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GEOLOGICAL SURVEY

Locations and descriptions of mineralized rock samples from Mississippi Valley-type lead-zinc occurrences in central Pennsylvania

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Introduction

Widely scattered occurrences of epigenetic lead-zinc mineralization, presently noneconomic, are located within a 5000 square km region of central Pennsylvania including Centre, Huntingdon, Blair, and Bedford Counties. Within this region, eight areas are most abundantly mineralized (Fig. 1): Milesburg, Julian, and Skytop, Centre County; Mapleton, Huntingdon County; Birmingham, South Sinking Valley, and Roaring Spring, Blair County; and Woodbury, Bedford County.

Minor exploration and mining have taken place intermittently in some of these areas during the past two hundred years. The first lead mines in Pennsylvania were operated in South Sinking Valley between 1778 and 1779. Small-scale mining resumed in 1795 near Birmingham, but it was not until 1864 that more active operations began. Between 1864 and 1870, the Keystone Zinc Co. removed several thousand tons of ore from the area (Butts and others, 1939; Rose, 1970). In the 1870's and 1880's, small operations began in the Woodbury area, where Samuel Snyder dug two short shafts and Scott Smith drove a short adit at a location some 1.3 km to the north a few years later (Smith, 1977; Tregaskis, 1979). The Schad adit in the Milesburg area was driven in the early 1900's and reopened during 1938-1941 and in 1954 (Smith, 1977). Exploration resumed in South Sinking Valley between 1944 and 1950 as several holes were drilled by the U.S. Bureau of Mines and a mining company, and it was about this time that numerous holes were drilled and several adits and shafts extended in the Birmingham area (Rose, 1970). In 1973, New Jersey Zinc Co. conducted soil surveys in the Woodbury area and as a result sank six diamond drill holes (Tregaskis, 1979). A short diamond drill hole was collared recently near Mapleton (Smith, 1977).

The continued interest in the lead-zinc occurrences in the region warrants a better understanding of the genesis of the deposits. A study was undertaken to examine the mineralogy, textural relations, fluid inclusions, and stable isotopes of oxygen and sulfur of rock samples from locations in the eight most abundantly mineralized areas (Table 1). The data collected were used to place constraints on the temperature, chemical composition, and isotopic composition of the fluids that deposited the lead-zinc mineralization, and from this framework a model for the formation of these deposits was developed (Howe, 1981). The purpose of this report is to locate and describe the mineralized rock samples examined in the study.

Summary of Geology and Geochemistry

The lead-zinc occurrences are located in the western portion of the highly folded and thrust-faulted Valley and Ridge province of the Appalachian Mountains. The mineralization occupies fractures, joints, and breccias of Late Pennsylvanian to Early Permian age in lower Paleozoic carbonates, shales, and sandstones; it also occurs as disseminations in sandstones and sandy laminae of shales. The most abundantly mineralized units include the Upper Cambrian Mines Dolomite, the Lower Ordovician Larke, Nittany, and Bellefonte Dolomites, the Upper Ordovician Bald Eagle Formation, and the Lower Silurian Tuscarora Sandstone. Epigenetic mineralization can be divided into six paragenetic stages, each separated by an episode of tectonic disturbance: (1) pyrite + arsenopyrite $\pm$ pyrrhotite; (2) quartz; (3) barite + celestite + dolomite + calcite $\pm$ fluorite $\pm$ hematite; (4) sphalerite, in three substages; (5) chalcopyrite + galena $\pm$ jordanite $\pm$ bournonite (?); and (6) quartz +

