



FRIENDS OF MINERALOGY

Pennsylvania Chapter

NEWSLETTER

VOL. 15, No. 1, Spring, 1986 1987

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NOTES, NEWS, and VIEWS

Minerals of the Codorus Stone Supply, Inc., Quarry Emigsville, York County

An interesting article by Jeri L. Jones in the April, 1987, issue of the York Rock and Mineral Club Geoinformer, describes many aspects of the Codorus Quarry. Included is information on the minerals found there thus far.

Calcite occurs either as translucent rhombohedral crystals or as cleavage masses, or as filling in joints, stress fractures, and faults. Dolomite occurs as small saddle-shaped, flesh-colored crystals or as pink cleavages associated with calcite. Fluorite occurs in massive form or as small cubic, purplish crystals in calcite seams, tending to be larger and more abundant in upper beds. Hematite occurs only as blood-red, earthy masses in the light gray dolomite beds. It is also seen on the exterior of rocks associated with ground water percolation, and occurs as small metallic gray plates in calcite seams.

Mercasite was collected by Larry Eisenberger, of Hanover, in 1985. The reddish micro needles occurred in a small cavity in a calcite seam. Sphalerite was collected by the author in 1985.

NOTES, NEWS, AND VIEWS (cont'd)

Ramsbeckite: A New Mineral for Pennsylvania
from the Ecton Mine, Montgomery County

In a recent article in the Mineralogical Record ("Ramsbeckite, an American Occurrence at the Ecton Mine, Pennsylvania," vol 18, March-April, 1987), Donald R. Peacor, Pete J. Dunn, and R. Darko Sturman relate how they had been preparing a description of a new mineral from the Ecton Mine, Audubon, Montgomery County simultaneously with the German authors, who published the description of a new copper-zinc-sulfate mineral, named by them "ramsbeckite" (Hodenberg, R., v. Krause, W. Schnorrer-Kohler, G., and Tauber, H., 1985, "Ramsbeckite, $(\text{Cu}, \text{Zn})_7(\text{SO}_4)_2(\text{OH})_{10} \cdot 5\text{H}_2\text{O}$, a New Mineral," Neues Jahrbuch für Mineralogie Monatshefte, p. 5550-556.

Concerning the Ecton Mine, the authors encourage readers interested in the Audubon mines to read the accounts by Smith (Smith R.C. II, 1977, Zinc and Lead Occurrences in Pennsylvania, Min. Res. Rpt. 72, Pa. Geological Survey, 4th Series, p. 247-262) and Evans (Evans, F.H., 1980, Historical Sketches of Copper and Lead Mining in Montgomery County, Pennsylvania, Spec. Pub. No 2, Friends of Mineralogy, Pa. Chapter, 36 p.), saying: "These publications are very well written and highly informative."

The labelling of the specimen from the Ecton Mine (NMNH 136297) does not provide any knowledge of either its occurrence or relations within the mine, but while the German occurrences are all post-mine, the Ecton material appears to be contemporaneous with other secondary minerals.

The ramsbeckite occurs as blue-green, subhedral crystals, both as individuals and in clusters which are part of an assemblage of secondary minerals derived from oxidation of a primary galena/sphalerite ore occurring in a quartz vein (the copper may have come from chalcocopyrite). Linarite, anglesite, pyromorphite, posnakite, and ramsbeckite are among the other secondary minerals whose relative position in the paragenetic sequence are not clear, although the serpierite must have been the last formed, since it partially covers the other minerals. In one vug ramsbeckite occurred alone, perhaps due to weathering. Collectors familiar with the Ecton Mine could not recollect having seen anything similar to the ramsbeckite, suggesting that it might be rare at this locality but the additional five German occurrences suggest that ramsbeckite may be present at many localities.

Extensive work by the American authors on the optical properties, crystallography, and composition of the Natural History Museum specimen revealed overall strong similarities between the German material and the Ecton Mine specimen, thus confirming them as the same mineral. However, optical study of the Ecton Mine ramsbeckite, showed an orientation consistent with triclinic crystal system symmetry, while the X-ray diffraction studies showed that it is monoclinic, like the German specimens.

Peacor, Dunne and Sturman suggest that, although a theoretical solution can be offered, further work, comparing specimens from the two localities, is needed to solve this problem.

THE INFRARED SPECTRA OF MINERALS: PART I, INTRODUCTION

Infrared spectroscopy is a powerful tool for mineralogical investigations in the laboratory, supplementing X-ray diffraction both for mineral identification and for some aspects of structure.

Infrared is applicable to over 95% of the estimated 3200 mineral species listed in Michael Fleisher's latest Glossary (1987). It is particularly useful for minerals containing oxygen. In the twenty years that I have been applying the techniques of infrared spectroscopy to the study of minerals, I have run some 20,000 spectra of minerals, and have accumulated a substantial collection of infrared spectra of identified mineral species, perhaps some 2000 by now.

