this lead-zinc mine, which has been considered commercially infeasible for quite some time, is going to be closed. Time will tell. There were a few specimens with thin, tabular, tan, 3 to 10-mm wulfenite crystals dispersed among the barrel-shaped pyromorphite crystals, a combination rarely occurring at des Farges regardless of the color of the pyromorphite.

Europeans are generally most familiar with the bladed gypsum "sand roses" from Algeria, whereas the North Americans quickly recognize the larger sandy gray formations from Mexico. The Algerian rosettes are a beautiful color, a rich brownish orange, and are very esthetic in form as the rosettes pile on top of each other in multi-limbed aggregates to heights of over 2 meters. Such specimens are too heavy and fragile to transport out of the distant Sahara Desert and remain there as monuments in an otherwise treeless landscape. The name "sand rose" is most appropriate, as the flower-like bladed clusters can form dainty aggregates from only 1 cm in diameter up to giants with blades 15 cm or more across. They were formed under the sand in sometimes monumental multiple clusters and many are subsequently exposed by strong desert winds. Being somewhat fragile as well as heavy, they are difficult to transport, but hand-size groups are easily managed and make very attractive and interesting display specimens. Several fine collections of them were to be seen at St. Marie and at very moderate prices. They are readily available from Algerian street vendors and, if you are willing to make the long jeep trip to this remote part of the Sahara desert, they are quite easily found, but severe sandstorms can occur in this region and a two-way radio in your vehicle is good insurance. The export of these "sand roses" is generally prohibited by the Algerian government but somehow or other a fairly steady supply of them manages to find its way to Europe. Similar roses are found in the deserts of Morocco but are seen less frequently in Europe.

St. Marie is basically a mineral bourse but for the fast growing legion of fossil collectors there are some fine offerings, mostly from Germany, Spain and France. Being an avid tektite collector (I am still seeking my first Georgia tektite) I was particularly pleased to find a small collection of Malaysian tektites offered by one French dealer who had been to the fall area and purchased them from the natives. Prices were high, for even in this somewhat remote part of Malaysia, the natives know the value of these "magic stones." Since I had never seen them offered for sale before, I splurged and bought a fine assortment of the many available shapes.

Tail-gating is not particularly discouraged at St. Marie as well as many of the European bourses and if one got tired of fighting the crowds in the hot halls, there was plenty of good, mostly local, French material being offered out of a number of car trunks. One dealer who also had a stand in the main hall was doing a land office business in mostly Romanian minerals from the back of his station wagon, parked right out in front of the hall. He was offering some really good stibnite groups plus some fine examples of the pale rhodochrosite so typical of Kapnik. "The French believe that things are cheaper when sold out of the backs of cars," he declared, "but my prices here are the same as I have inside." At the end of the bourse nearly 80% of his sales had been made from the back of his wagon! Figure that one out if you can!

And so another St. Marie aux Mines bourse went into history. Sales were not all that brisk and most of the dealers were disappointed. One full-time German dealer I spoke to said he had done eight bourses in Germany and France, from spring to early summer, and had netted a total of about $900 as a result. High table costs and travel expenses plus the increasing cost of minerals at the sources are the main problems, he said, but he hoped to hang on until the fall when the bigger and better bourses take place. It is a problem only the mineral collector can solve, he believed.

Our travels throughout Europe covered not only France but Norway, Sweden and, of course, Switzerland. There was some interesting news from Scandinavia but I shall have to save that for a future column. Suffice to say that the Norwegian Amateur Geologists Association will have their national show in the town of Kongsberg on August 11–12; this is a most appropriate locality for sure. Not only will one be able to visit the famous Kongsberg Mining Museum and see the world's finest large collection of Kongsberg silver, but a trip into the famous old Kings mine is arrangeable. There is also an opportunity to search for silver specimens in several nearby silver mining dumps.

Most people tend to think of "Kongsberg" as having been a single mine in Norway but in reality there were approximately 300 mines scattered throughout the low mountainous region of the province of Kongsberg. The first silver strike was made by two children herding sheep in the area, who set out to gather firewood and moss to cook their evening meal. Stripping away a layer of moss from a small rocky ledge they uncovered the beginning of a large vein of solid silver, this in the year 1623. A year later, just four years after the pilgrims landed on Plymouth Rock, mining operations began and the mine was called the Kings mine. It turned out to be the richest mine of any subsequently discovered and was worked to a depth of nearly 1100 m, of which more than 550 m were below sea level. The mines shut down permanently in 1957, after 333 years of operation during which over 15 generations of Norwegian miners had toiled in them. Kongsberg silver specimens, long famous for their beautiful, long, thick wire forms, rarely are available today but the dumps of the Norske Love mine in Vinoren plus the Mildigkeit Gottes and Gottes Hulfe mines in Kongsberg do occasionally produce a good thumbnail or miniature specimen. A special thanks to Knut Eldjarn and Dagfinn Pedersen of Oslo for their fine descriptive brochure announcing the Kongsberg show.

We visited several dealers and private collectors in Switzerland and turned up some more interesting information. Tsumeb seems to be the hot topic in Europe at the moment, and the world continues to wonder what eventually is going to happen mineralwise in this famous mining area. Obviously the answer is tied to the question of what will be the ultimate political solution in Namibia (Southwest Africa) and even the best of the world's brains are still guessing on this one. Today's facts are quite plain in that the flood of mineral specimens continues to dwindle and prices, particularly for the better specimens, continue to rise. One major German dealer told me at St. Marie that they are getting less than one-third of the volume of Tsumeb and Berg Aukas minerals that they used to, and that even darker days lie ahead. It would be interesting to know if the commercial ore production of the Tsumeb Corporation is also falling or whether the reduced mineral supply is the result of many miners leaving, poor luck in hitting productive pockets, or what. I suspect it is a combination of all three. Most notable of recent Tsumeb finds are some very fine examples of mimetite sharply crystallized on clusters of especially brilliant cerussite crystals. The pyramidal mimetite crystals are sharply formed, rich yellow in color and range to 1.2 cm in length. They are a beautiful contrast to the very gemmy, complex clusters of bladed cerussite crystals which make up their matrix. A number of the cerussite clusters are complete floaters, but unfortunately the quantity of all the specimens recovered is quite limited.

I saw some very fine rhodochrosite (saved out until now from earlier finds at the N'Chwaning mine in northern Cape Province, South Africa) which had just arrived in Europe. The richness of the red in this collection of about 40 pieces was especially notable but prices were not exactly cheap. The many varied habits of rhodochrosite from this area were well represented including one of my favorites, the wheat sheaf. One rhodochrosite specimen also containing several 6 to 12-mm, well crystallized, clear, cubic apophyllite crystals especially caught my eye—it was truly attractive and a seldom seen combination.

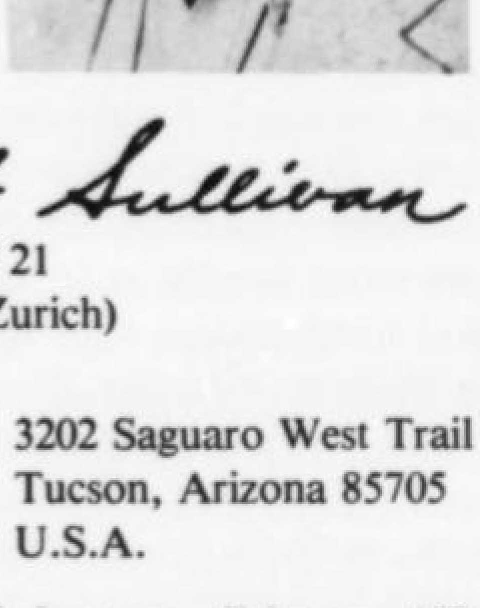
I was especially interested to observe the reactions of several Swiss to those very fine hematite "eisenrosen" (iron roses) from the Quartzite area of Arizona reported in the "What's New in Minerals" column of the *Record* (vol. 10, no. 3, p. 189). Certainly the single large specimen described is indeed a superb example and a photo of it is expected to appear in a future issue of the *Record.* However, some Swiss or even Italians might want to challenge the statement "this could well be the finest hematite specimen in the world," simply on nationalistic grounds. After all, who ever heard of an Arizona iron rose, or any American one for that matter? For the best of these have traditionally come from Switzerland and occasionally from northern Italy. Try telling this to Mike Sprunger, who dug the big one plus a bunch of superb smaller ones from a single vug in the Quartzite area over five years ago. Certainly it was one of the best kept "mineral secrets" for some time. The perfection and beauty of this single large specimen is indeed startling, but in many respects I think the true significance of this unusual find was somewhat overlooked in the admiration for the big grandfather. The rest of the family consists of about 150 major specimens varying from a bit more than 3 cm down to about 5 mm in diameter. They consist of sharply formed, extremely brilliant, overlapping, thin hexagonal hematite plates stacked up to form rosettes of the classical iron rose habit. The thickness of the stacks varies from 6 to 12 mm and the color is a rich, deep, shiny black. The really unusual aspect of these specimens is the fact that about 80% of the iron roses are complete floaters and double-sided as well, truly unique! A bit of a bonus is the fact that about 20% of the specimens have several 1.5 to 3-mm, clear quartz crystals, some doubly terminated, projecting mostly radially from the edges of the rose.

One rather prominent Swiss collector commented that they could not be from Arizona for they were much better than the Swiss ones! (When I asked him if I could quote him on this he said "No, but I believe it"!) To be sure, this was an extraordinary find and to many who saw them, they were the best thing to show up at Tucson time. I have never seen or heard of a Swiss or Italian double-sided floater iron rose, nor in fact of any significant American occurrence of any iron roses, but would welcome any reader comment on these questions. I thought they were great.

For several years now the first Spanish mineral bourse has been brewing in Madrid. Now suddenly not one but two have been announced for 1979 with both expected to continue on an annual basis. As I write this the first has already taken place in Madrid at the Hotel Castilla on June 2–3. The second is scheduled for September 7–9 at the Palacio de Congresos in Barcelona. Good luck to both, for they have been long awaited. If any of our Spanish readers have any news on these shows I would welcome it.

A final note of thanks to Vic Yount, who has informed me that there is still another European source for "Herkimer diamond" type quartz crystals, this in Spain. The "Spanish Herkimers" are found near the town of Bera Bes in Asturias province and, from his description, seem to resemble their French cousins, "Mirabeau diamonds" from Remuzat (the *Record,* vol. 10, no. 2, p. 122).

That is it and until next time, if you buy a mineral, make sure it is a *good* one!



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Mineralogical Notes

CARBONATE-FLUORAPATITE FROM NEAR FAIRFIELD, UTAH

by **Pete J. Dunn**
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The variscite nodules found near Fairfield, Utah, are now collector classics and are found in many mineral collections, both in the United States and in foreign countries. The nodules were found in moderate abundance and have gradually been disseminated by collectors and the forces of the mineral market. They are well known for their gem-quality variscite, frequently laced with yellow veinlets of crandallite; they also contain rare and unusual minerals such as montgomeryite, wardite, gordonite, englishite, overite, and kolbeckite (sterrettite). Such a nodule was illustrated in color on the cover of the March-April 1974 issue of the *Record.*

The original description of the nodules was given by Larsen and Shannon (1930) and a more detailed investigation of all the minerals from the deposit was given by E. S. Larsen, III (1942). According to Larsen (1942) the locality "is located about 50 miles south of Salt Lake City in the southern end of the Oquirrh Range." The specific locality is stated to be "on the north slopes of Clay Canyon, five miles west of the town of Fairfield."

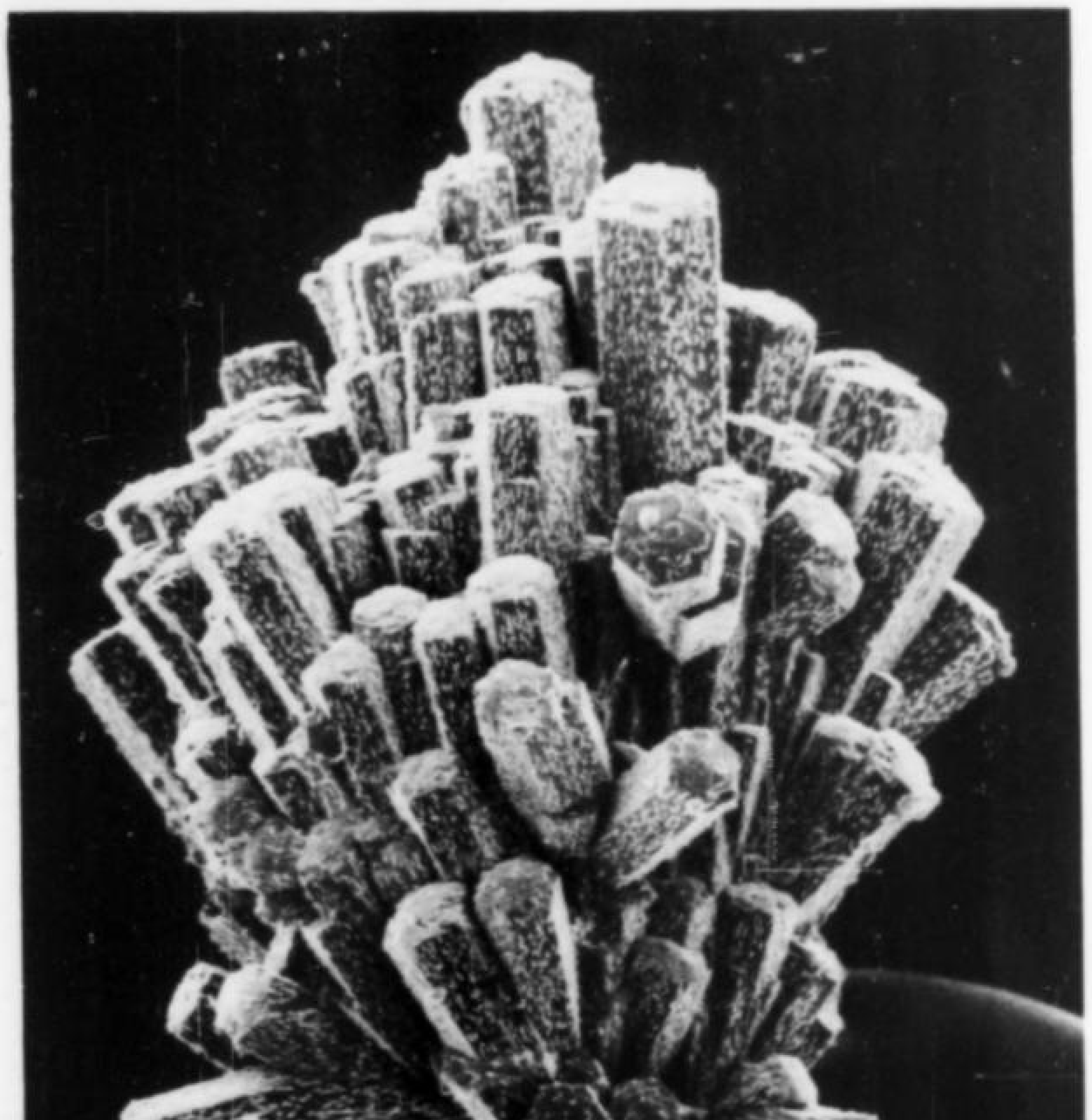

Figure 1. **A cluster of carbonate-fluorapatite crystals from near Fairfield, Utah. NMNH #104078 (SEM photomicrograph at 46x).**

Figure 2. **A closeup at 220x of part of the cluster shown in Figure 1. Here the probable epitaxy is more obvious.**

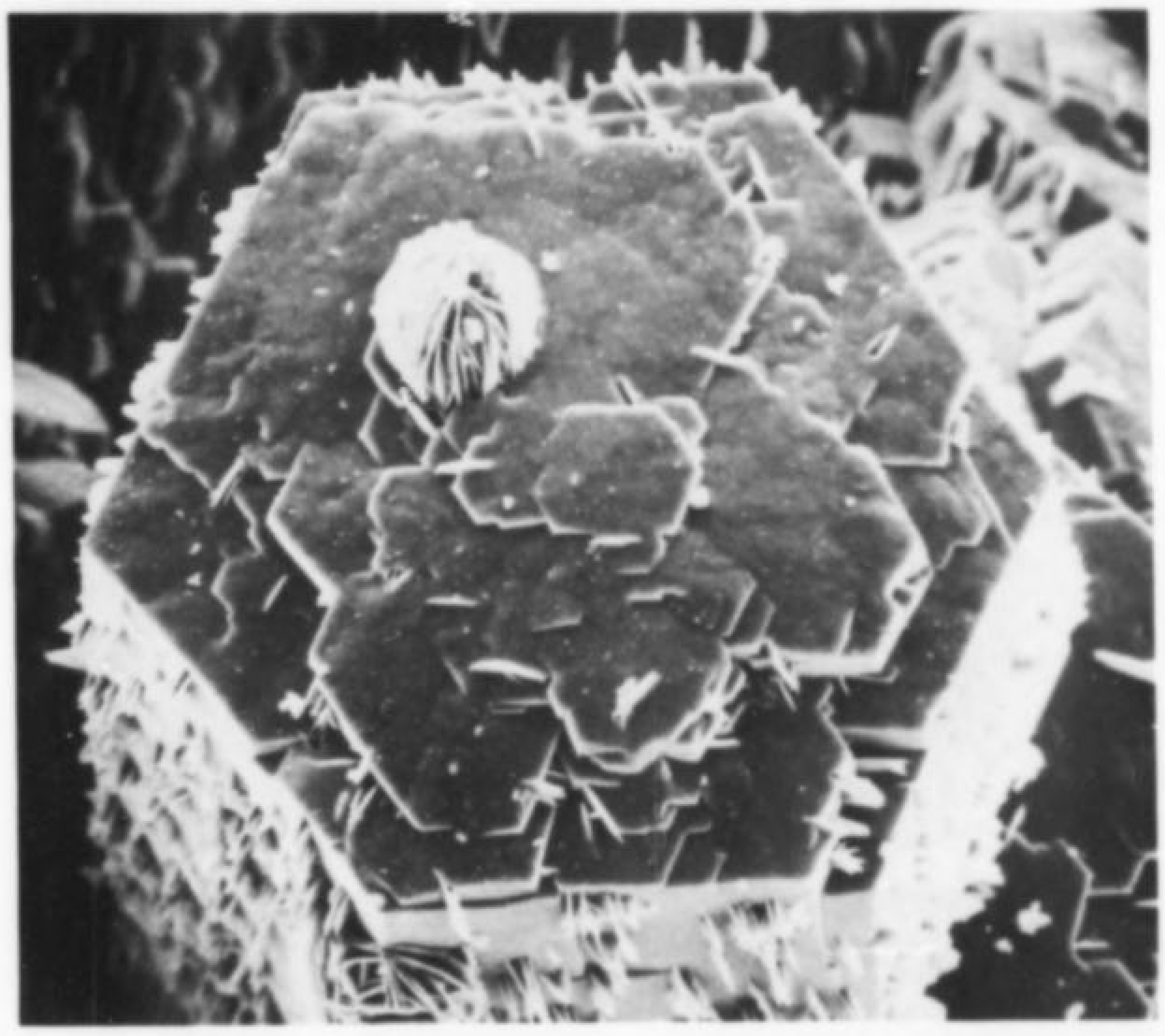

Figure 3. **The tip of one crystal in Figure 1. The spherule on the pinacoid of the carbonate-fluorapatite is probably crandallite (360x).**

Although the nodules are widely distributed as specimens now, their principal appeal has been as polishing-grade material and the small crystals in cavities in the crandallite have received very little attention from collectors. Foremost among the minerals which occur as microcrystals in crandallite seams, both in terms of crystal abundance and quality, is apatite.

The apatites found in these nodules were studied by Larsen and Shannon (1930a, 1930b) and, on the basis of faulty analyses, named dehrnite and lewistonite. They were reported to contain potassium and sodium and, because these elements are not usually

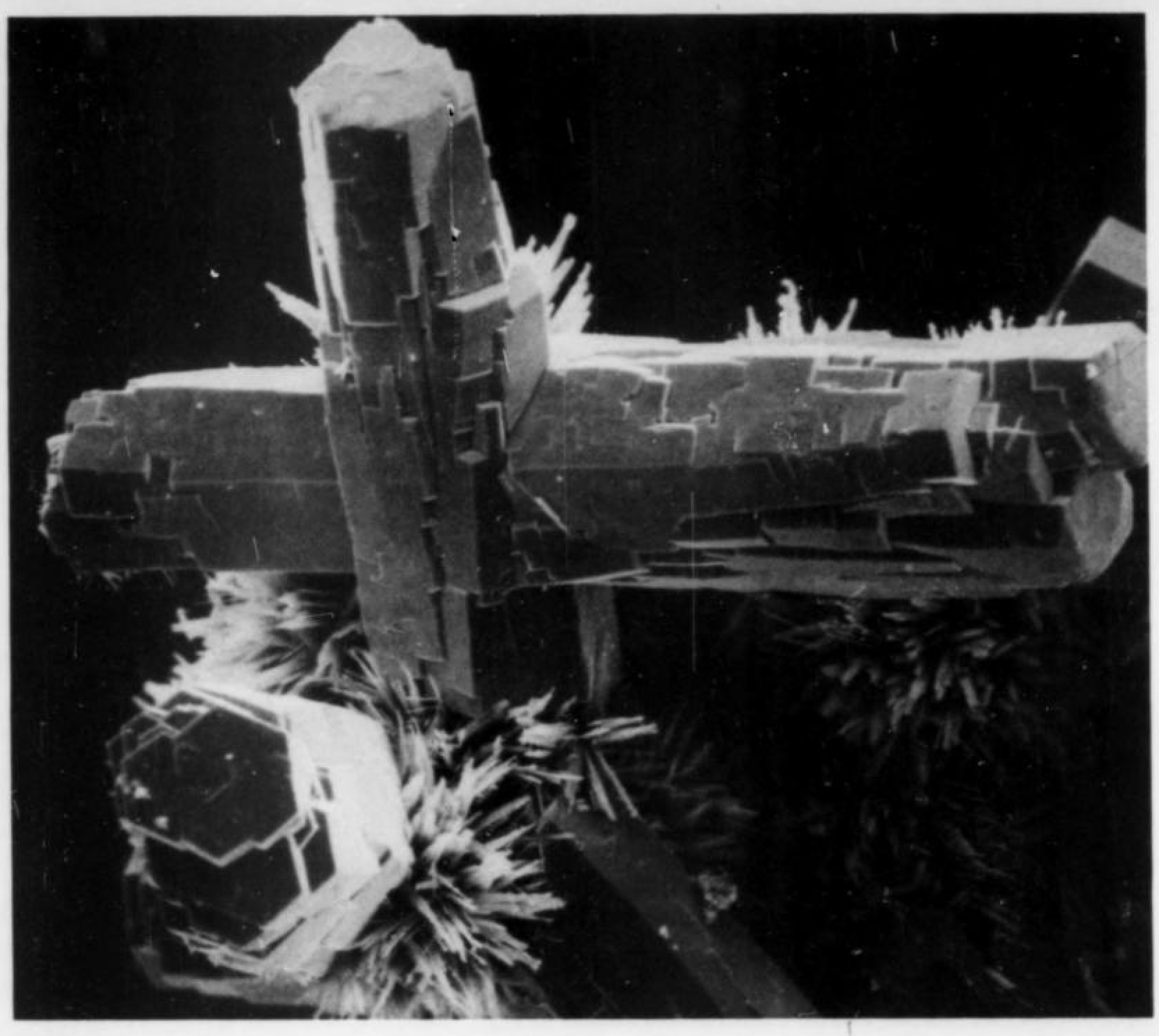

Figure 4. **Two carbonate-fluorapatite crystals intergrown in a cross-like arrangement. (190x), NMNH 104083.**