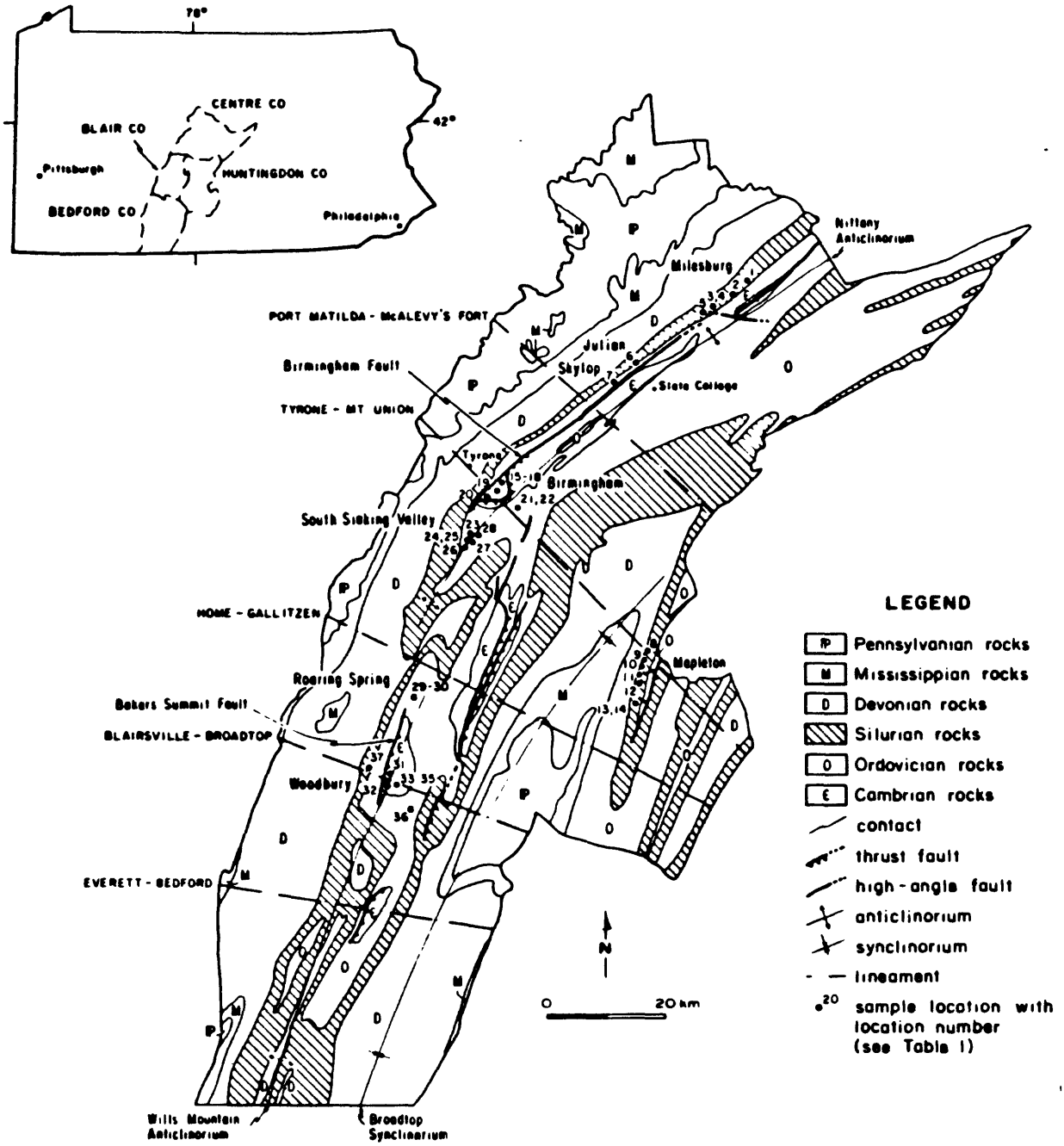

Figure 1. Generalized geologic map of central Pennsylvania showing sample locations within the eight most abundantly mineralized areas in the region. Geology after Moebs and Hoy (1959), Gray and Shepps (1960), Hsu (1973), Kowalik (1975), Smith (1977), Parrish (1978), Schasse (1978), and Tregaskis (1979).

Table 1. Sample Locations

Location no., this study	Location	Latitude N, Longitude W
	Milesburg area, Centre Co.	
1	Scree slope on the northeast side of Lamb's Gap, 2.3 km southeast of Bullit Run beneath U.S. Rte. 220	40°58'33", 77°41'40"
2	Roadcut along Interstate Rte. 80, 1.6 km northwest of the Pa. Rte. 26 exit, Curtin Gap	40°56'52", 77°44'10"
3	Approximately 1.6 km east of Milesburg Gap, 533 m north-northwest of of the crest of Trcziyulny Mountain, 548 m south-southwest of the Milesburg Reservoir	40°56'13", 77°45'52"
4	350 m southeast of an unnamed reservoir, 900 m north-northeast of Trcziyulny Mountain	40°56'26", 77°45'26"
5	Dumps to the adit at the Schad prospect on the east side of Pa. Rte. 144, 1.3 km south-southeast of the junction of Spring and Bald Eagle Creeks, 1.9 km west of the crest of Trcziyulny Mountain	40°55'52", 77°47'03"
	Julian area, Centre Co.	
6	Ganister quarry, 1.4 km south-southeast of U.S. Rte. 220 in Julian	~40°51'20", ~77°56'00"
	Skytop area, Centre Co.	
7	Roadcut on the northeast side of U.S. Rte. 322, 700 m northwest of the intersection of U.S. Rte. 322 and Pa. Rte. 550 at Buffalo Run, just south of the crest of Bald Eagle Mountain at Skytop	~40°50'00", ~77°58'10"

Table 1 (continued)