What infrared looks at mainly is the covalent bonding of atoms (Pauling, 1960, p. 7), which plays an extremely important role in mineral structure. Absorption of infrared energy of particular frequencies results from the stretching, bending, twisting, rocking, wagging, deformation, and breathing modes of the vibration of the covalently bonded atoms (Herzberg, 1945), thus showing the relationship of infrared spectra to molecular structure. In addition, there is evidence for perturbations to the infrared by neighboring cations (positively charged atoms) in the crystalline lattice.

On the other hand, there is substantially no contribution from the strictly ionic or metallic bonding. Therefore, minerals in the elemental state have substantially no infrared spectra, nor do the simple halides. Sulfides and sulfo-salts provide certain problems, part of which will be overcome with the set-up of a dry-air purge of my infrared spectrophotometer (Perkin-Elmer Model 580B), so that the range in the far infrared can be extended from 300 cm⁻¹ to 180 cm⁻¹. However, even with this current limitation, useable spectra can be obtained for about half of the sulfides and sulfosalts.

It has been said that infrared spectroscopy looks at short range order in the crystal lattice, in contrast to long range order for X-ray diffractions. In fact, in some ways, infrared distinguishes between mineral species with much greater sensitivity than X-ray diffraction (Lazarev, 1972; Farmer, 1974, p. 3).

Unlike X-ray diffraction, infrared can provide useful spectra of crypto-crystalline or amorphous minerals, including glasses. In general, infrared is not sensitive to trace concentrations of ionic or other impurities. A difference in elemental composition of more than about 1% is required to produce a significant infrared spectral difference. Therefore, within the permitted range of chemical composition of a particular mineral species, infrared is able to see significant differences.

It has been the author's experience that the labelling of mineral species in most mineral collections is in error to the extent of perhaps 20%, while the error rate for published spectra is significant, perhaps 5%! Such errors have substantially impeded attempted correlations of mineral spectra.

For this reason, an infrared identification is not considered fully established by the author until standard spectra are available for the same mineral from at least three different locations, with no significant discrepancies.

As the file of reliable reference spectra grows, it will be increasingly possible to elucidate certain aspects of structure of unidentified minerals, particularly in the regions of absorption characteristic, for example, O-H, N-H, CO₃, XO₄, YO₃, etc.

As a result of being able to run a complete mineral spectrum in less than

THE INFRARED SPECTRA OF MINERALS: PART I, INTRODUCTION (cont'd)

ten minutes (including sample preparation), it is possible to examine a great many more samples in a given period of time with infrared than with X-ray diffraction. It is profitable, particularly, to look at all visually different crystals on a specimen, and, in certain cases, to arbitrarily take similar-appearing samples from several locations on the specimen. A sample size of about one milligram ("a crumb") is preferred.

For search of the collection of spectra, the author has devised a "Feinberg Infrared Index" characteristic of the mineral, which can readily be written down by inspection of each spectrum. The locations, in wave numbers (cm^{-1}), of the three strongest peaks in the range 4000-400 cm^{-1} are written down in decreasing order of intensity of absorption. For wave numbers of 999-400 cm^{-1} , each wave-number is preceded by a zero. The fourth (least significant) digit is dropped for each peak, and the resulting three-digit numbers are pushed together (concatenated) to create the nine-digit "Feinberg Infrared Index" of the spectrum. Spectra are then filed in increasing order according to the Index. The system establishes well over a million slots. However, identity of the "Feinberg Infrared Index" is not considered sufficient for a match. For verification, the actual spectra themselves must be compared.

In a particularly powerful implementation of present instrumentation (data is acquired digitally, every one cm^{-1} via computer), the data is "messaged" by digital smoothing, and then subtracting one spectrum from another after suitable adjustment for intensity, thus allowing background to be subtracted. Furthermore, by subtracting the spectrum of a sample enriched in impurity from that enriched in the mineral desired, it is possible, in favorable cases, to obtain spectra of both the purified mineral and of the purified impurity!

In subsequent articles in this series, the spectra of individual minerals will be treated, including interesting data on such minerals as the alkali feldspars, hematite (two kinds or more), pyromorphite, pumpellyite, arsenopyrite, franklinite, ankerite, the actinolite-tremolite series, okenite, the serpentines, etc.

While the minerals of Pennsylvania are a special interest, as are the minerals of New Mexico (especially the Ortiz Gold Mine, Santa Fe Co), Franklin, Langban, Crestmore, and Mont St Hilaire, I am actually willing to work on unknowns from anywhere in the universe!

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