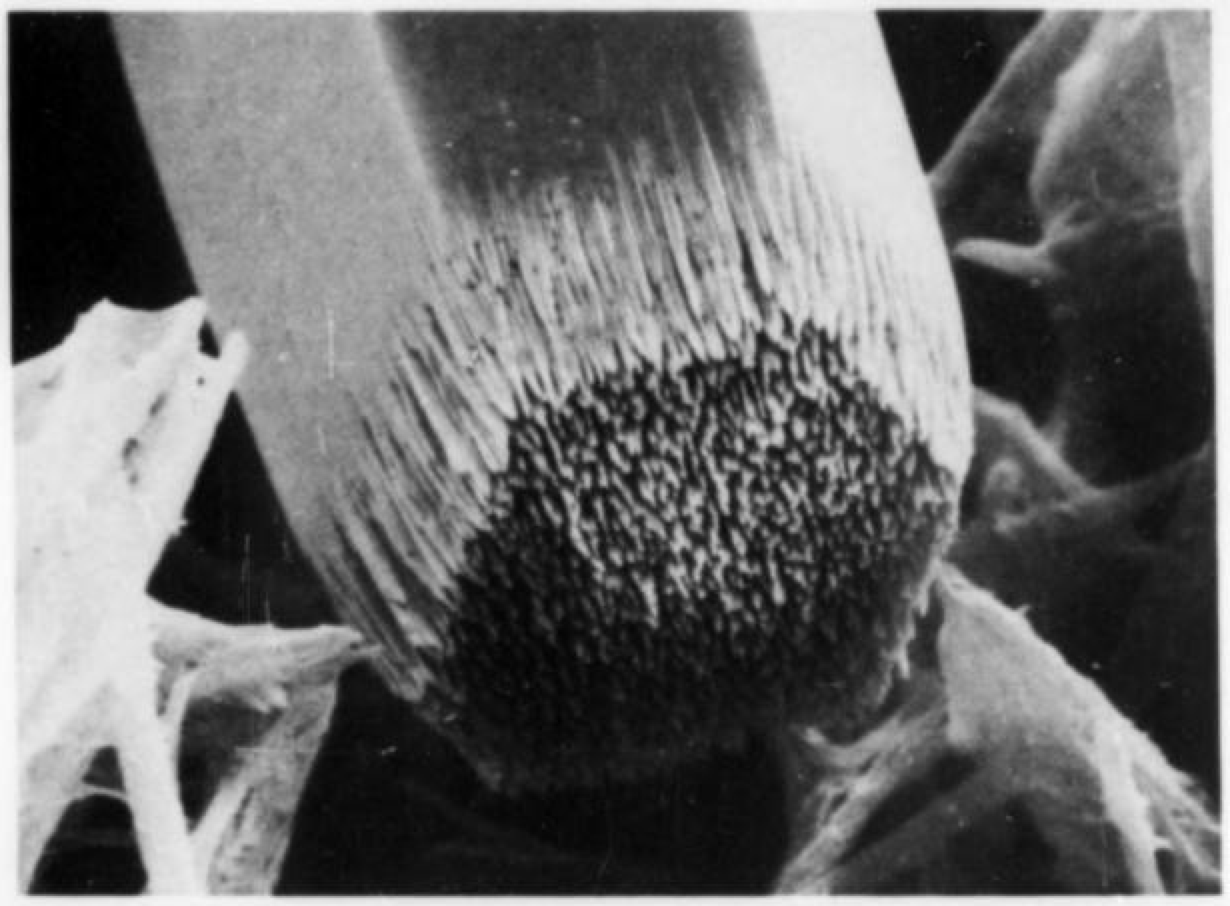

Figure 5. **A highly magnified (1960x) image of the tip of a crystal of carbonate-fluorapatite showing the needle-like terminations giving the appearance of a flat pinacoid face. NMNH #104075.**

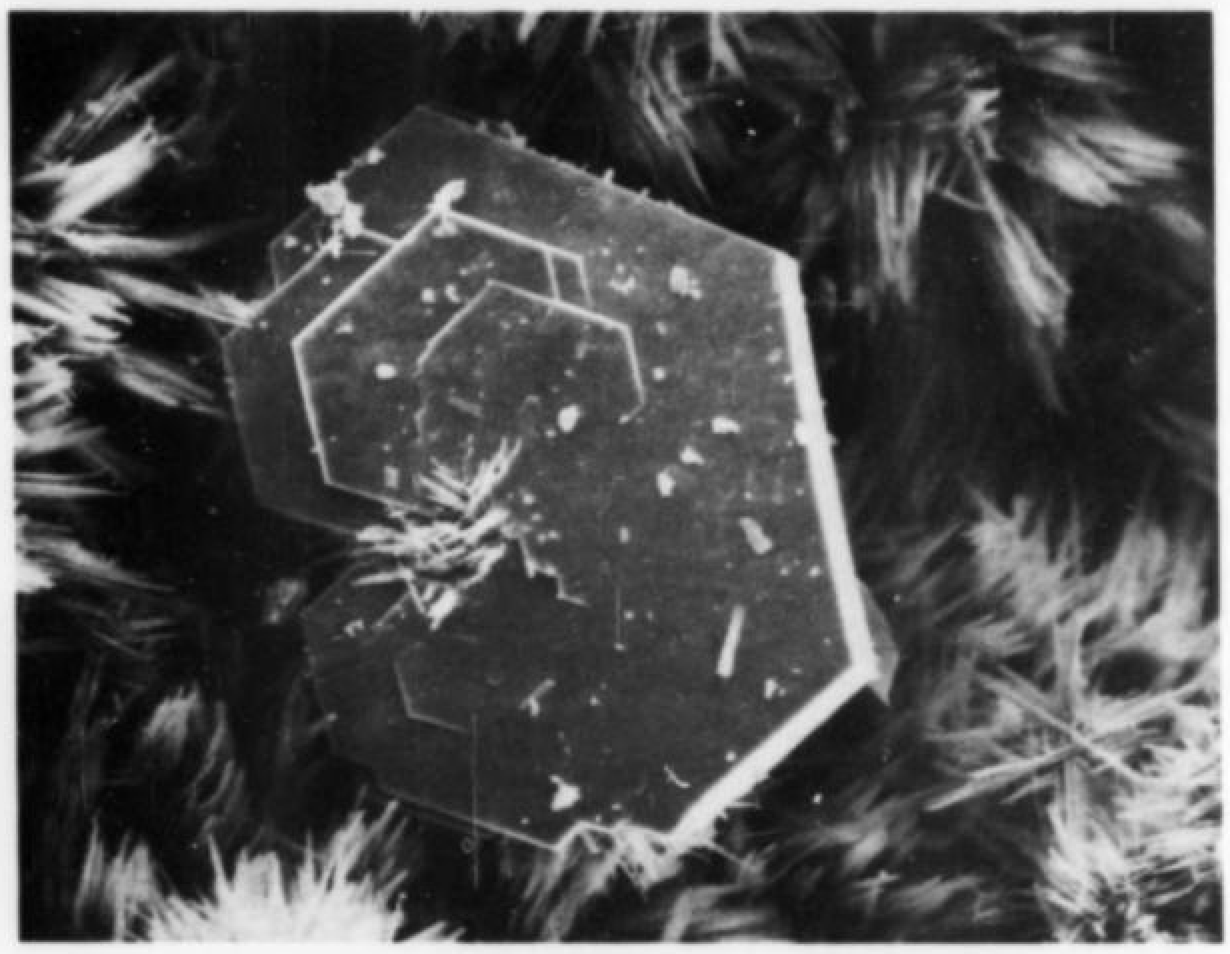

Figure 6. **A tabular crystal of carbonate-fluorapatite demonstrating the less common habit. (240x), NMNH #104083.**

found in apatites, these two species were considered unique. Dehrnite was also reported from Dehrn, Germany, the type locality, by Larsen and Shannon (1930a), but "lewistonite" is known only from the Fairfield variscite deposit.

Both lewistonite and dehrnite have now been discredited (Dunn, 1978) and the discreditation has been approved by the I. M. A. Commission on New Minerals and Mineral Names. Both lewistonite and dehrnite are *carbonate-fluorapatite,* and contain no appreciable sodium or potassium.

Although they occur principally as microcrystals and are not well-known to collectors, the perfection of development of the crystals makes them worthy of attention. Several specimens of carbonate-fluroapatite from the variscite nodules were examined with the scanning electron microscope and the photomicrographs are presented here for the readers' enjoyment. Most of the crystals are quite prismatic in habit and simple in morphological development, being comprised of the pinacoid and hexagonal prism. The crystals are relatively clean for the most part, but some are encrusted with a colorless, tabular mineral which is as yet unidentified, but is inferred to be crandallite, the most common associated mineral in the assemblages containing carbonate-fluorapatite. Figures 1, 2 and 3 show this intergrowth, which is likely an epitaxial arrangement of the unknown and the carbonate-fluorapatite.

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INESITE, A NEW U.S. OCCURRENCE NEAR CREEDE, MINERAL COUNTY, COLORADO

by **Richard E. Van Loenen**
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Abstract

Inesite fills late fractures in silicified fault breccia along a late Tertiary fault cutting volcanic rocks northwest of Creede, Mineral County, Colorado. This represents the fifth known occurrence of inesite in the United States and the first in Colorado. The chemical and physical properties of this inesite agree closely with those cited in the literature for the mineral.

Introduction

Inesite, a hydrous manganese calcium silicate, is common in the gangue of silver ore in the Equity mine, a relatively small mine in the San Juan Mountains of southwest Colorado. The mine is located 7 miles northwest of Creede, Mineral County, Colorado on West Willow Creek (Fig. 1). The mine has been worked sporadically since the early 1900's, but at present it is inactive and the underground workings are inaccessible. Production prior to 1930 was valued at $91,000, mostly from silver together with minor gold, copper, lead, and zinc (Larsen, 1930); production since has been small. Lester Turnipseed, of Creede, Colorado, owner of the mine, supplied the samples containing inesite.

Inesite has previously been described from localities in Australia and New Zealand (Ryall and Threadgold, 1968); Germany, Sweden, Romania, Mexico, Japan, and four localities within the United States. The U.S. localities are Quinault, Washington; Napa County, California (Glass and Schaller, 1939); the Crescent mine, Olympic Peninsula, Washington; and the Hale Creek mine, Trinity County, California (Wan and Ghose, 1978).

Geologic Setting

Inesite was deposited in fractures which cut intensely silicified rock along the Equity fault. The Equity fault is the north margin of the Creede mining district where recurrent faulting took place during several stages concurrent with the late Tertiary volcanic activity and caldera subsidence in the central San Juan Mountains of southern Colorado (Steven and Ratte, 1965; Steven and Eaton, 1975). Along this fault older rocks (Bachelor Mountain rhyolite) are juxtaposed against younger rocks (Nelson Mountain quartz latite). Inesite was deposited during the latest of three probable stages of hydrothermal activity. Inesite-rich veinlets as much as 5 cm wide cut the silicified breccia and argillized rock that served as a host for the precious and base-metal mineralization. Minerals found associated with inesite in the veinlets, in order of decreasing abundance, include the following: quartz, neotocite (?) (amorphous manganese silicate), sphalerite, pyrite, galena, rhodochrosite, calcite, dolomite, and pyrargyrite. Inesite constitutes over 70 percent of the vein material studied, but this represents local concentrations along the Equity vein system. The full extent of inesite along the system is not known.

Physical Properties

Inesite forms spherulites and fan-shaped clusters of acicular crystals. These spherulites are as much as 2 cm across and are composites of many crystals. On a fresh surface the inesite is pale pink or flesh-colored, but it fades to light brown when exposed to sunlight over a period of several months.

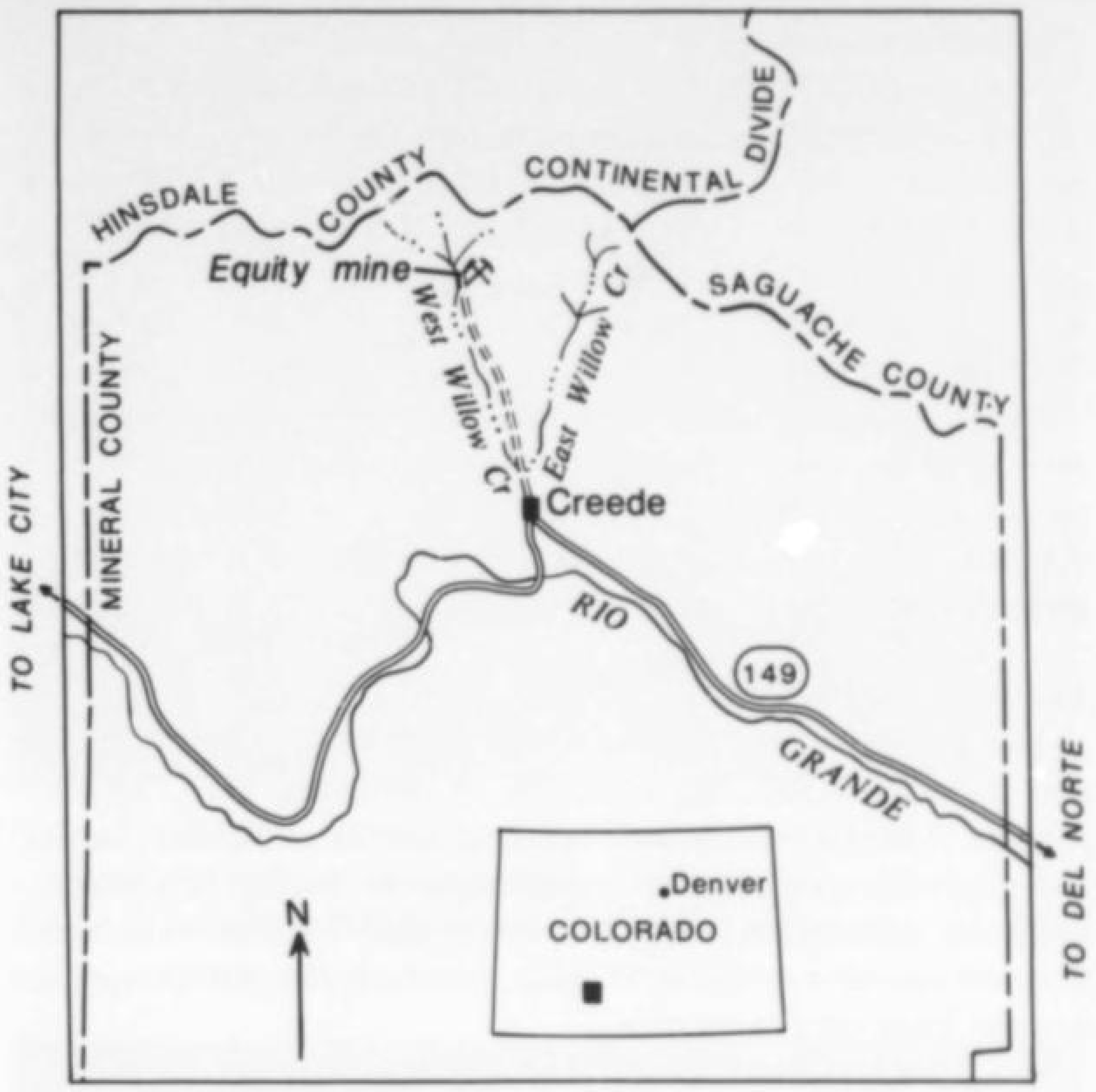

Figure 1. **Map showing the location of the Equity mine.**

The density of Creede inesite was measured at 3.042 g/cm³. Optically it is biaxial (-) with a 2V of 74°. The indices of refraction were determined to be $\alpha = 1.6712, \beta = 1.6388, \gamma = 1.6505$. Owing to the composite nature of the inesite spherulites, several determinations were made. No variation of optical properties between samples could be determined. The values are in good agreement with those described in the literature (Glass and Schaller, 1939).

Table 1. **Analytical data for Inesite.**

	1	2	3
SiO_2	45.00	44.52	45.60
Al_2O_3	0.32	0.28	
FeO	1.73	0.65	
MnO	37.48	36.80	37.69
MgO	0.47	0.41	
CaO	6.78	8.28	8.51
Na_2O	n.d.	0.13	
K_2O	0.01	0.06	
H_2O^+ 5.86 H_2O^- 2.41 at 106°C	8.27	8.83	8.20
Total	100.10	99.96	100.00

1 — Inesite, Equity Mine.
2 — Average of 13 analyses from Ryall and Threadgold (1968).
3 — Ideal $Mn_7Ca_2Si_{10}(OH)_2 \cdot 5H_2O$.

Analysis by V. Smith, E. Engleman, and J. Wahlberg of the U.S. Geological Survey. FeO determined colorimetrically, MnO by X-ray fluorescence, all others by gravimetrics.

Chemical Composition

Heavy liquids (methylene iodide and bromoform) and a Frantz isodynamic magnetic separator were used to obtain a pure inesite separate. The chemical analysis of the Creede inesite is shown in Table 1 (analysis 1). Table 1 also shows an average of 13 analyses taken from the literature for comparison. Richmond (1942) proposed the generally accepted formula of $Mn_7Ca_2Si_{10}O_{28}(OH)_2 \cdot 5H_2O$ for inesite. A crystal structure analysis of inesite (Ryall and Threadgold, 1968) suggests that the water and hydroxyl are coordinated to the heavy cations. Thus the formula for Creede inesite can be written as $[(Mn_{6.97}Fe_{0.32}Mg_{0.15})(Ca_{1.60}K_{.003})(OH)_2(H_2O)_{5.06}] \cdot (Si_{9.88}Al_{0.08})O_{28.94}$. The density and cell volume calculated from this analysis agree with the measured values.

Discussion

The genesis of inesite is not clearly understood. The structural and chemical relationship of inesite to rhodonite, $(Mn,Ca)SiO_3$, suggests that inesite could be a hydrated form of rhodonite. Inesite and rhodonite are associated in occurrences in Sweden (Richmond, 1942) and Japan (Kato, 1930), but no evidence was cited to indicate that one may have replaced the other. No rhodonite was detected in samples from the Equity mine.

Inesite was misidentified as rhodonite in several occurrences in Japan. Similarities in the physical properties and chemical composition of inesite and rhodonite could lead to misidentifications of the minerals and would perhaps explain the paucity of known inesite occurrences within the United States.

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THE HUMBOLT PILLAR

by **Henry Truebe**
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Occasionally present-day mine workings break into old mine workings. Sometimes the old workings provide historical insights: antique mining tools and techniques. Rarely do they provide a sample of high-grade ore.

Early in the summer of 1973, miners driving the 1R tunnel of the Inexco fluorite mine, near Jamestown, Colorado, intersected workings of the Humbolt mine, an old base and precious metal mine. As explained by Barbara Lowe in her MS thesis, the old workings provided not only examples of the timbering techniques of the 1880's, but also a sample of high grade ore.

A large pillar of rich, mineralogically complex ore, valued at $800 to $2000 per ton, was discovered in the old workings. The complexity of the ore made it impossible to process with the techniques of the 19th century. Since the metals couldn't be recovered, the miners left the ore as a pillar of "waste."

Lowe lists 35 different species from the pillar and nearby stopes. Most of the minerals are sulfides of copper, lead, zinc, and molybdenum; silver and copper sulfosalts; native gold, silver, and sulfur; and oxidation products. Four species are especially significant.

The presence of germanium in the ore permitted the formation of germanite, $Cu_3(Ge,Ga,Fe,Zn)(S,As)_4$, and renièrite, $Cu_3(Fe,Ge,Zn)(As,S)_4$. The germanite is described as "tiny pink non-tarnishing cubes in sphalerite and occasionally galena"; it is very rare. The renièrite is rare and described as "with chalcopyrite, tennantite, (and) enargite; in chalcopyrite and galena: 'orange border'." Lowe also reports geocronite, Pb_5SbAsS_8, and linarite, $PbCu(SO_4)(OH)_2$. These are the first reports of these four species in the state of Colorado.

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CONICHALCITE, CUPRIAN AUSTINITE, AND PLUMBIAN CONICHALCITE FROM LA PLATA COUNTY, COLORADO*

by **Joseph E. Taggart, Jr.**, and **Eugene E. Foord**
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Introduction

During exploration work with Homestake Mining Company, district geologist Steven Rose collected four specimens containing small amounts of light to dark green, microcrystalline, secondary minerals. Subsequent X-ray diffraction, semiquantitative scanning electron microscope (SEM) analysis, and optical studies have indicated the presence of conichalcite, cuprian austinite, plumbian conichalcite, and the inadequately described species β-duftite.

Geology

The specimens were collected from the main dump of the "Tuckers tunnel prospect" located in the NE ¼ NE ¼ section 13, T37N, R6W, La Plata County, Colorado. This area is about a quarter mile north of Runlett Peak in the San Juan Mountains.

The main workings at Tuckers tunnel follow an east-west trending breccia zone in the lower part of the Ouray limestone and the upper part of the Elbert formation. The breccia is dominantly limestone and dolomite, which is sandy in some parts. Some recrystallization of the carbonate host rock has taken place (Rose, personal communication, 1979).

Because of the radioactivity of some samples and their association with a suspected vein-type uranium occurrence, the minerals were viewed with some interest.

Mineralogy

Microscopic examination suggested that two minerals were present, one as dark emerald-green globules and the second as bundles of apple-green acicular crystals (Fig. 1). Preliminary qualitative analysis of the two phases by energy dispersive X-ray fluorescence analysis using an Ortec TEFA† instrument indicated the presence of copper, zinc, calcium, and arsenic in the first mineral and copper, zinc, lead, calcium, and arsenic in the second. The analysis thus eliminates the possibility of a uranium mineral. X-ray powder diffraction patterns were taken with a Gandolfi 114.5-mm camera. A check in the JCPDS mineral data files indicated matches with both the conichalcite and austinite patterns for both mineral habits. Due to the limitations of the data, the similarity of the patterns in the conichalcite-austinite series, and the compositional zonation of the examined minerals, it was not feasible to determine which species were present based solely on X-ray diffraction methods.

Figure 1. **Typical acicular crystals of cuprian austinite with plumbian conichalcite and β-duftite. Width of photo is about 150 micrometers.**

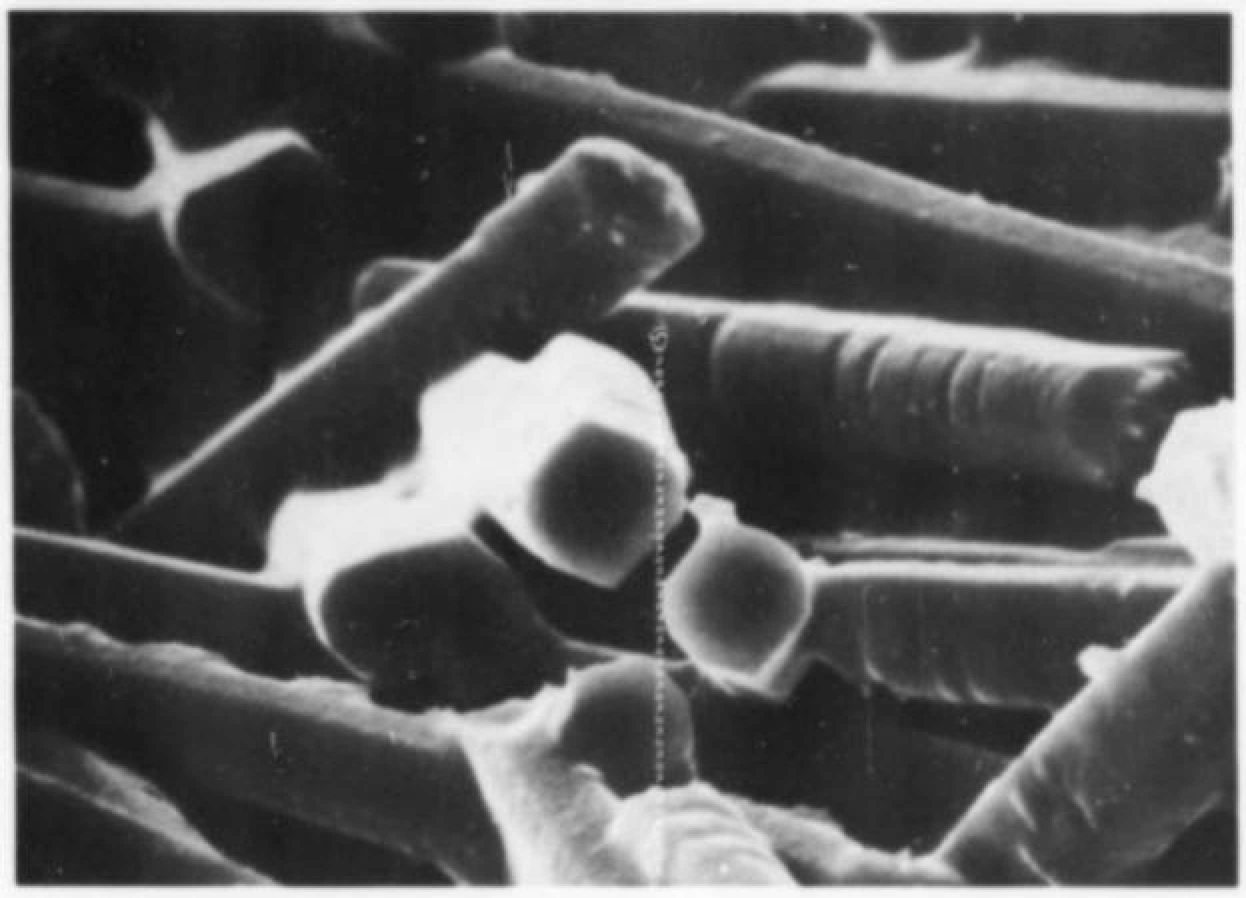

Figure 2. **View of crystals showing zonation of basal cleavage surfaces. Width of photo is about 35 micrometers.**

The samples were then examined with an Ortec† scanning electron microscope equipped with an energy dispersive X-ray analysis unit. The dark-green globules showed abundant arsenic, calcium, and copper with minor zinc. This phase can be conclusively identified as conichalcite, $Ca(Cu,Zn)(AsO_4)(OH)$. The light green mineral was found to be growth zoned (see Fig. 2) into a core and rim. Qualitative energy dispersive examination verified that both zones had abundant arsenic. Examination of the core showed the presence of calcium, zinc, and copper with a trace of lead. A comparison of the copper and zinc Kα peak heights showed that zinc was considerably more abundant than copper in the core, thus indicating the mineral to be cuprian austinite, $Ca(Zn,Cu)(AsO_4)(OH)$. Examination of the rim showed more copper than zinc in that part, and a significant amount of lead was present as well.

A synthetic lithium tetraborate glass standard was prepared containing copper, lead, zinc, and calcium in equal atomic abundances. This standard was then compared to the two zones of the mineral with the SEM energy dispersive unit. The core had approximately an 8:1 ratio for Zn:Cu and contained major calcium and arsenic and only traces of lead. The rim, however, showed major arsenic, copper and zinc with a Zn:Cu ratio of 2:3, and major calcium and lead whose Ca:Pb ratio ranged from 5:1 to 1:2 at various points. Because of the small size of the crystals, quantitative electron microprobe analyses were not feasible.

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*Approved for publication by the Director, U.S. Geological Survey.

†Any trade names in this paper are for descriptive purposes only and do not constitute endorsement by the U.S. Geological Survey.

Optical properties for the zoned crystals were determined. The cores were colorless, with $\alpha = 1.762$, $\beta = 1.767$, $\gamma = 1.787$, $\gamma - \alpha = 0.025$, and $2V_z = 55°$. All crystals were elongate along the X axis. The rim zone was too thin to permit determination of definitive optical properties, but the following was observed: grass-green, β about 1.95, and $2V_x$ about 80°.

In 1956, Guillemin tentatively named and described the occurrence of a new mineral; β-duftite, $PbCu(AsO_4)(OH)$. He concluded that this mineral formed a series with conichalcite, $CaCu(AsO_4)(OH)$, by substitution of lead for calcium. As pointed out by Fleischer (1957), the name β-duftite is confusing; the mineral should be described and renamed as a separate species. Clearly, in the Tuckers tunnel material those portions of the rim where lead exceeds calcium and copper exceeds zinc can best be identified as the inadequately described β-duftite; and where calcium exceeds lead, plumbian conichalcite. Most published analyses of either austinite or conichalcite show them to be fairly pure (e.g., Zarkova and Shushkanov, 1972; Radcliffe and Simmons, 1971). However, a zinc-rich conichalcite was reported by Dunin-Barkovskaya (1962).

It is interesting to note the relative abundance of zinc in the β-duftite and plumbian conichalcite from Colorado. We suggest that a general formula for the austinite-conichalcite-β-duftite series is $AB(AsO_4)(OH)$ where A = Ca and Pb, and B = Cu and Zn. This formula is compatible with that of Anthony *et al.* (1977) for duftite-β. Furthermore, the general formula implies that there may also exist an as yet undescribed zinc analogue of β-duftite, $PbZn(AsO_4)(OH)$.** Adelite, $CaMg(AsO_4)(OH)$, also belongs to this mineral group.

Conclusions

The occurrence of conichalcite, cuprian austinite, plumbian conichalcite, and the inadequately described β-duftite at Tuckers tunnel prospect appears to be the first occurrence reported for these minerals in Colorado (Eckel, 1961). The possibility of a Zn-rich β-duftite coupled with the known structural data for minerals of the adelite group (Radcliffe and Simmons, 1971) leads to the speculation that a quaternary series may exist, having the general formula $AB(AsO_4)(OH)$ where A = Ca, Pb and B = Cu, Zn.

Acknowledgements

The authors thank Steven Rose of Homestake Mining Company and Jack Murphy of the Denver Museum of Natural History for bringing the samples to their attention. Thanks are also due to Homestake Mining Company for permitting Steven Rose to discuss the geology and mineralogy of the area. James Nishi of the U.S. Geological Survey assisted in the SEM examination of the material.

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**Ed. note: A description of and name for this new mineral by P. J. Dunn and P. Keller was recently approved by the I.M.A.

THREE COPPER SULFATES FROM COLORADO

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Linarite, posnjakite, and serpierite, three rare secondary copper sulfates, have been found on the dumps of several abandoned silver mines in the Colorado Front Range. The discoveries of linarite and posnjakite mark the first known occurrence of these minerals in Colorado. The vein deposits at these mines share a similar mineralogy. Hypogene minerals include pyrite, chalcopyrite, galena, sphalerite, tetrahedrite-freibergite, proustite-pyrargyrite, and pearceite-polybasite in a gangue of quartz or siderite. Secondary mineralization in cavities and fractures in vein rock includes bright green brochantite coatings, long prismatic cerussite crystals, malachite, azurite, pale greenish blue, long prismatic aurichalcite crystals and linarite. Posnjakite, serpierite, some linarite, and shiny, black, prismatic acanthite crystals are post-mine deposits as shown by their occurrence investing sulfide specimens and cementing dirt in the mine dumps.

Linarite occurs as coatings or poorly to well-formed prismatic crystals ranging up to 0.5 x 0.5 x 0.2 mm. Radial groups of crystals found encrusting sulfide specimens indicate some of the linarite is a post-mine deposit. The bright blue color of the linarite resembles that of azurite but the two can be distinguished by the following simple test: a drop of 10% HCl readily reacts with linarite causing the linarite to become white with a coating of $PbSO_4$. In Colorado, linarite has been found at the Yellow Pine mine, Crisman, Boulder County; the Murry and Annamosa mines, Clear Creek County; and the Everett, Kirtley, and Wide West mines, Georgetown, Clear Creek County.

Posnjakite is found as poorly to well formed crystals of a medium blue color very similar to caledonite. The crystals are singles or twinned into pseudohexagonal plates. Good plates from the Yellow Pine mine reached 0.7 mm across. The mineral is most abundant at the Murry mine, occurring in small crystals.

Serpierite occurs commonly on the Murry mine dump as coatings up to 0.2 mm thick on sulfide specimens. The mineral is very pale blue and not macroscopically crystalline.

The widespread occurrence of small amounts of these three minerals across the Front Range suggests that they may be more common than previously reported and should be expected wherever lead and copper sulfides have been oxidized.

I wish to thank Eugene Foord, of the U.S. Geological Survey, who aided in the identification of the posnjakite and serpierite by X-ray diffraction, optical, and electron microprobe techniques.

METAMICT MINERALS AT THE BEMCO MINE NEAR CRANBERRY LAKE, NEW JERSEY

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Introduction

The Bemco mine is in Sussex County, northwestern New Jersey, about 15 miles southwest of Franklin. Mining in the late fifties revealed a narrow ore band along the strike of the contact between a Precambrian granite pegmatite and the surrounding wall rock, a pyroxenitic gneiss. The ore consisted of a friable matrix of magnetite and a suite of accessory ore minerals containing thorium, uranium, and rare earths. Previously published reports on this occurrence include Williams (1967) and Haji-Vassiliou *et al.* (1974).

Mineralogy

The spatial relationship between the narrow ore zone and the associated rock units (the granite pegmatite and the pyroxenitic gneiss) is shown in Figure 1. The granite pegmatite is made up of K-feldspar and quartz, with minor magnetite and several accessory minerals such as zircon and fergusonite. The gneisses in the vicinity of the Bemco pegmatite are banded with augite and hornblende. These bands grade into amphibole-bearing pyroxenitic lenses such as the pyroxenitic gneiss adjacent to the ore.

The ore minerals occur almost exclusively in narrow zones or bands along the hanging and footwall contacts between the pegmatite and the pyroxenitic gneiss. The ore in contact with the pegmatite (type "A" in Fig. 1) is composed of a fine-grained matrix of magnetite (up to 76%) that is rich in zircon in the form of euhedral crystals disseminated through the matrix. It is also rich in uranothorite (up to 9%) and fergusonite (up to 4%). The ore in contact with the pyroxenitic gneiss (type "B" in Fig. 1) is essentially a magnetite ore (up to 92%), but it also contains accessory fergusonite (up to 3%) and zircon (up to 4%).

With the exception of magnetite, the other major ore minerals (zircon, fergusonite, uranothorite) are metamict. Their crystal structure becomes evident through X-ray diffraction after heat treatment (1000°C for 1 hour in a muffle furnace).

The zircon crystals average about 4 mm in length, with some as long as 2 cm. They are generally gray, strongly zoned, and some exhibit twinning. Uranothorite and fergusonite occupy the core of the zoned crystals. X-ray fluorescence analysis shows the zircons ($ZrSiO_4$) to be rich in thorium, uranium, and ytterbium as well as to contain hafnium and yttrium.

Fergusonite, $Y(Nb,Ta)O_4$, occurs mainly in the type "B" ore as brown vitreous grains that commonly contain magnetite inclusions. Like zircon, fergusonite is rich in thorium and uranium as well as several rare earths. Uranothorite, $(Th,U)SiO_4$, occurs mainly in the cores of zoned zircons but also in the form of veinlets in the ore matrix.

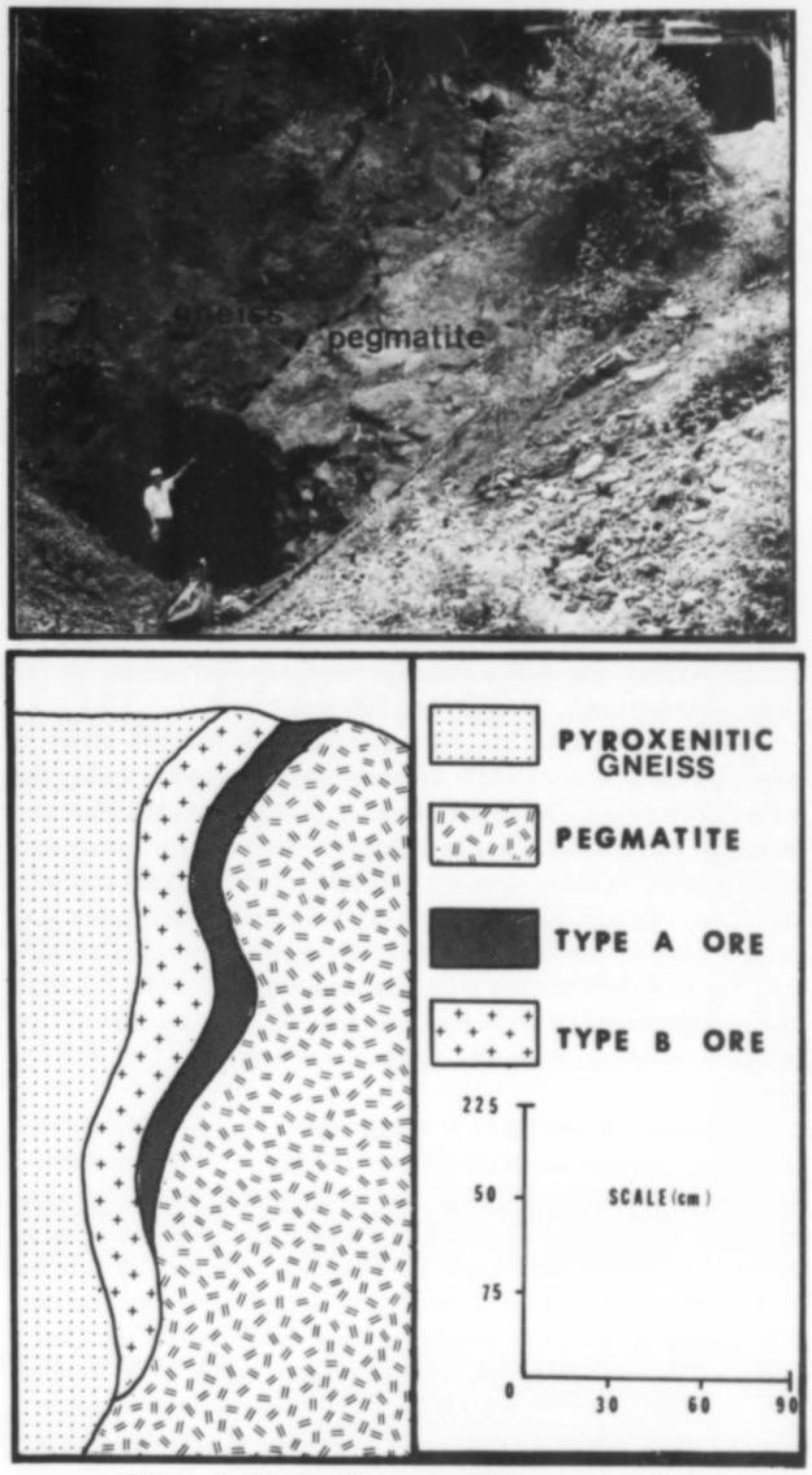

Figure 1. **Photo: The pegmatite - pyroxenitic gneiss contact at the Bemco mine. Diagram: Schematic cross-section illustrating the spatial relationships between the associated rock units (gneiss and pegmatite) and the ore occurring at their contact.**

Besides being the predominant mineral in the ore zone, magnetite also occurs in both the pegmatite and the pyroxenitic gneiss. The magnetite of the ore is similar to that found in the pegmatite and unlike that found in the pyroxenitic gneiss in terms of TiO_2 content (Haji-Vassiliou *et al.*, 1974). This suggests a direct genetic link between the ore and the pegmatite.

Acknowledgements

The author is indebted to Ralph D'Andrea Jr. and David A. Fontaine for aiding in the preparation of samples and illustrations.

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NEWS FROM THE AMNH

by **Joseph J. Peters** and **George E. Harlow**
Department of Mineral Sciences
American Museum of Natural History
Central Park West at 79th Street
New York, New York 10024

During the past four years the Mineralogy Department of the American Museum of Natural History has experienced a remarkable rejuvenation. Indeed, even the name of our department has been changed to the Department of Mineral Sciences to more accurately reflect our staff's research interests which center on the fields of mineralogy, petrology and meteoritics.

Our full-time staff has increased from a low of three (a chairman-curator, a scientific assistant and a secretary) during the early 1970's to six. Dr. Martin Prinz is department chairman and meteorite curator, Dr. George Harlow is curator of minerals and gems, Joseph Peters is scientific assistant for the mineral and gem collections, Robert Klimentidis is our microprobe technician and filling a newly created slot, James Ferraiolo is our curatorial consultant. Gertrude Poldervaart is departmental secretary. Our full-time staff is augmented by six research associates, three associates, five graduate research students, seven volunteers and one CETA worker.

The opening of the Harry F. Guggenheim Hall of Minerals and adjoining J. P. Morgan Hall of Gems on May 21, 1976, marked the department's coming of age. The mineral and gem halls were designed by former mineral and gem curator Dr. D. Vincent Manson and architect Fred Bookhardt. Covering a third of an acre on the first floor, the Hall of Minerals and Gems is the largest permanent display area in the museum. Over 6,000 of the museum's 50,000+ minerals and gems are on display in the halls. George Harlow and Joe Peters are currently working with the museum's exhibition department readying three new rotating displays for the mineral hall. One display will feature the fabulous Tsumeb azurite and Grass Valley gold specimens which Newmont Mining Corporation has donated to the museum. The other two displays will feature recent mineral and gem acquisitions and topical exhibits such as "Afghanistan Minerals."

Besides a new mineral and gem hall the museum helped raise funds to construct a completely new lab-office-collections complex in the fourth-floor space formerly occupied by the old Morgan Mineral and Gem Hall. Our lab facilities include a mircoprobe lab housing an ARL-SEMQ microprobe with six fixed and three variable spectrometers which is capable of giving a fully corrected nine-element analysis in 30 seconds. A newly added energy dispersive analyzer now gives a quick reconnaissance of the composition of minerals either singly or in rock. An X-ray lab houses three X-ray generators, four single-crystal precession cameras, six ports for Gandolfi powder cameras and a set-up for doing powder diffractometry.

We have two well-equipped thin-section and polished-section labs (sample preparation labs). The outer "dirty lab" is where initial sectioning work is done. An inner "clean lab" houses the polishing laps needed for final section preparation. A separate air-conditioning system filters the air in this lab helping to maintain the pristine nature of the samples being prepared. Our facilities also include a chemistry lab, microscope lab and computer lab.

***Figure 1.* Mineral collections area.**

We are especially proud of our vastly improved and modern collections facilities. The mineral collection is stored in 103 seven-foot-high metal cabinets which typically hold 40 drawers per cabinet. The minerals are arranged according to a revised and updated Dana's system for non-silicates and a revamped Strunz for silicates. Both of these revised lists have been prepared by curatorial consultant Ferraiolo who plans to publish them in the near future. Cabinets have been set aside for our growing type specimen collection as well as for selected locality suites of local significance (Franklin, New Jersey, New Jersey traprock and Connecticut pegmatites). Three cabinets are used in storing pending accessions and materials on loan to the AMNH. Large minerals are placed on sturdy wall-mounted metal shelving running perpendicular to the line of storage cabinets. The museum has started a micromount mineral collection and provisions are being made to modify our existing wooden drawers to house this material. Faceted gems or gemstone carvings not on display are stored in a specially constructed vault which we share with the museum's anthropology department located near the collections area.

Ongoing projects include a summer intern program to expand and update our X-ray powder pattern file. Such an updated file will greatly facilitate rapid identification of mineral unknowns. A complete inventory of the mineral and gem collections has begun under the supervision of curatorial consultant Ferraiolo. One reason for doing the inventory is that it will prepare the collections for eventual computer-based data retrieval.

So, as you can see, there has been a great deal of activity at the AMNH in the past few years and we are making headway with the collections, exhibition and research now that the building phase is largely completed. We will try to keep you posted on developments as they occur.

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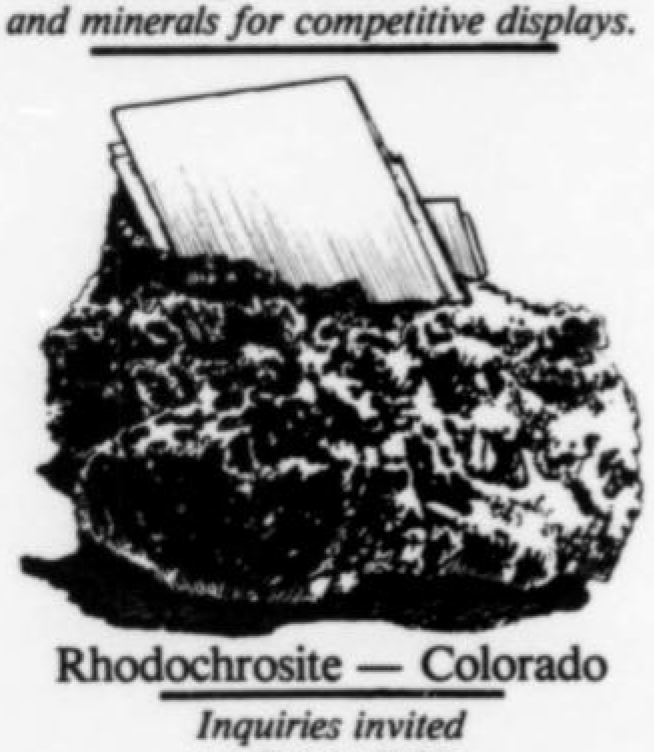

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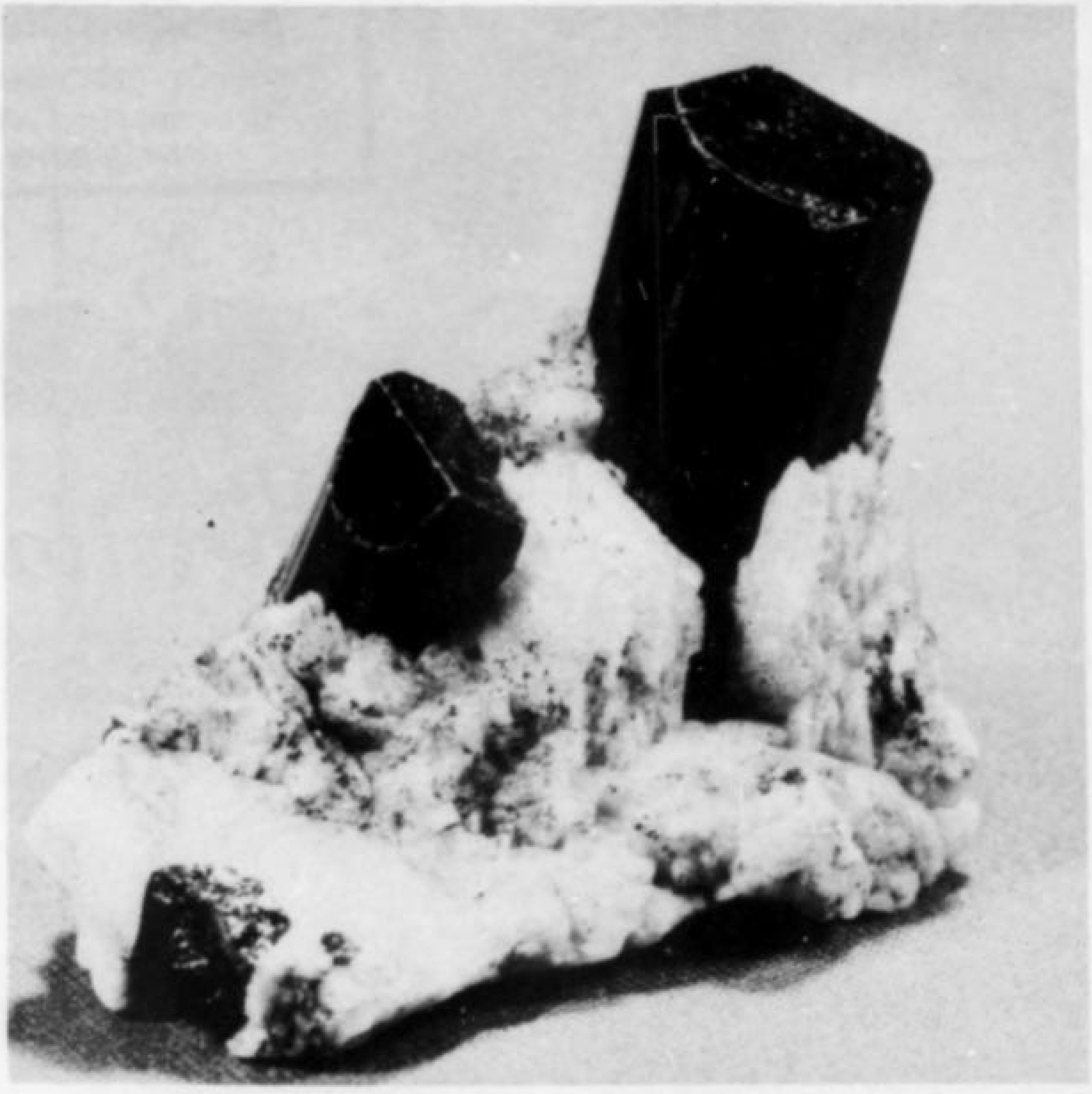

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Microminerals

by **Bill Henderson**

SWAPPING

In not too long, micromounters exhaust the possibilities of nearby mineral localities. A steady diet of the same old thing palls, and addition of still more self-collected micros to the collection seems to become pointless. What to do? Buying is a possibility, and I do so fairly frequently myself. Still, I much prefer to exchange, and that brings me to the topic of this column. Swapping is a great way to add variety to a micro collection, to see and become familiar with minerals and parageneses not locally available, to make new friends, and to gain new outlooks on collecting. Who knows, it may even lead to an invitation to Switzerland and a chance to collect in the Lengenbach quarry. It happened to me!

When it comes to exchanging by mail, mircomounters are very fortunate. Most micro collectors have access to at least one locality with unique or extremely interesting material, perhaps even a classic locality. Since, unlike hand specimens, micros tend to be prolific when found, most collectors have duplicate material in fair abundance. So, with a supply of material and with the low cost of shipping micros by mail, it only remains to create a demand.

I create demand for my material simply by writing to people with material which interests me. In almost every issue of the *Record,* there is an article describing material I would dearly like to own or study. In many issues, names of people desiring to exchange are listed. In days gone by, I wrote to people mentioned in Neal Yedlin's column. An ardent swapper himself, he knew his name-dropping would help others toward enjoyable exchanges. Even professionals, provided I have something which fits their interests, are fair game for exchanges.

I have to admit that many collectors who exchange by mail have been disappointed more often than not. This is not so in my case, as at least two-thirds of my first-time exchanges turn out successfully. Once a good trading partner is found, the micros can travel back and forth for years, each exchange adding further gems to the collection. I think there are a few simple steps which lead to fruitful swapping, and I will go into them one at a time.

The most important point is that both micromounters in an exchange understand clearly what the other wants. When first writing, I usually state that I have been collecting micros for 20 years, that I have about 7,000 mounts, that I prefer undamaged crystals, that I am more interested in superb material than large specimen size, and that I use up to 30X and very occasionally 60X. Since I am usually writing in response to an article by or about the other collector, I can usually request specific items. I especially like to receive suites of microminerals from classic localities or ones with interesting parageneses. For instance, I am currently looking for people with material for exchange from Terlingua, Texas, and for collectors with phosphates from the rinds of Fairfield, Utah, variscite nodules or Black Hills pegmatites. I make a point of finding out what the person to whom I am writing collects as well.

I try to offer material which will be new to the potential exchange partner and things which will be of interest to him. Of course, most micro collectors are attracted by a very rare mineral in good crystals but, by catering to specific interests, it is possible to exchange other material as well. Did he write an article about pegmatite phosphates from Brazil? Then, offer the same minerals or other phosphates from New England. Did a professional write about a new zeolite from Sardinia? Probably, he does not want phosphates, but might jump at an offer of the new zeolite *tetranatrolite* from Mont St. Hilaire. He might even like a small fragment of scolecite from Connecticut! Was his name mentioned in an article on Lengenbach sulfosalts? Try him with Canadian sulfosalts, which he may never have seen.

Of course, there is nothing like a whole suite of rare species to offer as trading material. Currently, my ace card in swapping material is a long list of the nepheline syenite minerals from Mont St. Hilaire, Quebec, Canada. In addition, I offer to trade phosphate minerals from a number of northeastern localities. Bertrandite, which is quite common and well crystallized in Connecticut, does quite well in Europe or Australia, where it is rare or overlooked.

At least as important as *what* you offer is *how* you offer it. A mere list is not as effective as a good description. Consider the following three offerings.

1. Switzerland-........., hematite, ...
2. Hematite rose, Wallis, Switzerland.
3. Group of three extremely brilliant, iridescent hematite roses, largest 3 mm, with pyrite, clear adularia, Cervandone, Wallis, Switzerland.

Obviously, a collector with five Swiss hematites is not greatly attracted by a listing of mineral names by country as in (1) above. If he has a hematite rose from Wallis, (2) will not entice him either. If he is hooked on Alpine minerals and has no hematite rose from Cervandone, (3) will get him every time. If he has no hematite from Switzerland at all, (3) is still the winner since it obviously describes a specimen of real beauty and quality. So, give as complete and honest a description of the material as possible, and give the *specific* locality. Be sure, too, to state whether the mineral has other selling points. Is it from a Dana locality? A classic? An extinct locality? Unusual habit or associations? All these points help to sell what you have to offer.

When you get a favorable reply to a swapping offer, the battle is half over. It only remains to choose your material carefully, pack it well, and label it clearly. You can send materials in chunks suitable for several mounts, or you can trim it down to final size. Often the bigger pieces travel better, but perhaps you can afford to send a greater variety in smaller sizes. Keep in mind that Europeans use a somewhat larger micro box than do Americans, and a bigger piece of matrix is usually appreciated. Be sure you pack the material carefully. There are many ways to do this, but you should assume the package will be tossed a meter or so at some time during mailing. Segregate heavy and light specimens in separate compartments in the package. Otherwise, the heavier ones will pound the smaller ones to pieces.

I prefer to insert a number with each specimen in the package and give the key to the numbers in my letter, sent separately. Since I keep a carbon copy of my letter, both the receiver and I have a permanent record of what I sent, an aid in future exchanges. In addition, since the identity and locality of the specimens does not ap-

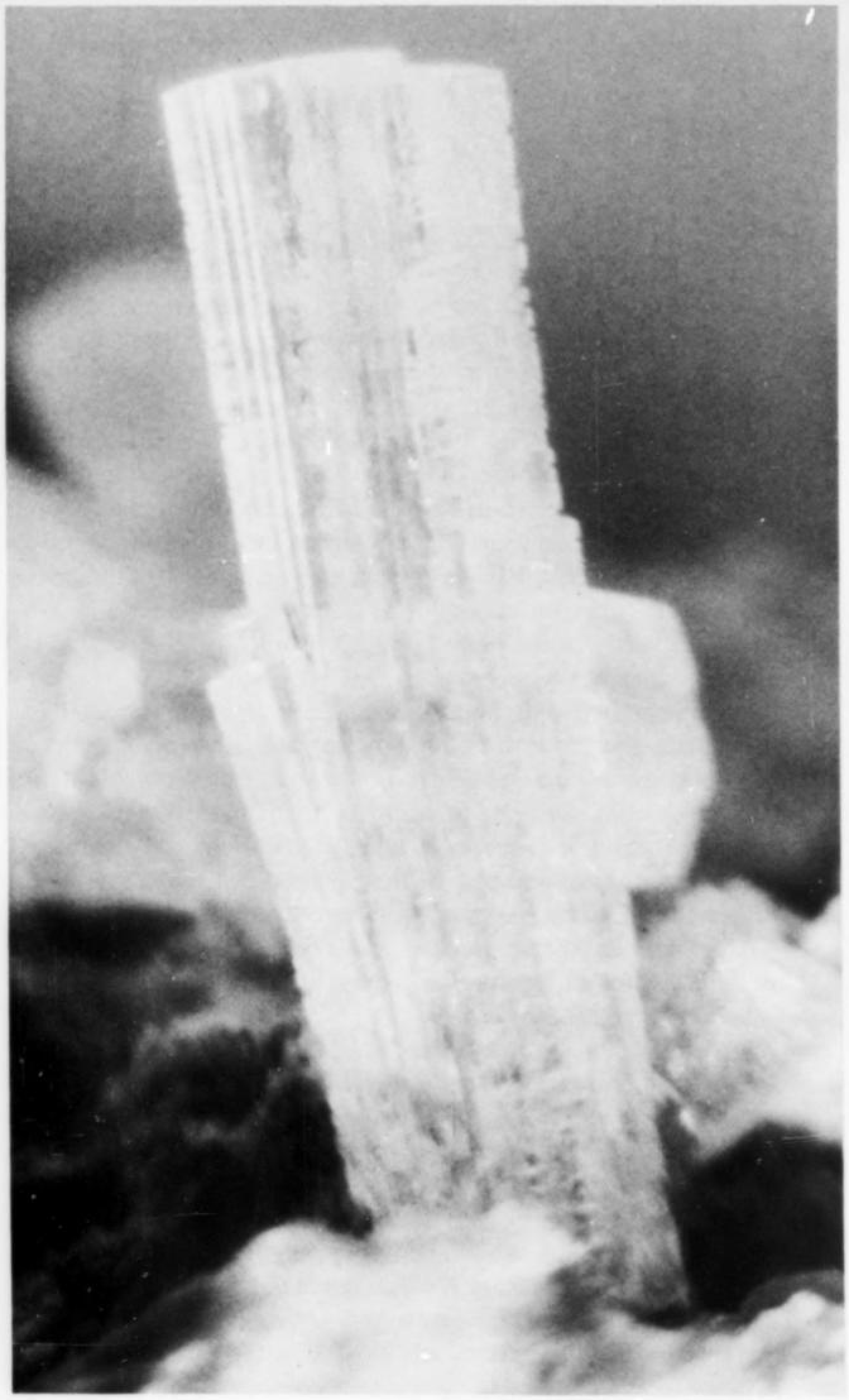

Figure 1. **Scholzite, a colorless 3.2-mm crystal from Hagendorf Süd, West Germany. Photo by Vi Anderson.**

Figure 2. **Pseudolaueite. bright orange, a 1-mm crystal from Hagendorf Süd. Photo by Vi Anderson.**

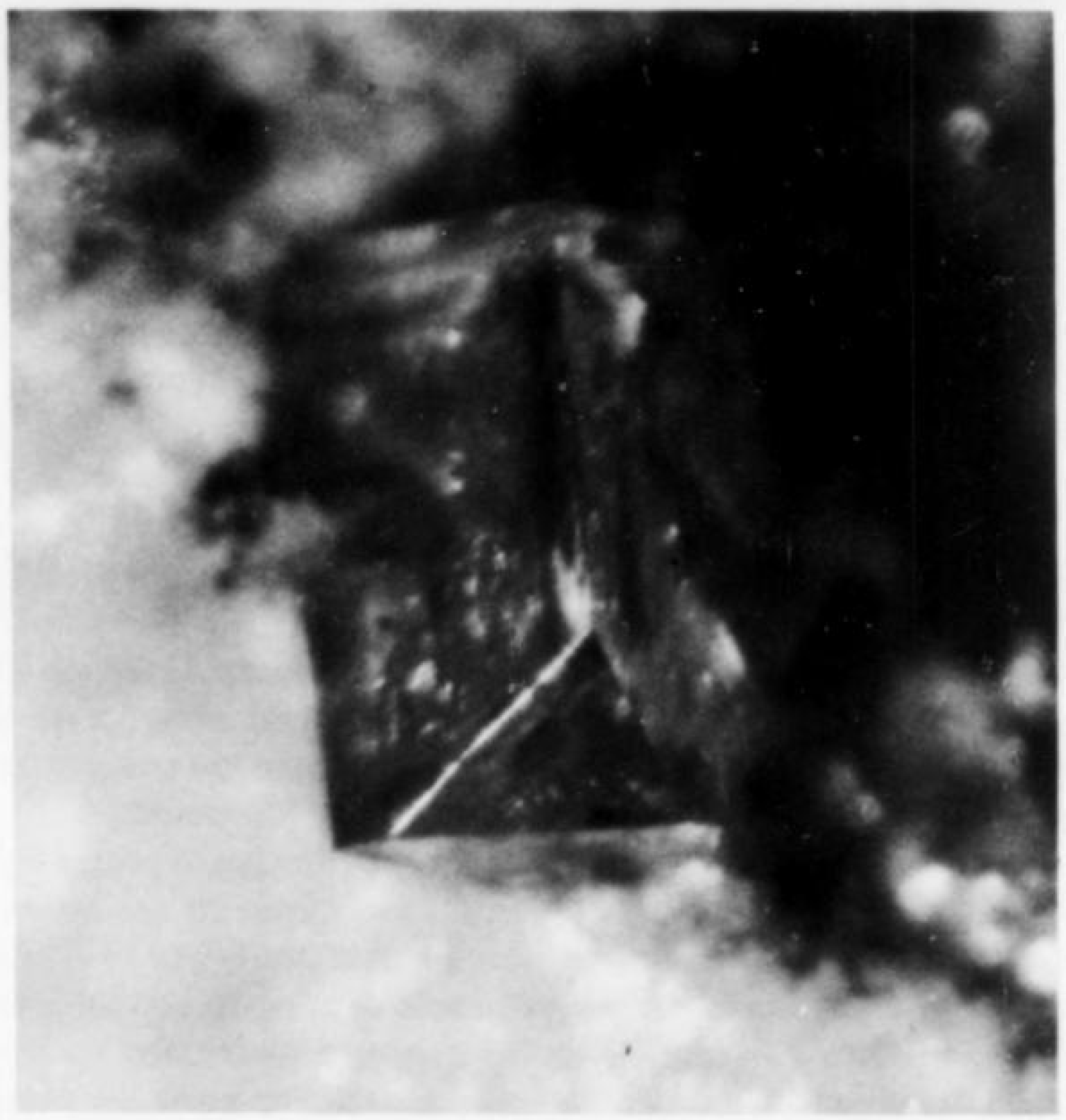

Figure 3. **Orange laueite crystals, the largest 1 mm, with gray-green beraunite spheres from Hagendorf Süd. Photo by Bill Henderson.**

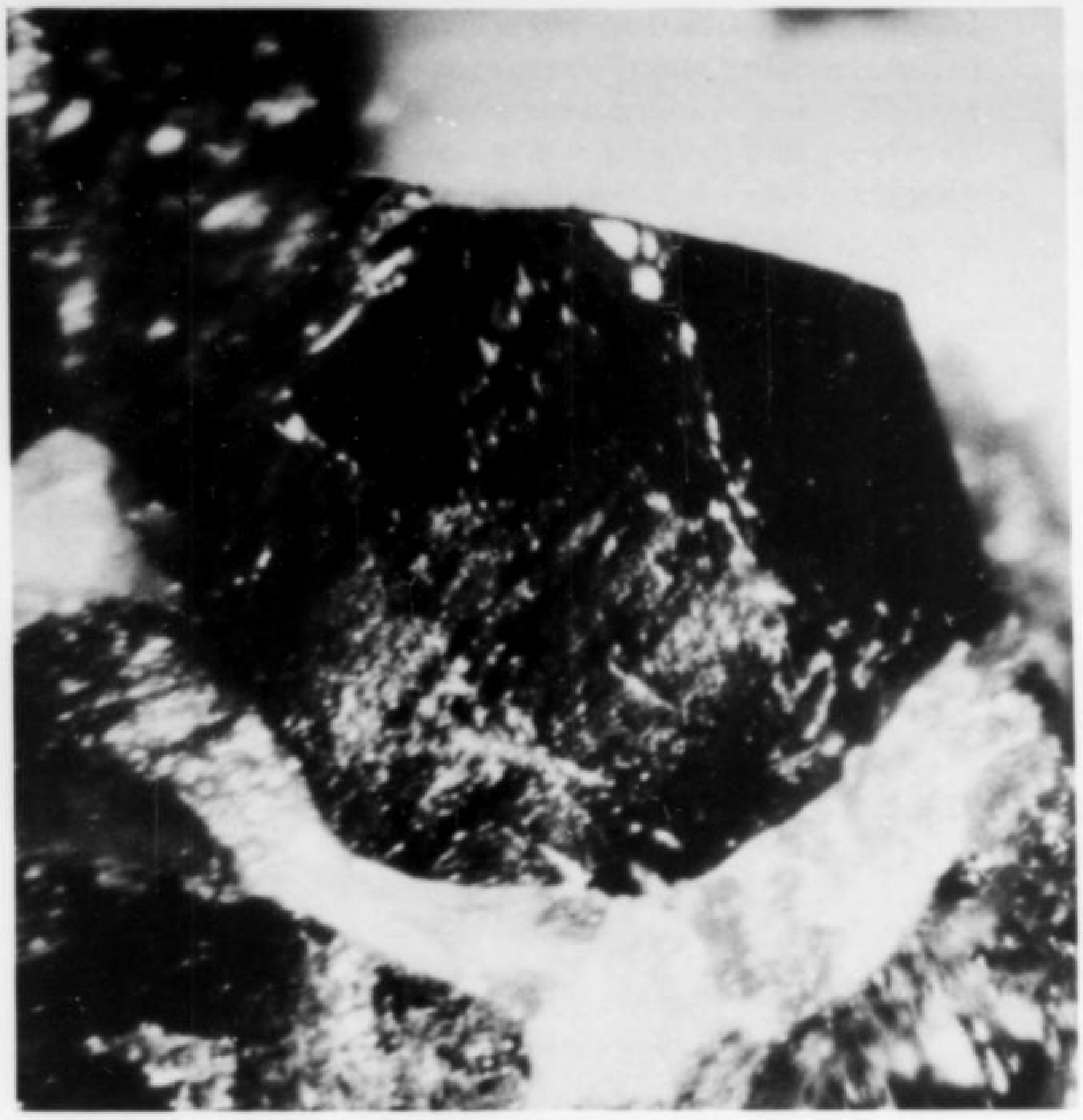

Figure 4. **Kryzhanovskite, as a dark brown, 1.2-mm pseudomorph after phosphoferrite, from Hagendorf Süd. Photo by Bill Henderson.**

Figure 6. **Phillipsite, a colorless, 1.2-mm twin from Klöch, Austria. Photo by Vi Anderson.**

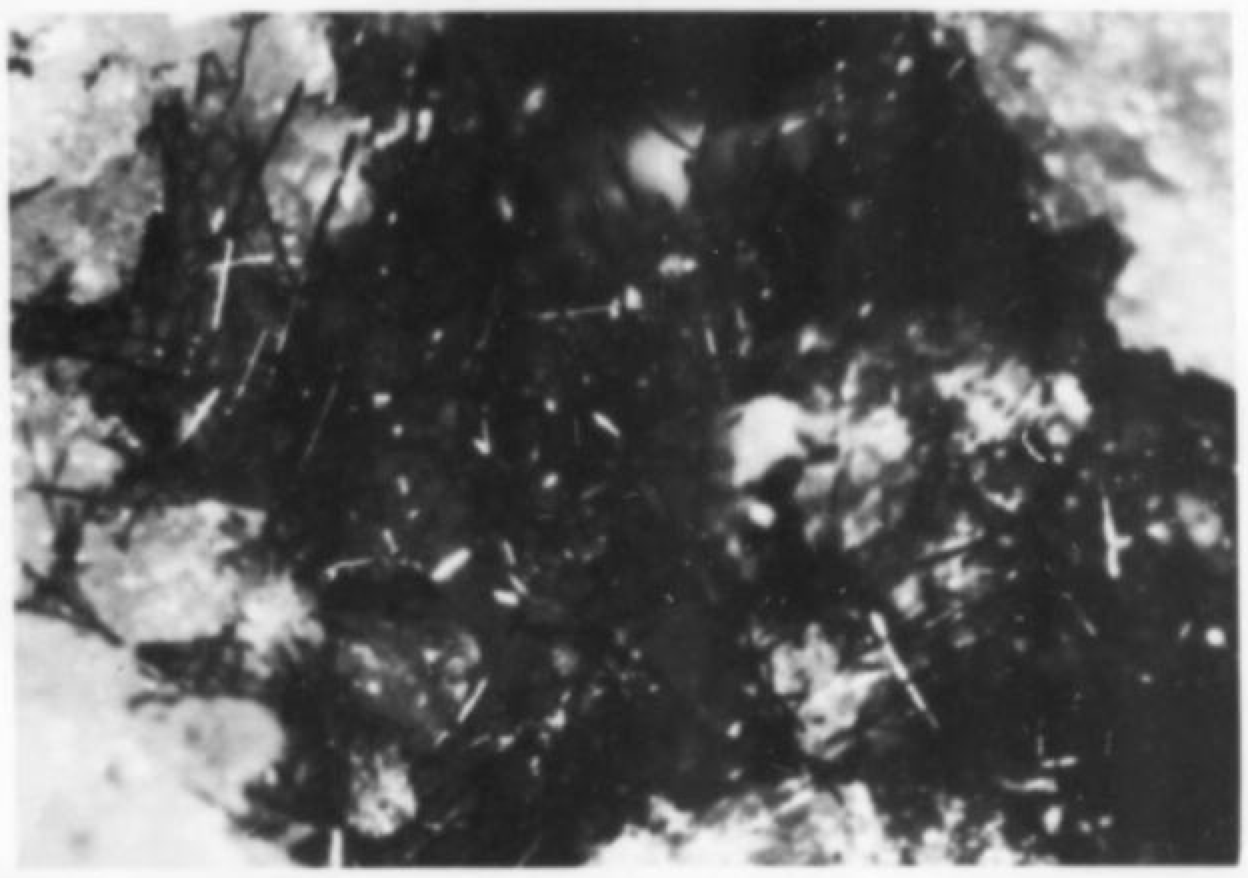

Figure 7. **Bismuthinite, in black columnar crystals on calcite from Krupka, Czechoslovakia. The field of view is about 2 mm across. Photo by Bill Henderson.**

Figure 5. **Phosphophyllite, a pale green, 2.4-mm twin from Hagendorf Süd. Photo by Vi Anderson.**

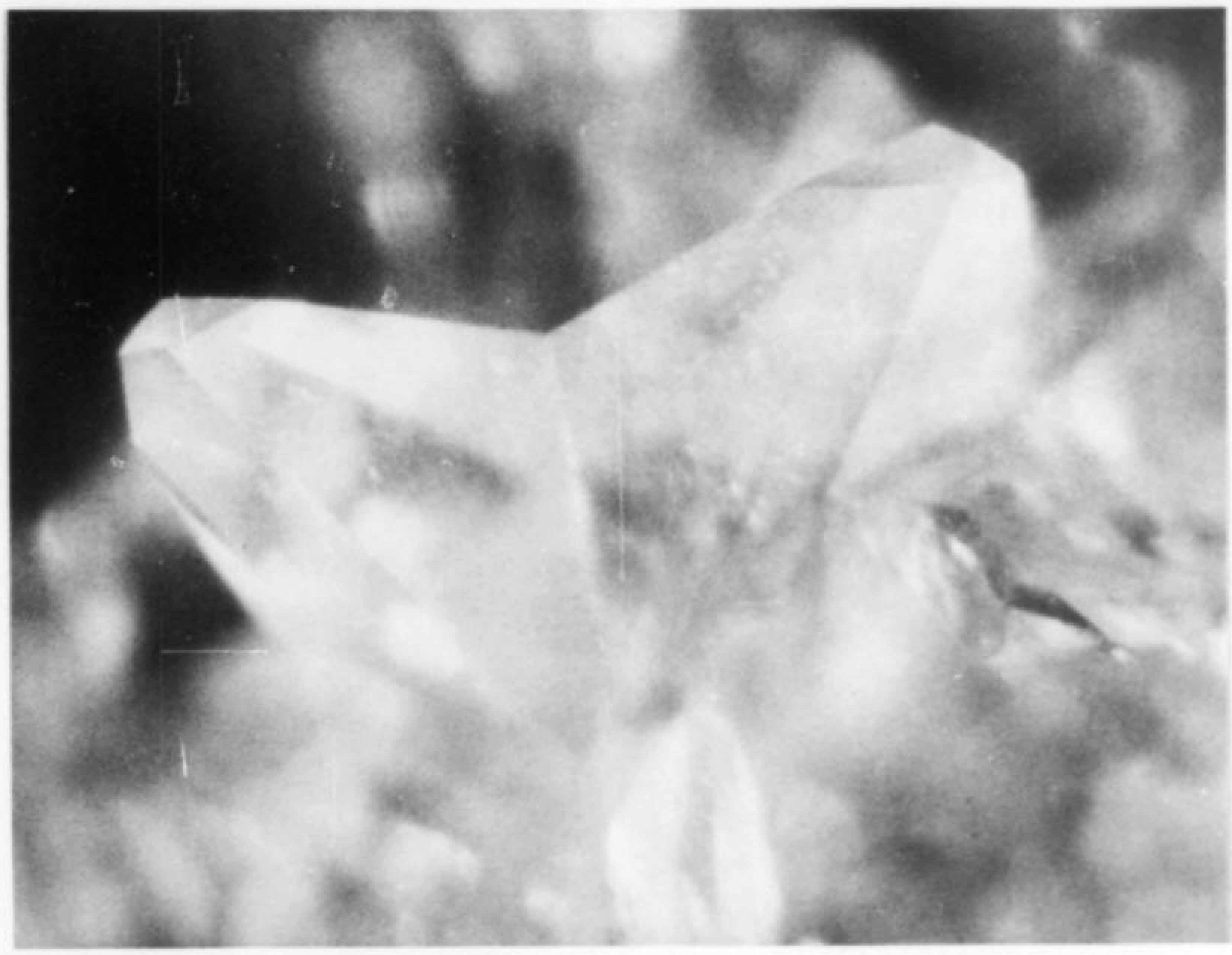

Figure 8. **Rutile, as a 1-mm gray crystal group of unusual acicular habit, from the Lohninger quarry, Rauris, Austria. Photo by Bill Henderson.**

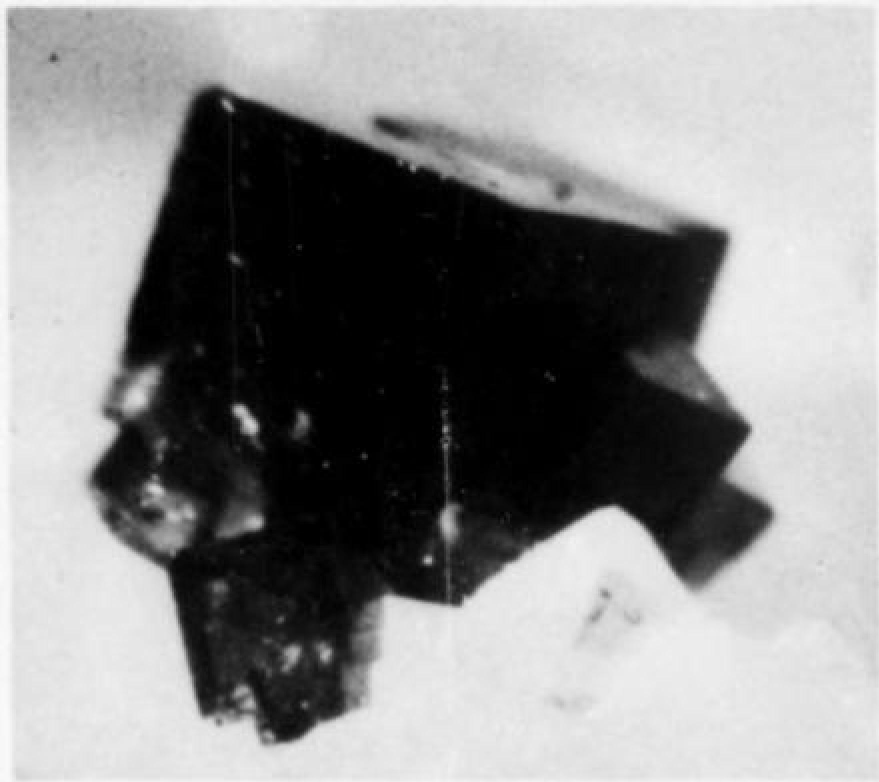

Figure 9. **Pharmacosiderite, a deep brown, 0.8-mm crystal from Grube Clara, Oberwolfach, West Germany. Photo by Vi Anderson.**

pear in the package, there is less chance of "leakage" in the mails or during customs inspection. Believe it or not, I have had considerable trouble with a customs inspector who was also a mineral collector!

When I am trading overseas and my trading partner writes in German, for instance, I am careful to *type* my letters and write out localities *in full.* Write out "quarry," "county," "mountains," names of states, etc. I well remember receiving a beautiful specimen of ferrierite from a German-speaking collector. The label was hand written, and the locality given as Weitendorf (?), Skmk or Stmk or some such thing, A. It took quite a bit of effort and the aid of a German friend with a very good European atlas to find that the locality was indeed Weitendorf in the province of Steiermark or Styria in Austria. So make the labels clear!

And finally, remember that one cannot expect silken purses in return for porcine ears. Always try to send material you would mount yourself—at least reasonably crystallized samples of rare minerals and only superb specimens of the common ones. If you do this, since exotic material is almost always more highly valued than local material, both you and your trading partner will profit by the exchange. Both he and you will be well pleased, and that is what trading minerals is all about.

What looks like a simple exchange can snowball, though, as witness the following. In 1977, Dr. Gerhard Hentschel's superb article on minerals of the Laacher See area appeared in the *Record.* I wrote him and, after several exchanges, he had a nice collection of Hilaire minerals, and I had most of the minerals and habits of Laacher See minerals described in his article. When I asked whether he had Hagendorf phosphates to exchange, he did not, but gave my name to two other collectors and put an ad in *Der Aufschluss* for me offering to exchange New World minerals for European micros. Although I have never even seen the ad, about a dozen European collectors responded, and we have been exchanging ever since!

Most particularly, I wanted to obtain micros of the secondary phosphate minerals found at the world-renowned Hagendorf Süd, a pegmatite locality. Through swapping, I now have 35 different phosphates and other minerals from Hagendorf, many in superb specimens, some of which are pictured here. This is far more than I have from the Palermo quarry, a locality where I have collected myself many times. Besides the minerals pictured in this column, Hagendorf offers excellent specimens of schoonerite, whitmoreite, stewartite, strengite and strunzite. Other extremely rare phosphates available from Hagendorf are cyrilovite, robertsite and keckite.

Returning to the subject of exchanging micros by mail, a few of the other specimens I have received are also shown in the accompanying photos. For those who would like to try their hands at exchanging, I would like to mention some of the collectors with whom I have been trading. Hannes Rose is a very discriminating collector who has sent me superb material from Hagendorf, including many of the rarer species. He also has Alpine minerals. Rupert Hochleitner has sent me excellent pseudolaueite and other Hagendorf species, phosphates from the old workings at Hühnerkobel, and monazites and xenotimes from the Lohninger quarry. He has an exchange list. Robert Winkler is a young collector, very active, with excellent material from the Lohninger quarry. He also has superb wulfenite from Bleiberg, and pharmacosiderite from the Clara mine, material which proves that the New World has competition abroad. Helmut Herndlhofer sent me the phillipsite pictured in this column, the finest I have seen and the closest to the idealized twins pictured in Dana of which I am aware. He also has other fine Austrian zeolites, Grube Clara material, and specimens from the Lohninger quarry. Siegfried Gassenmann is especially interested in micros of elements, sulfides, arsenates and vanadates. He also has Hagendorf material to exchange, including excellent pseudolaueite, schoonerite, jahnsite and stewartite. Wolfgang Jannsen has sent superb scholzite, phosphophyllite and bermanite from Hagendorf, as well as Grube Clara minerals. Although all of these read English, Helmut Herndlhofer and Siegfried Gassenmann prefer to write in German.

Their addresses are as follows.

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Mr. Robert Winkler
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Ing. Helmut Herndlhofer
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Mr. Siegfried Gassenmann
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D-7735 Dauchingen
West Germany

Mr. Wolfgang Jannsen
General-Barby-Str. 34
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West Germany

A few basic ground-rules: the first to write should be the first to send specimens. Always write to acknowledge a package received. No comment on a package received (aside from acknowledging having received it) implies mild dissatisfaction with the contents. Complain about or return only very poor material.

Happy swapping!

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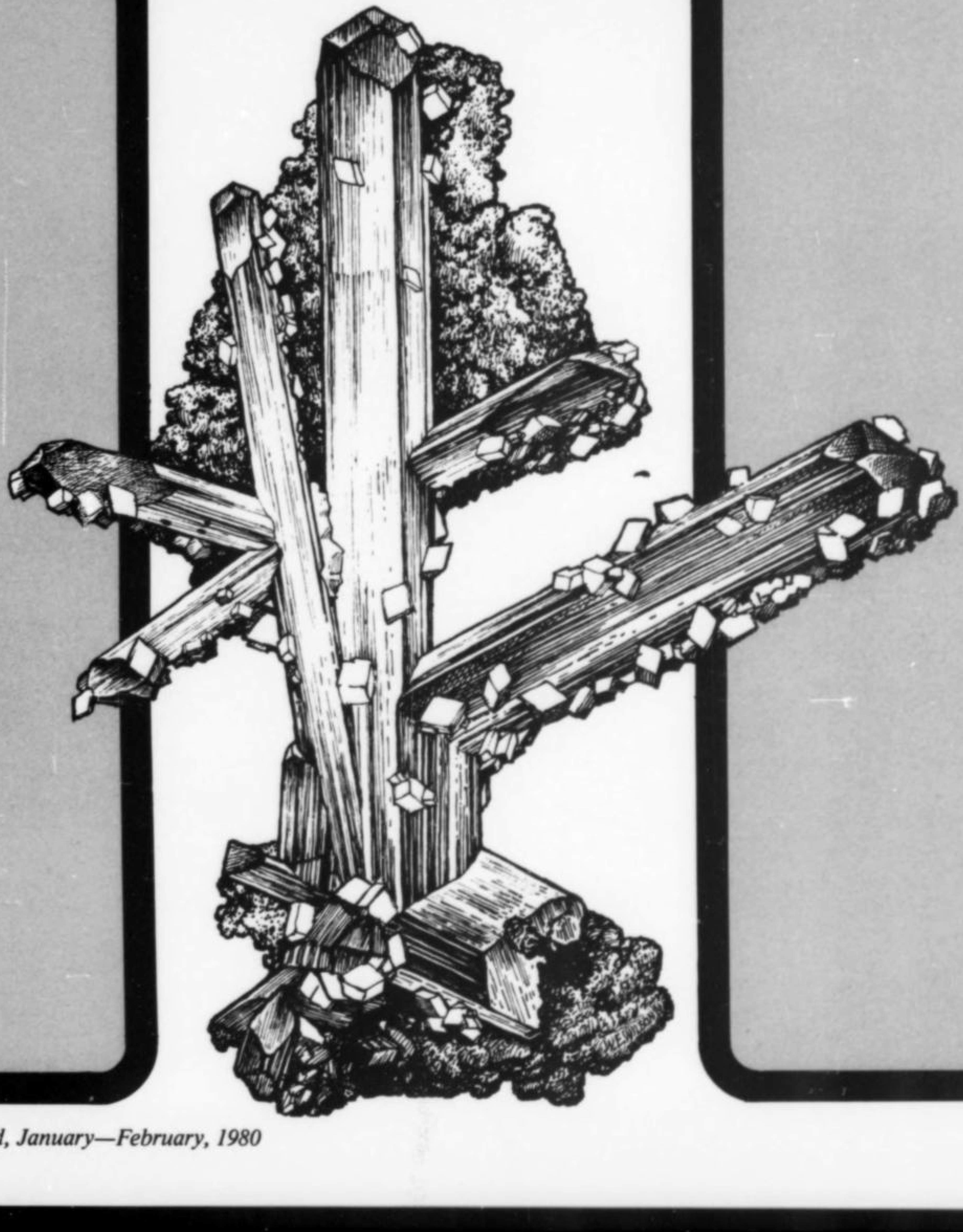

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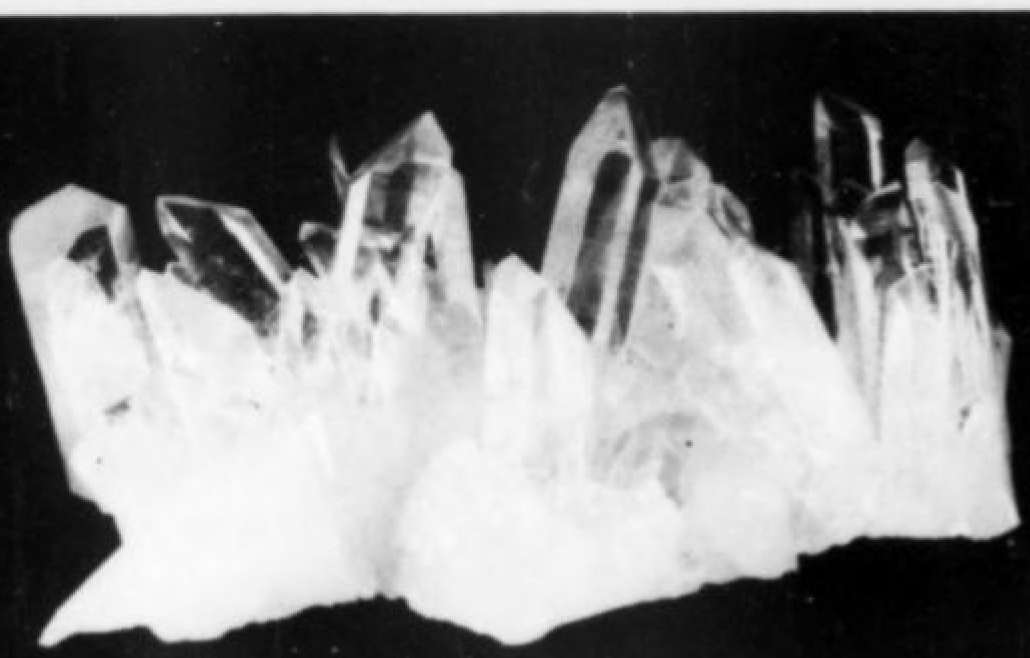

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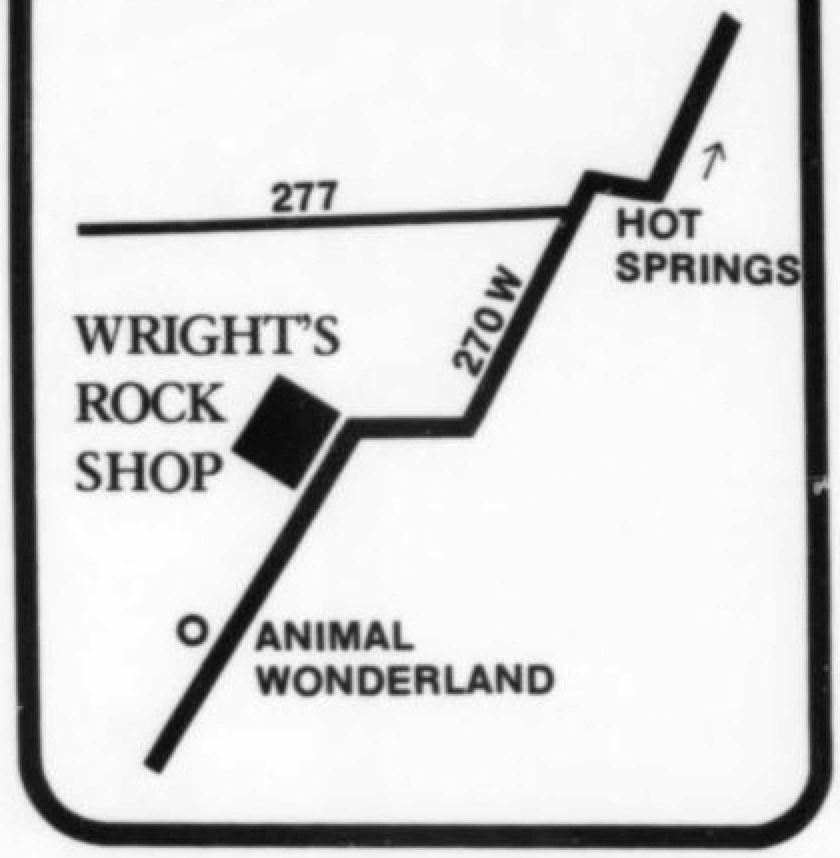

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***The Mineralogy of Pennsylvania 1966–1975,* by Robert C. Smith II. Special Publication No. 1, Friends of Mineralogy, Pennsylvania Chapter, Inc. Hardbound, 304 pages, 135 figures, 8 color plates, available from FM, c/o Bryon Bookmeyer, P. O. Box 19, Dept. MR, Blue Bell, Pennsylvania 17506; $14.95 plus 60¢ postage and handling.**

Smith provides us here with the second supplement to Samuel Gordon's *The Mineralogy of Pennsylvania* (1922) (the first supplement was Arthur Montgomery's *The Mineralogy of Pennsylvania 1922–1965*). Sixty-two recently verified mineral species from localities in Pennsylvania are described, as well as previously recognized species for which significant new data have become available. The book is arranged alphabetically by species; for each there is a comprehensive discussion of properties and occurrences within the state. Included is a chapter by Martin Anné devoted to the history of mineralogy in Pennsylvania, an extensive bibliography, a glossary of technical terms, and a comprehensive listing of the 276 species which, in the author's opinion, have been satisfactorily established as occurring in Pennsylvania.

This book is essential to any well-stocked mineralogical reference library, and also for amateur and professional mineralogists interested in the minerals and localities of Pennsylvania. It is an impressive contribution to the mineralogy of a state wherein people have been collecting minerals for nearly 200 years, and where new minerals and occurrences are still being found.

Robert Middleton

***Manual of the Mineralogy of Great Britain and Ireland* by Robert P. Greg and William G. Lettsom. A facsimile reprint with supplementary lists of British minerals by L. J. Spencer, and a fourth supplementary list (1977) together with a foreword by Peter G. Embrey. Hardcover, 550 pages, many text figures, 15 x 22 cm, published by Lapidary Publications, Broadstairs, Kent, England (1977). Available in the U.S. from Si and Ann Frazier, 1724 University Ave., Berkeley, California 94703; $20.00 plus $1 postage and handling.**

Among the treasures of many private and public mineral collections are specimens from such famous sources as the tin and copper mines of Cornwall, the lead mines of Alston Moor and Weardale, splendid fluorite from many deposits in Derbyshire and elsewhere in the British Isles, and brilliant calcite from the iron mines of Cumberland. Despite a comparatively small area, the British Isles are singularly blessed with both variety and abundance of beautiful as well as scientifically important minerals. Thus it is most appropriate in these days of keen interest in mineral collecting to greet this reprinting of the single most complete and reliable source of information on British minerals and their localities. This large and impressive work, previously available only at high cost through antiquarian booksellers, is now available to everyone.

Greg and Lettsom's 1858 classic is reprinted cleanly and accurately and forms the main body of the present book. It is a systematic treatment, describing in detail, and with crystal drawings as appropriate, the hundreds of species and varieties recorded from Great Britain and Ireland. The nonmetallic species are discussed first, then the metallics, and lastly appears a supplement of species, a list of British pseudomorphs, an extensive list of Devon and Cornish mines, and an appendix of statistics. The prefatory matter contains the references used by the authors. All of the original work is provided, including the unaltered title page.

The value of the book, however, is greatly enhanced by the additions furnished by Peter G. Embrey, Curator of Minerals in the British Museum (Natural History). These consist of a splendid historical foreword which provides a background to the original work and the accomplishments of the two gifted amateur mineralogists who were its authors. As Embrey points out, this work "owes more to the amateur than to the full-time professional development of the science, and this comes as no surprise to those of us who believe that the contributions of the talented amateur collector and of the specialist dealer have, over the years, been sadly and generally under-appreciated." Thus this book represents not only the state of descriptive mineralogy in England at the time, but also the highly successful and enduring attempt of a pair of amateurs to record what was then known about British minerals.

Appended to Embrey's foreword is an excellent "Biographical Notes" section, giving brief sketches of several dozen collectors and dealers who were active during the period and who influenced in some important way the final form and content of the book. In order to make this reprinting even more useful, several supplementary lists of minerals are supplied, originally published in the *Mineralogical Magazine* by Spencer, and a fourth list, specially prepared by Embrey to bring the work up to date.

Richard Lambert of Lapidary Publications is to be congratulated for undertaking this reprint, unsubsidized in any way, which is both large and filled with valuable information, and is surely one of the best bargains in mineralogical literature to be had today.

John Sinkankas

***Minerals of Georgia (Their Properties and Occurrences)* by Robert B. Cook (1978). Bulletin 92, Georgia Department of Natural Resources, softcover, 8½ by 11 inches, 189 pages. Order from Georgia Dept. of Natural Resources, Geologic and Water Resources Division, 19 Dr. Martin Luther King, Jr. Drive, Room 400, Atlanta, Georgia 30334; ($5.00).**

The latest in a growing number of very good state mineral occurrence guides is Robert Cook's *Minerals of Georgia,* modestly priced at $5.00 for such a large format paperback. Georgian occurrences of 198 minerals or undivided mineral groups are described in detail, and a list of 21 meteorites found in the state is provided.

A classical systematic arrangement of minerals is followed, beginning with the elements and ending with the silicates. The latter are subdivided on the basis of their structural subgroups. The localities for each species are arranged by counties. At the end of the book is a six-page bibliography, an index of species by counties, and an alphabetical index by mineral names.

There are no illustrations or maps save for colored photographs of a gold nugget (front cover) and rutile, magnetite and goethite (back cover). The binding is durable; it is stapled and glued, but has the disadvantage of not lying flat when the book is open.

Unfortunately, Dr. Cook's credentials are not given. He is highly qualified, has been teaching economic geology and optical mineralogy at Auburn University for seven years and has been a dedicated collector of minerals, with an emphasis on those of the southeastern U.S., for 26 years. He has personally collected at most, if not all, of the localities cited in the book. For these reasons the data he has presented are precise and accurate, and the book is an excellent state mineral guide.

Special features are few but include a tabulation of the most important gold nuggets discovered in Georgia, and all units of measure are given in U.S. and metric form.

John Sampson White

Mineralogische Tabellen **by Hugo Strunz (1978). Published by Academische Verlagesellschaft Geest and Porter, K. -G, Leipzig. Hardcover, 621 pages, 9.5 by 6.5 inches, 7th edition (DM 54.00).**

Having waited since 1970 for the new edition of Strunz' *Mineralogische Tabellen,* it was quite a disappointment to see the 6th edition of this work, which was merely a "corrected edition" did not contain a single new mineral species not listed in the (1970) 5th edition. The 6th edition, when it came out, was consequently an anticlimax for those who had hoped to see an actual update of this authoritative reference work.

That disappointment has been renewed with the recent publication of the 7th edition, which is identical in content to the 6th edition. Aside from changing the copyright date from 1977 (6th edition) to 1978 (7th edition) and adding the fine-print disclaimer *unveranderte Auflage* ("unchanged edition") to the title page, this edition is exactly the same as the 6th edition, itself a redundant version of the 5th edition.

Strunz' *Mineralogische Tabellen* is a bare-bones technical reference work which has little to interest the average mineral collector. However, it has been useful in the past to the active mineralogist. The deplorable practice of giving misleading new edition numbers to reprints of earlier editions should be strongly discouraged.

Pete J. Dunn

Menschen, Minen und Mineralien **(Men, Mines and Minerals) by Werner Lieber (1979), with an introduction by Paul Ramdohr. Hardcover, 208 pages, 4 color plates; published by Christian Weise Verlag, Oberanger 6, D-8000 München 2, West Germany; (DM 28.50).**

Subtitled *Mineralogy through 10,000 Years,* Lieber's new book is a history of mineralogy and at the same time a history of culture and technology. During the last 100 centuries man has learned to use the treasures of the earth to better his standard of living. Practical knowledge of the properties and uses of minerals arose early on the long path, which has led to our time of lasers, semiconductors and synthetic crystals.

The last history of mineralogy was written in 1926 by Paul Groth. Since that time, only limited sections of the field have been reviewed. In Lieber's new book we find a compact history of mineralogy from earliest times right up to today.

The first chapter, "Criteria in the change of time," is divided into three sections: from the Stone Age to Paracelsus, from Agricola to Roentgen, and from Laue to the present. Lieber describes the laborious path of the increase of knowledge, from the first intuitive uses to modern-day structural analysis.

Other chapters cover "Our Present Knowledge," "Modern Methods of Investigation," "The Search for Ore and its Recovery," and "The Uses of Minerals." A registry of names and short biographies of over 160 people, and a registry of minerals and related data to end the work.

Professor Paul Ramdohr states in his preface, "The author was able to give not only a pertinent picture of mineralogy within the allowable scope, but also an explanation of the present state of knowledge in pleasant and readable form. The book is all the more valuable in being directed at the amateur as well as the professional. Thanks to his close association with the science, Lieber was able to support our point of view. It is to be hoped that this book finds a wide distribution."

Having read the book I can only say that I wholeheartedly agree with Professor Ramdohr. Of particular interest are the various portraits of famous men in mineralogy whose names are well known but whose faces are not. I was amazed that so much information could be condensed into 208 pages.

Paul Seel

Molecular and Crystal Structure Models **by Anne Walton. Published by John Wiley and Sons, 605 Third Avenue, New York, New York 10016 (1978); 201 pages, glossy pressboard cover at $22.50. The original publisher in England is Ellis Horwood Ltd., Market Cross House, 1 Cooper Street, Chichester, Sussex, England. Wiley handles U.S. distribution.**

This volume is a unique and most interesting compilation. It is directed toward the teacher of crystal structures who has need of varying kinds of crystal models. Chapters include detailed expositions of space-filling molecular models, ball-and-spoke models, skeletal models, macromolecules, orbital models and others. There are separate chapters on construction devices and techniques, and two-dimensional models using pictures, projections and computers. There are two appendices: one listing manufacturers and suppliers of models, the other giving the known brand-name models (such as *Addatoms, Atomix, Atomunits*) and the suppliers of these specific models.

The book is intended to be a comprehensive compilation of the available information on crystal structure models, their use, construction techniques, advantages and disadvantages, and availability. The work succeeds admirably; this will be essential as a reference to the practicing teacher of crystal structure determinations and interpretation.

Pete J. Dunn

Rock-Forming Minerals, **Volume 2A, single-chain silicates, by W. A. Deer, R. A. Howie and J. Zussman. Published by John Wiley and Sons, 605 Third Avenue, New York, New York 10016 (1978); 668 pages, 9½ x 6½ inches, glossy pressboard cover at $55.00.**

Rock-Forming Minerals was originally published in 1962 and very quickly found use as the standard reference in the study of rock-forming minerals. The work has become a classic in the intervening years and has not been surpassed by any other work.

It is with some great excitement that this first-released volume of the second edition has come from the presses! This issue treats only pyroxenes and single-chain silicates and does so quite admirably. The 1962 edition was a five-volume set, volume two of which treated both pyroxenes and amphiboles in 379 pages. The new edition treats only half the subject matter of the first edition in 668 pages; the actual increase in coverage is threefold. To one involved in publishing mineral data, this volume inspires a profound sense of awe. *Rock-Forming Minerals* is a compilation of *all that is known* about pyroxenes and single chain silicates. The amount of knowledge published about these minerals is enormous and the distillation and synthesis of this volume of material by the authors constitutes a superb work. It is not a book for all collectors, but those seriously interested in expanding their comprehension of the mineral world would certainly benefit from having a copy for reference. The work is intended to be a reference for the practicing mineralogist or petrologist and deals with technical aspects of the minerals instead of what I would call collector information. Nonetheless, a collector could learn much by perusing the volume. It is indeed unfortunate that the high price will dissuade many purchasers and, to some degree, will result in less widespread knowledge. The price also seems high in view of the rather cheap pressboard cover instead of cloth.

The basic format of the original volumes is retained, and each section is well referenced. Considering the minerals well-known to the collecting community, there are 17 pages devoted to wollastonite, 14 to rhodonite, and 20 to jadeite. There is greatly increased information regarding phase equilibria, thermodynamic studies, and a greatly increased number of chemical analyses. The petrological sections are also expanded; in fact, it is difficult to find any section of this work which is not bigger and better! In my opinion, the practicing mineralogist cannot live without it, and the collector could benefit somewhat from using it. One can only wait anxiously for the other volumes of the second edition to be published. Volume 2A has come out preceding Volume 1.

Pete J. Dunn

OTHER TITLES RECEIVED

Introductory Econometrics by Phoebus J. Dhrymes. Published by Springer-Verlag New York Inc., 44 Hartz Way, Secaucus, New Jersey 07094; hardcover, 566 pages, $18.80 (1978).

Principles of Sedimentology by Gerald M. Friedman and John E. Sanders. Published by John Wiley and Sons, One Wiley Drive, Somerset, New Jersey 08873; hardcover, 8½ x 11 inches, 792 pages, $21.95 (1978).

The Moscow [Idaho] Opal mines 1890–1893 by Ron Brockett. Published by Pacific Northwest Books, Box 314, Medford, Oregon 97501; softcover, 5¼ x 8½ inches, 65 pages, $4.50 (1975).

The Rockhound's Guide to Washington, volume III, by Bob Jackson. Published by Jax Products, 1550 Union Ave. NE, Renton, Washington 98055; softcover, 5½ x 8½ inches, 46 pages, $3.95 (1978).

Modification of Soil Structure edited by W. W. Emerson, R. D. Bond and A. R. Dexter. Published by John Wiley and Sons, 605 Third Ave., New York, NY 10016; hardcover, 6 x 9 inches, 438 pages, $46.00 (1978).

North American Geology Early Writings, edited by Robert M. Hazen. Benchmark Papers in Geology v. 51, published by Dowden, Hutchinson and Ross, distributed by Academic Press Inc., 111 Fifth Avenue, New York, New York 10003; hardcover, 357 pages, 7 x 10 inches, (1979), $29.50. Includes a facsimile reprint of pages 58–69, entitled "Mineralogy, part I. Experimental Mineralogy; with a description of the necessary apparatus," from *Encyclopedia, or a Dictionary of Arts, Sciences, and Miscellaneous Literature,* v. 12, Philadelphia, by T. Dobson (1794).

Standard Mineralogical Catalog 1980, by E. G. and L. S. Brazeau (1979). Softcover, 112 pages, 5.5 x 8.2 inches; published by Mineralogical Studies, 7808 Division Dr., Battle Creek, Michigan 49017; $4.95 postpaid.

A valiant attempt to assemble, correlate and average the market prices of thousands of mineral species in various sizes and levels of quality. Includes a special section on the prices of "extraordinary" specimens.

Rocks and Rock Minerals by Richard V. Dietrich and Brian J. Skinner (1979). Thin hardcover, 319 pages, 6 x 9 inches; published by John Wiley and Sons, 605 Third Avenue, New York, New York 10016 ($00.00).

Bibliography of Virginia Geology and Mineral Resources—1960–1969 by F. B. Hoffer (1977). Virginia Division of Mineral Resources Publication 1, Charlottesville, Virginia. Softcover, 68 pages, 8½ x 11 inches, $2.25. Available from Virginia Division of Mineral Resources, Dept. M, Box 3667, Charlottesville, Virginia 22903. Other bibliographic listings are available for the years 1941–1949 (Information Circular 14, 50¢), and 1950–1959 (Information Circular 19, $1.25). Virginia residents add 4% sales tax.

Mineral Collector's Field Guide — The Northeast by Bill Shelton and Bud Webster (1979). Softcover, 8½ x 11 inches, 137 pages, $8.50. Available from Mineralogy, P.O. Box 504, Wallingford, Connecticut 06492.

Mineral Names: What Do They Mean? by Richard S. Mitchell (1979). Hardcover, 6 x 9 inches, 256 pages, $13.95. Published by Van Nostrand Reinhold, 135 West 50th Street, New York, New York 10020.

The first comprehensive study of the subject since 1896. Discusses the origins of over 2600 mineral names. Brief biographical data are provided for persons after whom minerals have been named.

Asbestos; Properties, Applications and Hazards v. 1, edited by L. Michaels and S. S. Chissick (1979). Hardcover, 553 pages, 6 x 9 inches, $62.50. Published by John Wiley and Sons, 605 Third Avenue, New York, New York 10016.

An Introduction to Crystallography by F. C. Phillips (1971), 351 pages, has been reissued in paperback at $15.95. Order from John Wiley and Sons, 605 Third Avenue, New York, New York 10016.

Minerali Ossolani by Vittorio Mattioli (1979). Hardcover, color figs., 300 pages, 6 x 7 inches, $25.00. Available from Semeriglio Rapazzini, via Ozanam 3, 20129 Milano, Italy. *(In Italian.)*

The Audubon Society Field Guide to North American Rocks and Minerals by Charles W. Chesterman (1978). Softcover in plastic, 856 pages, 4 x 7½ inches, 702 color mineral photographs by well-known photographers, the specimens being almost exclusively from North America; $9.95. Distributed by Random House Inc., New York, New York.

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Letters

THINGS ARE ROUGH ALL OVER

Dear sir,

On a recent overseas trip I came across an article which I thought might interest you. Here is a rough translation: "Four Swiss alpinists were placed under arrest yesterday in Chamonix (France) after the discovery of a clandestine exploitation of minerals in the Massif of the Grandes Jorasses. About 700 kg of diverse stones were seized by the police who classify this offense as 'an act of piracy and of vandalism.' It is emphasized that the looters will have to answer to the indictments supported by the mining code and customs code in accordance with environmental regulations. The four Swiss had mounted a practically industrial exploitation of Chamonix crystals. The gang clandestinely passed some explosives on the French side, and opened veritable small quarries in the pre-existing workings in that sector of the Grandes Jorasses. The crystals extracted were transported by a helicopter belonging to a French society lower in the valley, where a small truck waited for the cargo. The specialists from Savoy affirm that in recent years the mineral market has flourished in Switzerland." (From *Le Figaro,* 25 July 1979.)

I guess it's not just the Americans who are having trouble with their localities.

Howard Belsky
Brooklyn, New York

ALTYN-TYUBE

Dear sir,

Regarding Mr. Frechette's question about Altyn-Tube, even well-known mineral localities are often vague or insignificant topographical features, and finding them requires more than a good atlas and mineral book. An excellent place to begin looking is L. J. Spencer's *Catalogue of Topographical Mineralogies and Regional Bibliographies (Mineralogical Magazine* (1948), vol. 28, p. 303–332). Leonhard's *Handwörterbuch der Topographischen Mineralogie* (1843) is also often informative. The entry in the latter for Altyne-Tübe dioptase reads: "Russia. Siberia: the west slope of the small mountain Altye-Tebe, near the small river Altyn-Szu, in the region of the central Kirghiz Steppes, about 100 versts (66 miles) from the Russian settlement of Kar-Karaly; usually crystallized, rarely massive, in veinlets in a compact unfossiliferous limestone." Koksharov (*Materialen zur Mineralogie Russlands,* vol. 6, (1870), p. 286) gives some details of the original discovery, and gives the locality as "Altyn-Tübe, Altyn-Ssu river, about 300 versts (200 miles) south of the outpost Koriakowsky." I can't read Russian, but I can make out the words "Altyn-Tyube," "Altyn-Su," and "130 km WNW of Karkaralinsk" in A. E. Fersman's *Precious and Colored Stones of the USSR,* vol. 2, (1925), p. 260.

Armed with this information, we can then consult the superb maps and gazetteers produced by the U.S. Army Map Service. The gazetteer gives an Altyne Tyube, but this one is near Tashkent, away from the Steppes, and so the wrong one. It also lists a stream Altyn-Su (49°59'N, 73°58'E), which (Map NM43) turns out to be about 70 miles WNW of Karkaralinsk and so the one we need. The discrepancy between 130 km and 70 km from Karkaralinsk (about 11 miles) suggests that Altyn-Tyube may lie this distance west of the Altyn-Su stream. So, in plain language, the locality should be given as Altyne-Tyube, about 30 miles E. of Karaganda (the nearest sizeable town), Kazakh, U.S.S.R.

Peter G. Embrey
Curator, British Museum (Natural History)

Dear sir,

My copy of *A Course of Mineralogy* by A. Betekhtin, published in Moscow, gives the following:

"In the U.S.S.R. very large achirite crystals have been found at Altyn-Tyube (central Kazakhstan) in cracks in limestone. It is from these that in 1780 a Kazakh merchant, Achir, bought crystals which were for a long time mistaken for emerald, then named achirite, and more recently dioptase. In the U.S.S.R. the former name has been retained."

Brian Prowse
Leavesden, England

SAN DIEGO EXHIBIT

Dear sir,

An event of considerable interest took place on May 18th of last year: the San Diego Museum of Natural History held the opening of their "San Diego Minerals" exhibit. Created under the curatorship of Josephine ("Josie") Scripps, the display provides San Diego with an exhibit worthy of the great mineral and gem heritage of the area.

The display is artfully arranged in a prominent position just opposite the museum entrance. Set into four separate alcoves are display cases devoted to the major gem and mineral producing regions of the county, Mesa Grande, Pala, and Ramona, with the fourth case devoted to other areas of the county. The large wall in the triangular room is devoted to an early gold discovery in the Julian area. Four small table cases hold gem materials from the county; two are devoted to the Ware collection of faceted gems and matching rough, one to county gems in general, and the fourth to bowls carved from various gem materials by George Ashley of Pala.

Each case holds specimens both representative and spectacular—some specimens caused even the connoisseurs to look twice. In the Ramona case the pair of Little Three mine hamburgite crystals are especially noteworthy. The Mesa Grande case contains some seldom seen specimens from the Cota, Esmeralda and San Diego mines, as well as three of the superb, doubly terminated tourmaline "logs" recovered in April by Pala Properties operations at the Himalaya mine. The Himalaya mine crystals are gemmy, rich, reddish pink in color with a blue-green zone, somewhat tapered in shape, and measuring about 8 inches maximum.

In the Pala case are a number of fine beryl varieties, one a large aquamarine on quartz crystal matrix that is very exciting.

The general county case holds several very fine spodumene crystals from the Beebe Hole mine on Tule Mountain. These were on loan from Mr. Beebe.

Perhaps the only thing lacking was a good suite of phosphate "uglies" from Pala—and the great "Steamboat" and "Candelabra" tourmaline specimens now in the Smithsonian.

Josie and the museum staff and directorship are to be congratulated on the success of their efforts. *Record* readers should not pass up the opportunity to visit this lovely display when in San Diego.

Mark E. Rogers
Yucaipa, California

JAPAN-LAW TWINS

Dear sir,

As a quartz collector, I read the article by Cook on Japan-law twinned quartz (vol. 10, no. 3, p. 137) with particular interest. Being familiar with all of the Washington localities mentioned, I thought your readers might appreciate a few additional comments.

The Bald Hornet claim and the Blue Mountain Saddle are the same locality. Typical twins from this locality are extremely flattened (I have one that is 25 mm across and 1.5 mm thick), and are associated with or included by acicular greenish tourmaline. To my knowledge, only two twins were produced at the King County pyrite locality. Amethyst sceptered twins have reportedly been found at Denny Mountain, but I have been unable to locate a specimen in the major Denny collections here. Clear twins to 36 cm across were found at Denny Mountain in the 1950's. A vug of small glassy twins associated with sericite was found there in 1974; sizes range from a couple of mm to 5 cm. Many miniature specimens contain no untwinned quartz at all.

All of the localities listed except Denny Mountain are breccia pipes within the Snoqualmie granodiorite, and contain both quartz and sulfides. All are held under mining claim. Two other Washington localities have produced modest numbers of twins; McCoy Creek in Skamania County produces micro twins predominantly of prismatic habit, and Sultan in Snohomish County produces flattened twins to 2 cm. Both are hydrothermal veins along faults.

Bob Jackson
Renton, Washington

A MICRO MINERAL COLLECTOR FOUND

Dear sir,

I thought you might be interested in a recent discovery reported by R. B. Frankel and R. P. Blackmore (in *Chemical and Engineering News,* April 16, 1979, and *Science,* 1979, vol. 203, p. 1355). They found some aquatic bacteria that carry magnetite crystal compasses to direct their travel. The yet unnamed class of bacteria are "magnetotactic," that is, they swing toward the north pole in a weak magnetic field. Bacteria with this ability have been found in the U.S. and also in the Baltic Sea.

Bacteria were grown under controlled culture conditions and then examined by electron microscopy and Mossbauer spectroscopy to see how they were able to sense the earth's magnetic field. They found that the bacteria contain cubes of magnetite about 50 nanometers on a side, strung together into chains of about 22 cubes long.

Magnetite is the mineral first used by early mariners to make compass needles. In large masses it must be subjected to strong magnetic fields before the many internal dipoles become aligned and it acts as a permanent magnet. Magnetite cubes larger than 80 nm have multiple dipole moments, and cubes smaller than 40 nm have unstable dipole moments. Therefore the size chosen by the bacteria is just right, and it takes at least 20 such cubes, working together, to be able to detect the weak magnetic field of the earth.

The scientists speculate that the magnetite crystals help the bacteria swim toward their preferred bottom sediment environment, since at the latitudes where the bacteria are found the earth's magnetic field points primarily down rather than northward.

Gary R. Hansen
St. Louis, Missouri

DIMORPHOUS MINERALS

Dear sir,

Do you happen to know which minerals crystallize in more than one crystal system, such as ilvaite does (orthorhombic and monoclinic)?

Gordon V. Axon
New York, New York

In most cases a dimorph of an accepted mineral is given a new name and considered to be a new mineral. The new name may be unrelated to the first name (e.g. greenockite and hawleyite), or the relationship may be acknowledged in the naming of the dimorph (e.g. fergusonite and beta-fergusonite, or safflorite and clinosafflorite). The ilvaite dimorphism is unusual, and exists only because no mineralogist has yet taken it upon himself to formally describe the monoclinic dimorph as a new mineral. Cases of dimorphism continue to be discovered as species are studied more closely. Often the structural differences are discerned only after intensive and sophisticated X-ray analysis. Unfortunately I do not have a listing available of the currently accepted dimorphous species.

Pub.

THE PRIEST'S STORY

Dear sir,

While reading the Memorial to Neal Yedlin in the July-August issue I was astonished to see the paragraph in Lou Perloff's tribute which referred to a young priest in New York City and how they acquired his collection. I am that priest, no longer young, now retired in South Carolina.

I thought the history of the collection Neal bought from me might be of interest. It all began when I was a student at the University of Pennsylvania in 1930. I took a course in mineralogy from Dr. Olvach, and had managed to collect a few hand specimens, but I changed my whole viewpoint when he showed me a collection of micromounts there at the university, most specimens of which were from the collection of Rev. Rakestraw, plus some of the collection of C. S. Bement. I helped clean up the rather untidy, dusty collection of hand specimens at College Hall and gathered a few very small pieces which had broken off. Then I met Dr. Wills, and spent many an evening viewing his collection and learning more about localities. He gave me some of his duplicates.

In 1936 I moved to a church in Providence, Rhode Island, and later to Bridgeport, Connecticut. I perused Schortmann's catalogs with great interest and purchased specimens from them and from Ward's Natural Science Establishment. Around this time I met Dr. Pough, who helped in identifying specimens found in Connecticut, and I did some collecting in Maine where my parents spent the summer. I recall visiting Buckport, Mt. Pleasant, and Paris, but got most of my material and help from Stanley Perham at Paris Hill, who was just starting a small shop. The collection grew.

The real strike, however, came in New York. Martin Ehrmann had rented a floor in the RCA building—nothing more than a large loft filled with case after case of beautiful cabinet specimens from the Calvert collection. I went over these drawer by drawer, and since they were poorly packed there was much broken material. Mr. Ehrmann was most kind and allowed me free rein, afterwards identifying the specimens I had salvaged; most were from Cornwall, Derbyshire and Cumberland. I found many beautiful micros of copper and lead minerals. And I recall a special find, Wheatley mine (Pennsylvania) pyromorphite, a small specimen covered over with red wulfenite!

It seems my specimens which Neal bought were not identified as to source, which is a pity. Apparently he remounted them in new boxes, as mine were not the best looking, but they were dust-proof and were labeled on the top in my own hand.

Rev. Robert L. Jacoby
Summersville, South Carolina

PUGH QUARRY CLOSES

Dear sir,

Pugh quarry, Custer, Ohio, has been sold to the France Stone Company and is now closed to all mineral collecting. Pugh was the last well-mineralized quarry in the entire state of Ohio open to collecting by the general public.

Henry Fisher
Columbus, Ohio

LOCALITY REFERENCES

Dear sir,

I'd like to inform your readers that the *fourth* edition of Dr. Pough's *Cleaning and Preserving Minerals* is now available, still at $2.75 each, from Earth Science Publishing Company, P. O. Box 1815, Colorado Springs, Colorado 80901.

John A. Jaszczak
Parma, Ohio

Dear sir,

I have been advised by the California Division of Mines in San Francisco that Bulletin 189, *Minerals of California,* will be reprinted sometime this year. It will not be an updated version, just a reprint of the 1966 edition.

I was recently able to obtain a mineral book I was looking for, at a reasonable price, from Outlet Book Company, 34 Englehard Avenue, Avenal, New Jersey 07001. They may have other out-of-print books as well.

Bill Spence
San Jose, California

Dear sir,

I was weaned on a very useful collector's guide which is still available from the Museum of Sciences, State Street, Springfield, Massachusetts: *Minerals and Rocks of Springfield and Vicinity* by Leo Derwood Otis (1952). It gives 15 collecting areas, along with information on how to reach them and the minerals to be found there. The cost is a mere 50¢ postpaid.

G. Fred Lincks
Pittsfield, Massachusetts

Dear sir,

After reading over the list of references compiled by Smith and Cook ("Minerals of the United States," vol. 10, no. 1) I had the thought that some of the U.S. Geological Survey publications listed as out-of-print might actually still be available from the survey. So I checked with the survey's publication distribution office and found that some indeed are still available from the U.S.G.S. The U.S. Government Printing Office stocks these publications for only a limited number of years, then transfers them to the U.S.G.S. and declares them to be out-of-print, even though they are then still available from the U.S.G.S.

The publications listed below, shown as out-of-print by Smith and Cook (as well as many other "out-of-print" survey publications) may be purchased at the indicated price from the Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, Virginia 22202.

Arkansas	Bull. 973-E	$ 2.85
Connecticut	Bull. 1042-Q	1.55
Idaho	Prof. Paper 229	2.95
Maine	Prof. Paper 255	10.40
Maryland	Bull. 1082-K	3.30
Maryland	Bull. 1283	1.00
Montana	Bull. 983	3.35
New Hampshire	Prof. Paper 353	5.60
New York	Bull. 1072-F	1.05
North Carolina	Prof. Paper 577	2.75
North Carolina	Bull. 1072-D	.50
Wyoming	Prof. Paper 405	1.05

Gilbert H. Espenshade
Arlington, Virginia

Dear sir,

While going over your article on "Minerals of the United States" I noted a few references which should be included under the headings for Colorado and Utah:

Colorado Pegmatites, by K. K. Landes (*American Mineralogist,* vol. 20, p. 319–333) (1935)

Pegmatite investigations in Colorado, Wyoming and Utah (1942–1944) U.S.G.S. Prof. Paper 227, out-of-print.

Minerals of Colorado, a 100-year record, by E. Eckel. U.S.G.S. Bulletin 1114. A reprint (without the map) is available for $5.00 from the U.S.G.S., Federal Building, 125 South State Street, Salt Lake City, Utah 84111

(Ed. note: the writer suggested several more, but those and others may be found in the bibliographies in the Colorado Issue #2 and the Thomas-Wah Wah article in vol. 10, no. 5.)

J. Lemanski
Salt Lake City, Utah

SETTING THE *RECORD* STRAIGHT

Dear sir,

In vol. 10, no. 5, photos of a number of our specimens were included in the Thomas-Wah Wah article. The only error I saw is in the caption to Figure 13, page 267. The bixbyite cluster shown was self-collected by us in June 1977, and has not left our collection. The specimen was on loan to Ken Roberts for one day during the 1978 Tucson Show, during which time you photographed it for the article and must have presumed it was Ken's.

Mike Sprunger
Leamington, Utah

Dear sir,

Marcelle Weber's Mont St. Hilaire "muscovite," pictured in my column on Mont St. Hilaire (vol. 10, no. 2, p. 108), and incidentally also sketched by Neal Yedlin in *his* column (vol. 2, no. 5, p. 211), has recently been analyzed and found to be manasseite.

Violet Anderson
Toronto, Ontario

Dear sir,

Mr. Leising was in error in his letter to the editor (vol. 10, no. 4) in which he chastised me for not pointing out in my article on the Blue Bell mine (vol. 8, no. 6) that the mine is privately owned. I clearly stated that "the mine is posted, and the owners are usually present on weekends."

Jack A. Crowley
Newark, California

Right you are. Apologies both from Mr. Leising and myself for the oversight.

Ed.

Dear sir,

I wish to point out that Saul Rosenberg (Neal's brother-in-law) did the painting of Neal Yedlin in vol. 10, no. 4, not Jules Bernhardt as the credit line indicates.

Ron Bentley
Windsor, Connecticut

Dear sir,

Regarding your note "airport X-rays revisited" (vol. 10, no. 3, p. 132), in which you were disconcerted to see your film through the lead-lined FilmShield bag on the airport security monitor, you should first understand the physics of X-ray attenuation. The criterion is not the transmittance of X-rays but the protection of the film from damage. When you wear an asbestos glove to handle something hot, you still feel the heat but at least your hand is not burned. The function of the glove is to prevent the burn, and the function of the FilmShield bag is to prevent X-ray fogging of the film.

There is particular cause for concern in countries like France and Switzerland where they absolutely refuse a hand inspection. The little lead-lined bags will be your only protection. Dr. Ulrich Klement of Regensburg University in Germany recently tested the FilmShield material and was satisfied with the level of attenuation it afforded.

Irwin H. Diamond
President, Sima Products
(manufacturers of FilmShield)

If you say so. I was under the mistaken impression that the bags were opaque to X-rays. They are not, but apparently total opacity is not necessary. And they are unquestionably better than nothing where a hand search is forbidden.

Ed.

Dear sir,

I am honored and pleased, on the whole, to see the translation of my *Lapis* article on minerals of the Alpine rodingites appear in the *Record* (vol. 10, no. 2, p. 85). Because these magazines are for the advanced collector, I should like to point out some minor spelling errors which crept into the translation.

Tetrahedron (hessonite) should be tetra*hexa*hedron.
Alaite (variety of diopside) should be ala*l*ite.
Rocca Tova should be Rocca Tov*o*.
Becci della Corbassere should be Becc*h*i della Corbassere.
Cogolato should be Cogol*e*to.
Antronapiano should be Antronapian*a*.
Champ*l*oluc should be Champoluc.
Most names such as Sansobbia-Tal, except in South Tyrol where German is spoken, should be corrected as Val Sansobbia, Val di Gava, etc., as should Germanisms such as Desio-Hütte be corrected to Capanna Desio.

In the meantime, several new discoveries have been made, especially in Piedmont (Val di Viu, Val Maira, etc.). Good specimens of these minerals, especially vesuvianite, are however quite expensive, even from local dealers.

Carlo M. Gramaccioli
Milan, Italy

Dear sir,

The following data will set the record straight on the Harvard silvers in Robert

Cook's fine article on Chañarcillo (vol. 10, no. 4, p. 197). The arborescent silver in Figure 5 is Harvard #93034, and came originally from the H. von Karabacek collection (which, incidentally, was mentioned in Fred Cassirer's memoir on page 228 of that same issue), purchased by Professor Palache in 1935. It measures 8 cm tall. The wire silver shown in the photo we provided for Figure 6 is Harvard #85067, purchased by Palache in 1945 and measuring 7 cm tall. Though it was also pictures in the *Manual of Mineralogy* (19th edition) as being from Chañarcillo, we unfortunately find that actually it is from Kongsberg, Norway. Sorry for the slip-up.

Carl A. Francis, Curator
Geological Museum, Harvard

Dear sir,

There are a couple of interesting anomalies in the article on the Carl Bosch collection (vol. 9, no. 3, p. 181). These refer to the notes on the Bosch labels and their translation and interpretation.

Figure 12 shows a specimen dated as 26 August 1881, and I own a Bosch specimen myself which is dated 12 July 1877. If we accept these as the dates of acquisition for Bosch, he must have been a precocious collector indeed, since he was born in 1874, and would have been only 3 years old when he acquired the latter specimen. The dates are clearly enough written, but I doubt they represented *his* date of acquisition. More likely they are carry-overs from an earlier collection, perhaps by his father or a relative, or perhaps from an older collection purchased as a whole by Bosch.

The second problem relates to the interpretation of the price code. I agree with the translation of the numbers, but disagree that they refer to German marks in most cases. I don't know the exact exchange rate in 1880–1910, but as an old stamp collector I remember that the 10-pfennig stamp was about equal to our 2-cent stamp. That would make the stephanite and acanthite about $20 apiece in the 1880's. It is important to remember that thumbnail-size specimens were not in vogue in that era, that the silver mines were still producing specimens, and that you could buy superb English barites and calcites for 50¢ to $1 in hand-size specimens. Considering these facts, I suggest that the code refers to pfennigs and not marks (there being 100 pfennigs to the mark).

Another way to test the pricing problem is to estimate the gross value of the collection, 25,000 specimens. At an average price of $20 each, Bosch would have spent $500,000 in turn-of-the-century money. To believe that this same collection (with gems and meteorites added) would only appraise for $400,000 in 1966 challenges credulity. If the pfennig interpretation is correct. Bosch's actual purchase price was closer to $5000, in an era when the average man made less than $1000 a year. This seems far more reasonable.

Jim Minette
Boron, California

Dear sir,

In vol. 10, no. 1, p. 33, you referred to Ron Sohn's Brushy Creek calcite as having come from Iron County, whereas Ron's labels say Reynold's County (Missouri). Which is it?

Marie Huizing
Editor, *Rocks and Minerals*
and *The Quarry*

The entrance to the mine is in Reynolds County, but the underground workings pass over into Iron County. Ron and I discussed it and agreed that a sort of "apex law" should apply for labels: the county wherein the mine entrance is located (i.e. Reynolds in this case) should be used for labels. An arbitrary choice, I admit, but an easy rule to apply to other locality problems where underground locations are uncertain.

Ed.

EXCHANGES

Dear sir,

Pyrophyllite crystals and micros of variscite crystals for trade. Send list first.

Bill Wall
803 Cumville Drive
Kernersville, North Caroline 27284

Dear sir,

I am a micromounter interested in trading for all good micromounts from the U.S. and Canada. I can offer specimens of most of the Eifel minerals in exchange. I would particularly like to find a trading partner who can supply me with ten pieces of each item, because I have many friends here interested in obtaining American specimens.

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D-5060 Bergisch Gladbach 2
West Germany

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via Cavour 193, 00184 Rome, Italy
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friends of mineralogy

Final Report of the FM Ad Hoc Committee on Locality Preservation

by
Mike Groben
1590 Olive Barber Road
Coos Bay, Oregon 97420

Carl Francis
Curator, Harvard Geological Museum
24 Oxford Street
Cambridge, Massachusetts 02138

and
Pete Modreski
12113 E. Dorado Place, N.E.
Albuquerque, New Mexico 87111

The *Ad Hoc Committee on Locality Preservation* was impanelled in 1974 to explore the problems of locality preservation and to recommend procedures to be adopted by FM to accomplish site preservation. The ambitious charge proved to be infeasible because each case is different and can only be resolved on an individual *and* local basis. Consequently, the committee has sought to *promote* locality preservation rather than direct it.

Toward this end, a group of successful examples of locality preservation was collected and published as previous FM columns (*Record,* v. 7, p. 101–104; 157–159; and 269–271). Three more cases (all written by Mike Groben) are appended to this report. Although not affiliated with the committee, Curt Segeler contributed a case history on the Lengenbach quarry to the *Record* (v. 7, p. 272–274). Also, Henry Truebe authored a valuable contribution, "mining claims for the mineral collector," (*Record,* v. 8, p. 43–46) which drew several significant responses (*Record,* v. 8, p. 412–413).

These 22 examples document diverse means of accomplishing site preservation. However, all revolve around securing access to the locality whether by negotiation for collecting rights with the property owner or by outright purchase of the property. This is the gist of locality preservation.

At the FM board of directors meeting in Tucson on February 10, 1979, it was agreed that since the *Ad Hoc Committee on Locality Preservation* had accomplished its purpose, it was made a standing committee to serve as a resource for chapters and regions involved with preservation activities.

EMERALD CREEK GARNET AREA

Benewah County, Idaho

The Emerald Creek garnet area is located in the St. Joe National Forest near Fernwood, Benewah County, Idaho. Almandine has been recovered from the schist and alluvial deposits by amateur collectors and commercial mining interests for more than 30 years. Crystals commonly range up to 2 inches in diameter and frequently display asterism showing four and six-rayed stars. An extraordinary specimen encountered in 1958 has been fashioned into a sphere 5.5 inches in circumference and exhibits 18 six-rayed stars.

The U.S. Forest Service acquired the locality in the 1960's from Potlatch and from the Sunshine Mining Company by exchange of lands. Because these lands were outside the established National Forest boundary they were exchanged under the auspices of the Weeks Law. Under provisions of this law mineral extraction from such "acquired lands" can only be done under permit or lease from the Bureau of Land Management. When the Forest Service proposed to make the garnet locality accessible through a concession-type lease in accordance with the law, the mineral clubs in Lewiston and Moscow as well as individual collectors protested, urging the Forest Service to sell permits directly. After contacting Senator McClure, the BLM was persuaded to revise the regulations so that acting as an agent for the BLM, the Forest Service does sell permits directly to collectors.

The garnet area is open daily from 8:00 a.m. until 6:00 p.m. from June 1st through September 30th. Permits cost four dollars and authorize the removal of up to five pounds of garnets. A maximum of 90 permits is issued each day. Collecting areas are specified by the Forest Service. As one area is depleted, another is opened and the depleted one restored to its original condition.

CURNOW'S ROAD, WHANGAREI, NEW ZEALAND

Curnow's Road is a 40-hectare (100 acres) block of undeveloped farmland which belongs to the Crown in New Zealand. The locality is situated between Waiotira and Toka Toka in the province of Northland and is easily accessible by road. Some years ago, rockhounds discovered that this area contained good lapidary material such as banded agate, carnelian, chalcedony, jasper, and petrified wood. Thereafter, the area became very popular with rockhounds who dug holes, pits and trenches in a rather unorganized manner. Because of the extensive and erratic digging and the ensuing soil erosion, the Crown, in 1974, banned any further digging and/or removal of lapidary material. The tract was then advertised for sale as farmland.

For the next two years the Whangarei Rock and Gem Club made a concerted effort, which was eventually successful, to have the Crown set the land aside for collecting purposes. Against strong opposition from local farmers, who were interested in acquiring the property, and from the Crown, due to the uncontrolled digging and resultant erosion damage, the club approached the government in 1974 through the local Minister of Parliament. A petition in favor of the area being set aside by the Crown as a collecting area was circulated and received a great deal of support from local collectors. Letters were also sent to public employees who were or would be involved in the ultimate decision as to how this parcel of land would be used. Unfortunately, in September 1974, the Crown notified the Whangarei Rock and Gem Club of its decision to refuse a lease application for collecting purposes.

The club then organized another campaign. This time the Minister of Lands was flooded with telegrams and letters from rockhounds throughout all of New Zealand and this was successful in stopping the immediate sale of Curnow's Road as farmland. As a result of all the interest shown by rockhounds throughout New Zealand, the Crown reconsidered its original decision and ultimately set aside 100 acres in the form of a 10-year lease to the club.

The terms of this lease were both specific and stringent. Some of the more important terms and conditions set forth are as follows:

1. An annual rent of $100 per year is to be paid in advance.
2. A royalty of 10¢/kg is charged for any and all material removed from the property.
3. A declaration of all material removed is made each month to the government.

(4) Accounts and records must be kept current by the club for inspection by the Crown to verify the amount of material removed and the payments made.
(5) Digging is confined to only 2 hectares at a time until the Crown authorizes digging in the next contiguous 2 hectares.
(6) All topsoil must be replaced in its original contour in all areas in which digging takes place and it must not be buried with subsoil, so that ultimately the land can be used for farmland when all the collectible material has been removed.
(7) No camping is permitted.
(8) No litter can be left on the property.
(9) A $200 cash bond is retained by the Crown to insure compliance with all the regulations.
(10) The Crown can revoke the lease at any time for a breach in the regulations.

Curnow's Road is the first and only area in New Zealand that the government has ever set aside for rockhounds. Only by strict compliance with the terms of the lease can the Whangarei Rock and Gem Club retain control of the property for collecting purposes. The area is "policed" by club members and a collecting fee of $1.00 is charged to all who enter. Scales are provided for the weighing of any material that is removed.

This is another instance of a rock and gem club that has been instrumental in setting a locality aside for collecting purposes.

We are indebted to Pete King of Mangawka and Dawn Gentry of Whangarei, New Zealand, for bring this locality to the attention of this committee and furnishing the material for this report.

OBSIDIAN CLIFF OSUMILITE LOCALITY LANE COUNTY, OREGON

The Obsidian Cliff locality is on White Branch Creek about 4 miles southwest of Frog Camp on the McKenzie Pass Highway and about 3 miles northwest of the North Sister Peak, in Lane County, Oregon. Osumilite occurs as sharp crystals to one-eighth inch in size associated with magnesian fayalite (hortonolite) in vesicules in rhyolite. This is the one of the few known osumilite localities in the world.

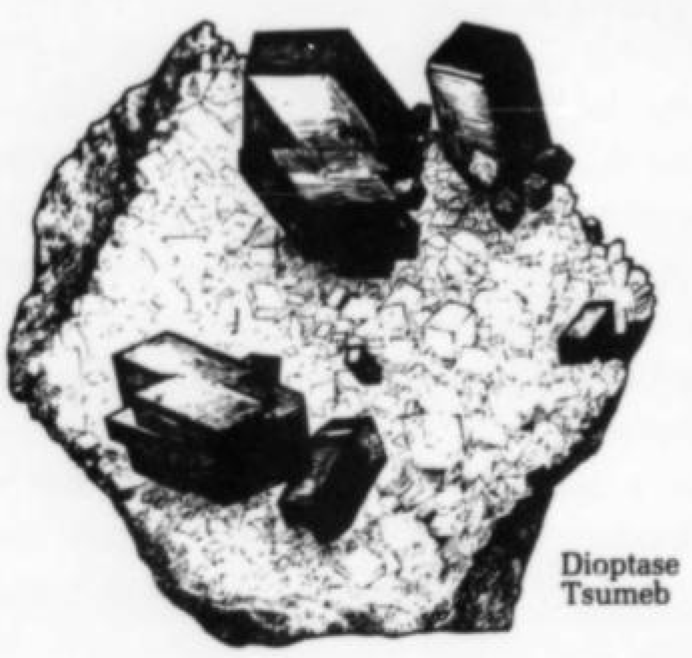
The locality was originally discovered by Ford Young in the summer of 1941. Although considerable work was done to characterize the then undescribed species, there was insufficient material for a chemical analysis. Subsequent visits to the locality by Dr. Young in 1946 and by Professor Lloyd Staples (University of Oregon) in 1959 eventually permitted the mineral to be identified as osumilite, a cordierite-like mineral from Japan described by A. Miyashiro in 1956. Professor Staples showed the material to A. L. McGuinness who, together with M. M. Groben, collected and distributed this rare species to collectors and museums.

On September 3, 1964, Congress passed the Wilderness Act. This resulted in the establishment of the Three Sisters Wilderness Area which includes the Obsidian Cliff locality within its boundaries. The Wilderness Act provided that the old mining and mineral leasing laws on all lands previously designated as National Forest lands would remain in effect until December 3, 1983. After that date, these lands would be closed to all mineral claims. Because of this provision the osumilite locality could have been in jeopardy for collecting purposes. Consequently, in September, 1977, the locality was staked by M. M. Groben as the "Betsy Girl" claim and duly recorded in the Lane County Courthouse. Notification was sent to the Bureau of Land Management and U.S. Forest Service and the required annual assessment work has been completed each year since that time.

The Betsy Girl claim is open to collectors during the summer months after the snow has melted. Permission to collect and directions to the locality may be secured from M. M. Groben at 1590 Olive Barber Road, Coos Bay, Oregon 97420, prior to visiting the property.

Those wishing further information about the Friends of Mineralogy may write to the current FM president: Delbert Oswald, Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213.

The **Lesnicks**



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What's New in Minerals?

DETROIT SHOW 1979

Always reliably good, the Detroit Show this year had something for everyone. Mineral displays were especially abundant . . . 18 institution cases and 60 private collection cases of minerals were on exhibit. The institutions displaying their treasures included the continent's best: the A. E. Seaman Museum, American Museum of Natural History, Arizona-Sonora Desert Museum, Carnegie Museum, Cranbrook Institute, Harvard University, Los Angeles County Museum of Natural History, Natural History Museums of Canada, Paterson Museum, Philadelphia Academy of Sciences, Royal Ontario Museum, Smithsonian Institution, University of Cincinnati, University of Delaware, and Wayne State University (some having more than one display case).

Of particular note among the institution cases was Harvard's case of azurite from worldwide localities . . . 22 superb specimens which give some idea of the real depth of the Harvard collection. In the Royal Ontario Museum case there shone a luscious pink group of morganite (beryl) crystals about 4 by 4 inches perched on a large white quartz crystal, from the Golconda mine, Minas Gerais, Brazil.

Perhaps the most outstanding aspect of the many exhibits was the large number of dazzling gold specimens. The American Museum's huge mass of leaves (about 6 inches) from the Empire Star mine, Grass Valley, California; Dave Wilber's incredible specimen (probably an eventual cover piece for the *Record*); the Leicht's case of California gold (and two antique instruments); the Smithsonian's big sheets of leaf-crystal gold from Tuolumne County, California, and the Mojave nugget (see inside cover, vol. 9, no. 3); Arizona-Sonora Desert Museum's 6-inch gold sponge from the Dos Cabezas Mountains, and their 3-inch nugget from the Huachuca Mountains, Arizona; and a private collection of 23 Alaskan gold nuggets from 1 to 4 inches in size. Undoubtedly 1979 will be remembered as Detroit's Gold Year.

Among the private displays, John Barlow's two cases of minerals from the Montreal mine, Montreal, Wisconsin, held some remarkable specimens from a locality not widely known among collectors. These included a 2-inch diamond-shaped blue barite crystal on matrix, a number of fine manganocalcite specimens, hematite groups, and many others.

The winner of the Detroit Challenge Cup this year was Philip Scalisi. His case included quite a number of exceptional specimens: large cuprite crystals on matrix from the Santa Rita copper mine near Silver City, New Mexico; three very fine azurites (Chessy and Bisbee); perhaps one of the best small cabinet specimens of Tiger (Arizona) wulfenite known; a very fine old brazilianite crystal on muscovite crystal matrix; an Untersalzbachtal (Austria) epidote; and 13 others of similar desirability.

Beth Gordon Minerals displayed an enormous group (about 15 inches across) of yellow mimetite from the Ingla Tierra mine, Santa Eulalia, Chihuahua, Mexico. Other noteworthy cases included Miriam and Julius Zweibel's emeralds, Pala Properties' pegmatite minerals from California, Rustam Kothavala's superb case of Indian minerals, What On Earth's case of newly mined pyrite and quartz from Washington, Ken and Betty Roberts' case of antique mining items (including a miner's candlestick with two hand loops and two candle sockets . . . probably unique), Curt Van Scriver's miniatures, and many others.

Among the few new items were some promising specimens of cinnabar crystals on matrix from a secret locality near Lovelock, Nevada; these were for sale by Pala Properties and by Wright's Rock Shop, but only a few specimens were on hand . . . more are expected. The crystals are lustrous, gemmy, twinned like their Chinese brothers, and typically ½ inch in size although the biggest seen are 1 inch. So far about 6 choice pieces and 24 very fine pieces have been found.

There was one other new item at the show, some azurite which I will discuss separately here; other than these there was little new to be seen, although the old localities and recycled collections yielded many extremely fine specimens. Most dealers reported brisk sales, and it was a good year to buy. Happily, specimens in the $1 to $15 range were still abundant, and I met several very young collectors running around and picking up many items for a total of $5 or so. Watching such people have so much fun with so little money can be a nostalgic experience for even the most advanced collector, remembering a similar time when excitement and total fascination came so easily.

Back at the Holiday Inn, nearly every room held a dealer or someone associated with the show. Again there was little new, but a few specimens caught the eye. David Byers, for example, was offering two nuggets from the Ural Mountains in the Soviet Union: an osmiridium nugget 2 cm across, and a platinum nugget 3 cm across (the prices asked were $6000 and $8000 respectively . . . not exactly within the reach of the ordinary collector, but certainly interesting to see).

Red Metal Minerals had some exceptional pyrolusite crystals, blades typically ¾ inch long and 1/10 inch wide, but reaching a maximum of an incredible 3 inches long and ¾ inch wide. All were on a matrix of drusy quartz, from the Taylor mine, Alberta, Michigan, and were very reasonably priced for such fine specimens ($5 to $30 each).

A recommended diversion for anyone visiting the Detroit Show is the Henry Ford Museum, located in Greenfield Village in Dearborn, just 2 miles north of Highway 94 (which everyone takes from the airport into Detroit). The collections of antique automobiles, furniture, pocket watches, power equipment and engines, are perhaps better than those of the Smithsonian. The most fascinating may be the collection of antique lighting devices, many hundreds of examples, including interesting miners' lamps of various types. For some people, these alone will be worth the visit (and the $3.75 admission charge).

Azurite from the Touissit mine, Morocco

Unquestionably the most exciting new thing for sale at the 1979 Detroit Show was the batch of superb azurite crystals from Morocco. A pocket was discovered at the Touissit mine near Oujda; Gary Hansen acquired part of the contents, which he offered at Detroit, and Frank Melanson (Hawthorneden) acquired other superb pieces which he sold at the Munich Show. The locality itself is not new, having produced modest amounts of specimens for many years. It is located in an old lead-mining area very near the Moroccan-


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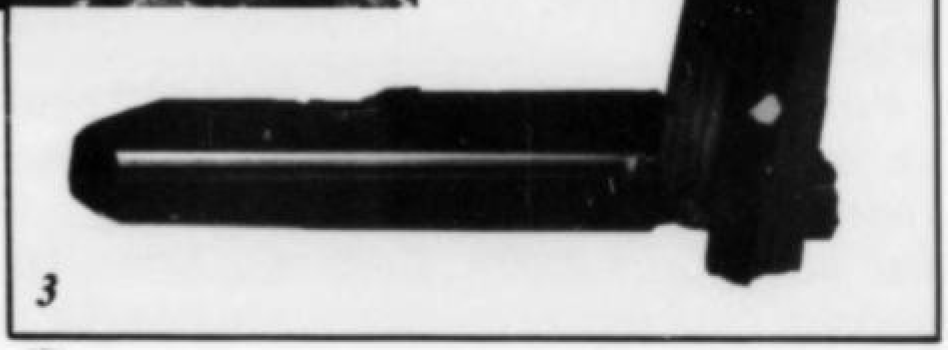
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Specimens from the Touissit mine, Morocco (this and facing page). Gary Hansen specimens except as noted. *(1)* Azurite on matrix, 10.6 cm tall. *(2)* Azurite crystals on malachite, tallest crystal 5.1 cm. *(3)* Azurite, 4.1 cm. *(4)* Azurite crystal group, 4.5 cm across. *(5)* Yellow wulfenite, 5 mm crystals (Roberts Minerals, through Vic Yount). *(6)* Azurite, 12.8 cm across (Harvard specimen).

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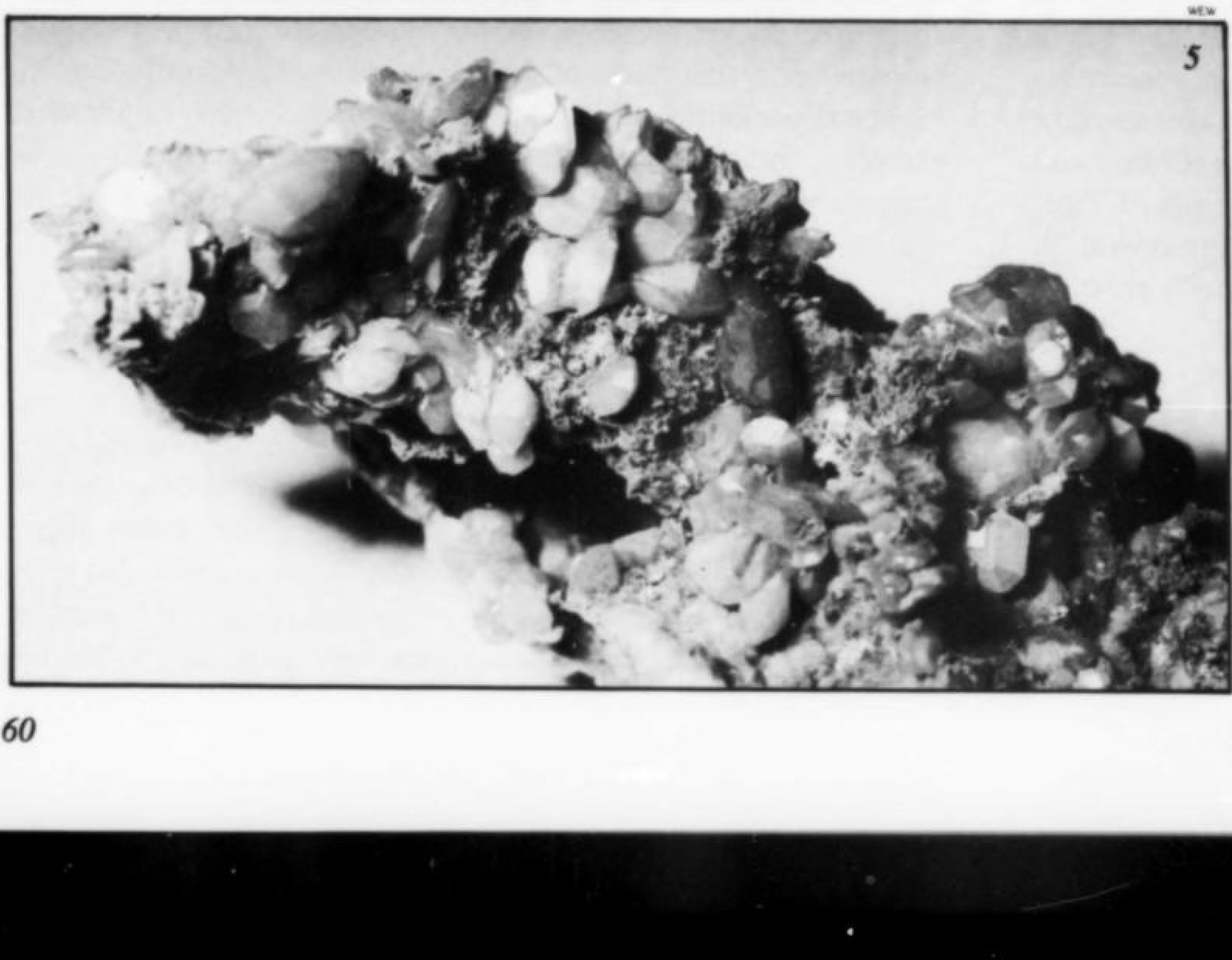
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Algerian border. In fact, some say the mine workings extend underground into Algeria, leading some to state the locality as "Morocco-Algeria." The "apex rule" applied to mineral labeling, however (see *Letters* in this issue), would decide the matter in favor of "Morocco."

Vic Yount has previously offered specimens of yellow wulfenite from this mine (first mentioned in Vol.10, no.3, p.188), and both he and Gary Hansen report seeing white crystals of pyromorphite to ¾ inch from the Touissit mine. Vic also reports seeing cerussite crystals to 2 inches, white saddle-shaped crystals of dolomite to 1 inch, and bright yellow, non-transparent crystals of wulfenite perhaps 1/10 inch thick and 3 to 4 inches across. This latter type of wulfenite is a different habit from that brought out earlier by Vic and pictured here.

The azurite specimens were a surprise. Azurite has long been found at the Touissit mine in decidedly uninspiring specimens which drew no attention at all from collectors. Then this new pocket was found which truly rivals Tsumeb for quality! The Touissit mine must henceforth go down in all future references as one of the world's great azurite localities. The crystals reach several inches and occur in a variety of habits, many reminiscent of Tsumeb azurite. A matrix of malachite is common, alteration or partial alteration of azurite crystals to malachite is also common, and second-generation azurite crystals forming on malachite pseudomorphs are known. Gary's best specimens ranged in price from $350 to $3400, perhaps somewhat lower than such specimens from Tsumeb would have cost, but still expensive. The color of the crystals is typically black, as at Tsumeb, but many show a distinct blue tint which is pleasant. Rather than describe the specimens in words, it may be best in this case to show photos of a selection of the Hanson specimens.

Readers interested in learning more about the area might consult the following reference:

CLAVEAU, J. *et al.* (1952) The lead and zinc deposits of the BouBeker-Touissit area, eastern French Morocco. *Economic Geology,* **47**, 481–493.

A number of other references, all in French, are listed in:

RIDGE, J. D. (1958) Selected bibliographies of hydrothermal and magmatic mineral deposits. *Geological Society of America Memoir 75,* 123.

W.E.W.

***(7)* Malachite pseudomorph after azurite, 7.7 cm tall. *(8)* Azurite, 4.5 cm tall. *(9)* Azurite crystal, 4.9 cm tall. *(10)* Azurite crystal, 3.6 cm tall, with velvet malachite ball. *(11)* Azurite crystals, 7.2 cm across, with blue-green partial alteration to malachite at center.**

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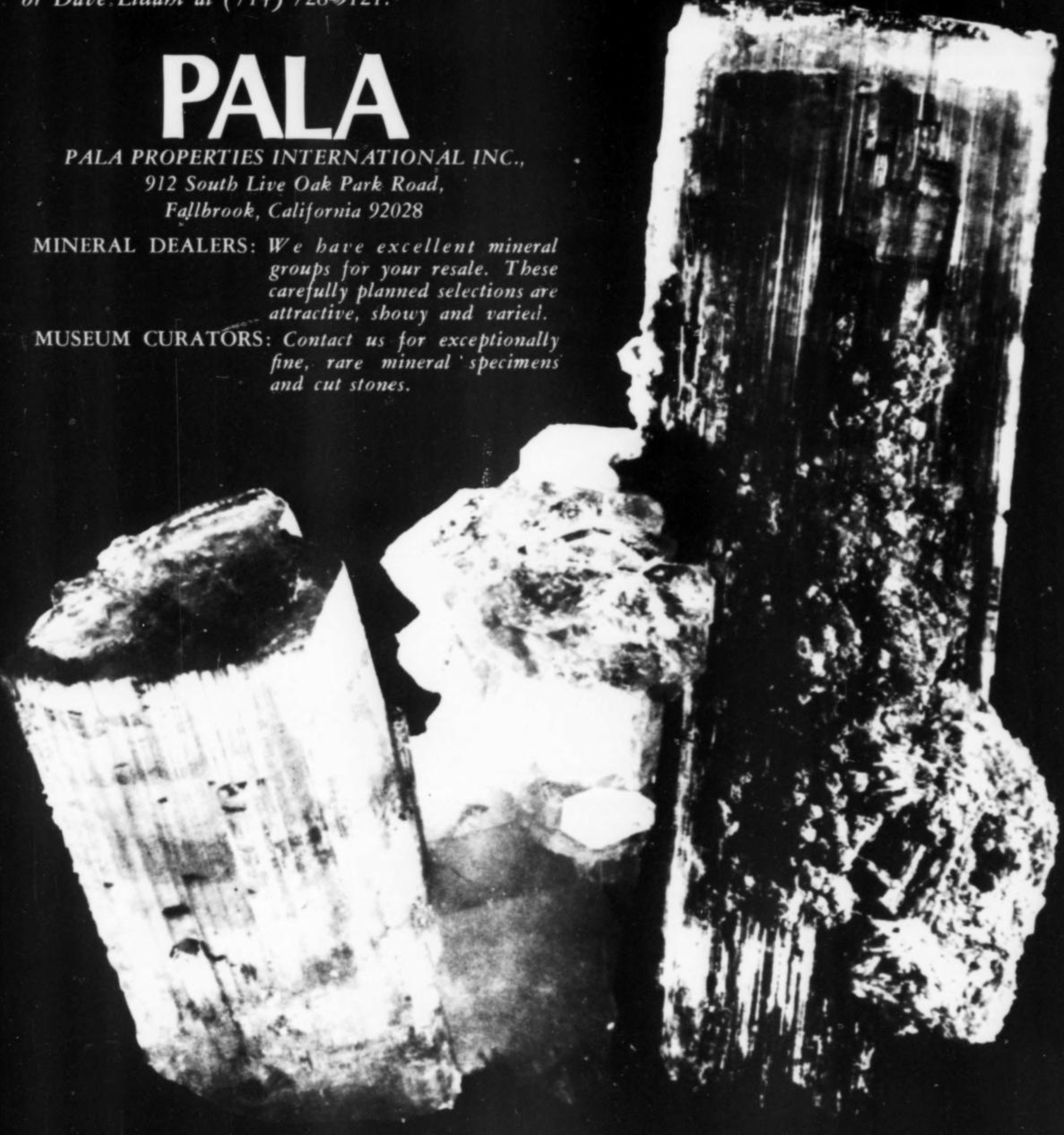

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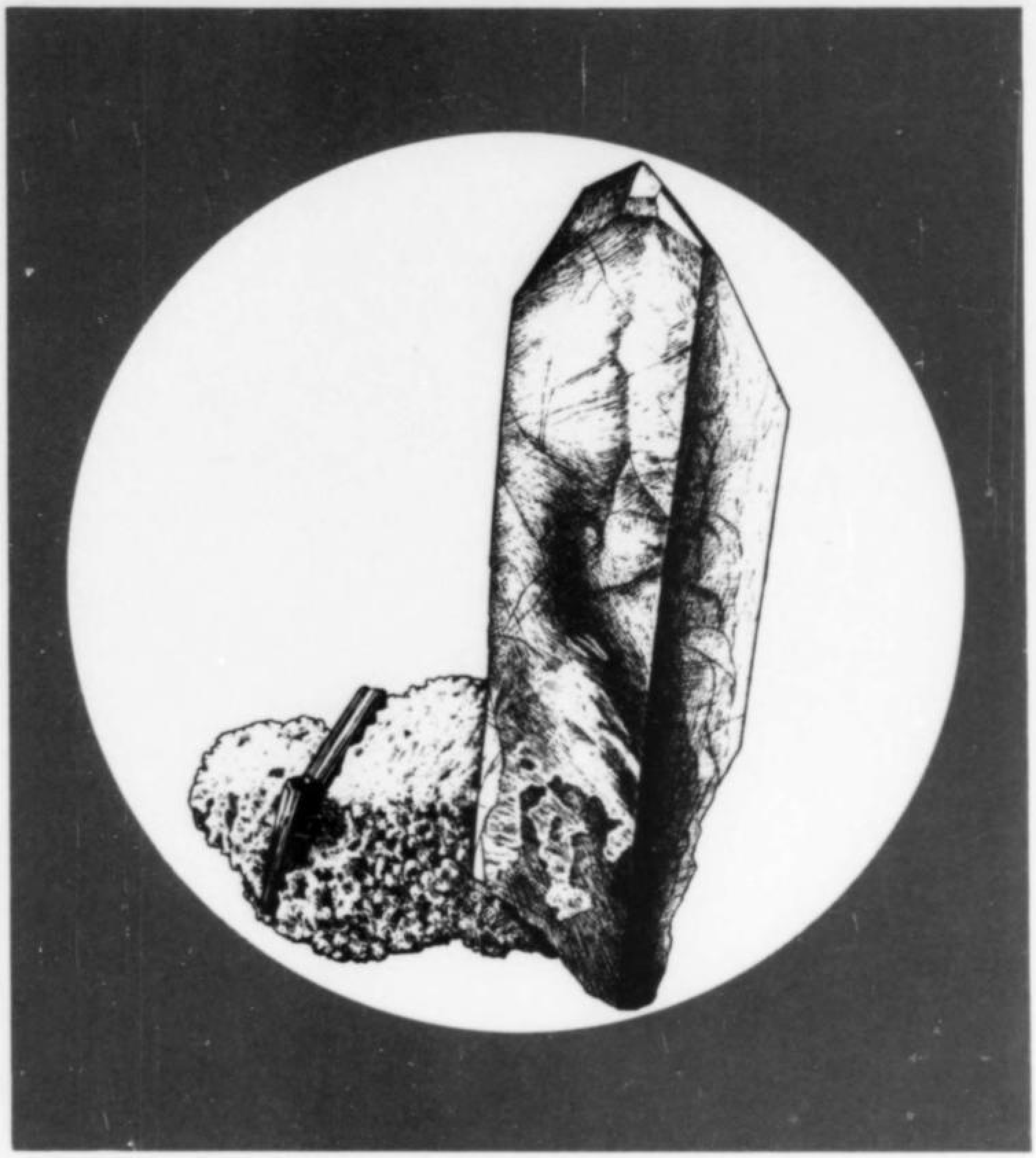

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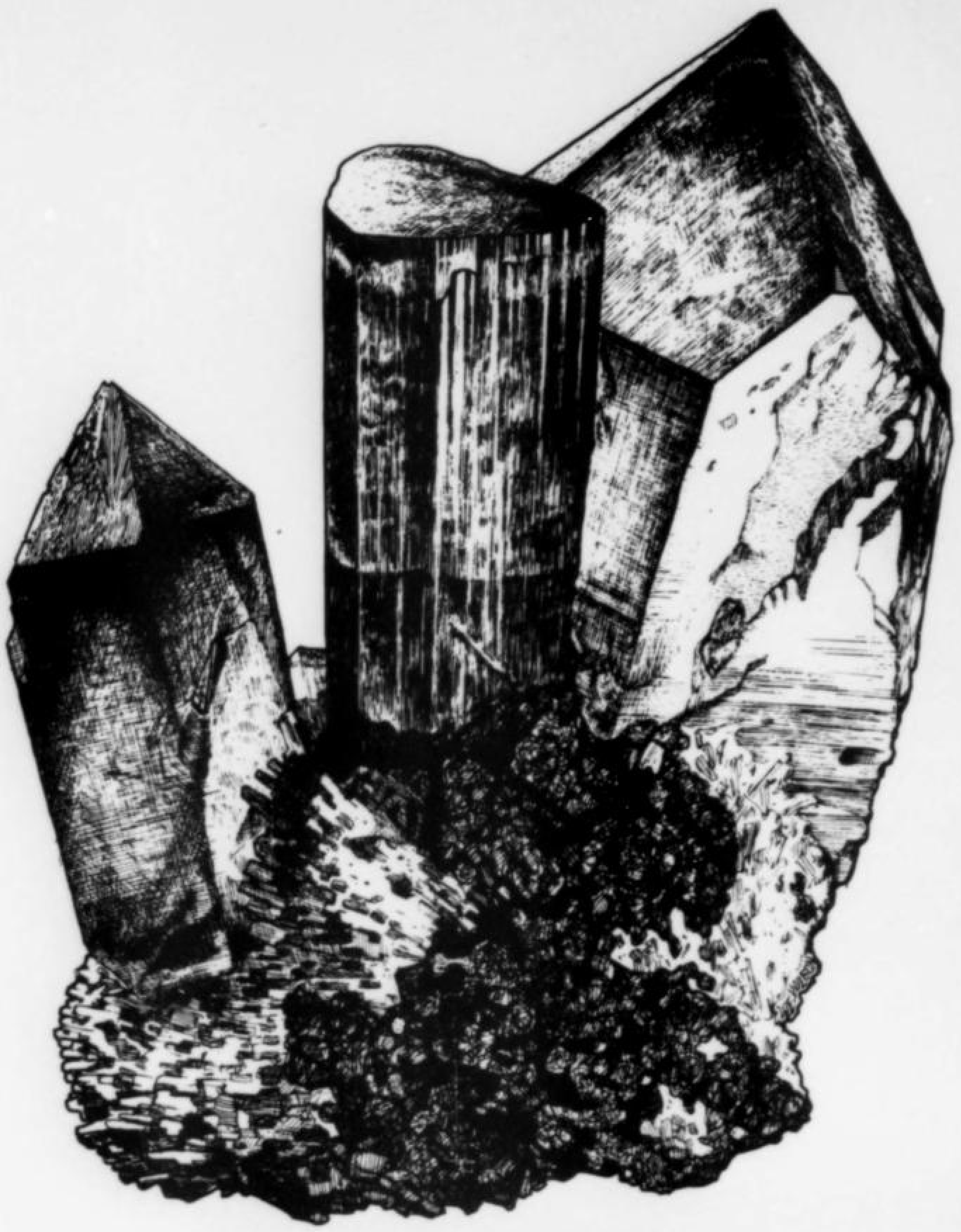

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