Location no., this study	Location	Latitude N, Longitude W
	Mapleton area, Huntingdon Co.	
8	Ganister quarry, 1.2 km east of the junction of Smith Run and the Juniata River	40°23'53", 77°55'36"
9	Road cut and drill hole on the northeast side of U.S. Rte. 22, 500 m east-southeast of the junction of Smith Run and the Juniata River	40°23'44", 77°55'50"
10	East end of cut by Conrail railroad tracks, 1.3 km southeast of the junction of Smith Run and the Juniata River	40°23'33", 77°55'45"
11	Ganister quarry, 825 m north-northeast of Scrub Run, 1.1 km south-southeast of the triangle in Mapleton	40°23'04", 77°56'10"
12	Ganister quarry, 60 m northeast of the Scrub Run reservoir, 1.6 km south of the triangle in Mapleton	40°23'43", 77°56'27"
13	R. Hammon mine, 120 m south-southeast of the creek junction in Querry Gap	40°20'06", 77°57'29"
14	Pipeline, 400 m southwest of the summit of Silver Mine Knob	~40°19'44", ~77°57'56"
	Birmingham area, Blair-Huntingdon Cos.	
15	Roadcut on the northeast side of Pa. Rte. 453, 189 m northwest of the intersection of Pa. Rte. 453 and Honest Hollow Road, in Huntingdon Co.	40°39'21", 78°12'18"

Table 1 (continued)

Location no., this study	Location	Latitude N, Longitude W
16	Roadcut on the northeast side of Pa. Rte. 453, 149 m southeast of the intersection of Pa. Rte. 453 and Honest Hollow Road, in Huntingdon Co.	40°39'18", 78°12'18"
17	Roadcut on the northeast side of Pa. Rte. 453, 160 to 200 m southeast of the intersection of Pa. Rte. 453 and Honest Hollow Road, in Huntingdon Co.	~40°39'16", ~78°12'16"
18	Outcrop on the southwest side of the Pennsylvania Railroad tracks, 350 m southeast from the underpass of Honest Hollow Road beneath the railroad, in Blair Co.	40°39'09", 78°12'15"
19	Keystone mine, 2.0 km southeast of the intersection of Pa. Rtes. 453 and 550, in Blair Co.	40°38'56", 78°14'26"
20	Roadcut on the southeast side of Elk Run Road, 3.1 km south-southwest of the intersection of Pa. Rtes. 453 and 550, in Blair Co.	40°38'20", 78°12'46"
21	Roadcut on the southwest side of Pa. Rte. 453, 66 to 105 m southeast of the expansion joint in the Pa. Rte. 453 bridge over the Little Juniata River, in Blair Co.	~40°37'38", ~78°10'34"
22	Roadcut on the southwest side of Pa. Rte. 453, 160 m south-southeast of the expansion joint in the Pa. Rte. 453 bridge over the Little Juniata River, in Blair Co.	40°37'37", 78°10'32"

Table 1 (continued)

Location no., this study	Location	Latitude N, Longitude W
	South Sinking Valley area, Blair Co.	
23	Dumps to the Ramey shaft, 960 m northwest of the 1053-ft (321-m) bench mark in Culp	40°35'06", 78°16'13"
24	Dumps to the northwest Bridenbaugh occurrence, 760 m west-southwest of the 1053-ft (321-m) bench mark in Culp	40°34'42", 78°16'09"
25	Dumps to the southeast Bridenbaugh occurrence, 760 m southwest of the 1053-ft (321-m) bench mark in Culp	40°34'34", 78°16'04"
26	Albright occurrence, 1.1 km south-southwest of the 1053-ft (321-m) bench mark in Culp	40°34'15", 78°15'50"
27	Dumps to the Crissman occurrence, 300 m south-southeast of the 1053-ft (321-m) bench mark in Culp	~40°34'40", ~78°15'34"
28	South shaft of the Mary Isett prospect, 1.2 km northeast of the 1053-ft (321-m) bench mark in Culp	40°35'07", 78°14'50"
	Roaring Spring area, Blair Co.	
29	New Enterprise Stone and Lime Co. quarry, 1.4 km northwest of the junction of Pa. Rtes. 36 and 164 east of Roaring Spring, 500 m northeast of the junction of Pa. Rte. 867 and combined Pa. Rtes. 36 and 164, and 900 m southeast of the junction of Halter and Plum Creeks in McKee Gap	40°23'47", 78°23'56"

Table 1 (continued)

Location no., this study	Location	Latitude N, Longitude W
30	E. Carper limonite mine, 400 m east-southeast of the junction of Pa. Rte. 867 and combined Pa. Rtes. 36 and 164, 1.4 km southeast of the junction of Halter and Plum Creeks in McKee Gap	40°20'28", 78°23'57"
	Woodbury area, Bedford Co.	
31	Scott Smith prospect, 107 m east of Pa. Rte. 867 over Potter Creek, 2.0 km south-southwest of the junction of Pa. Rtes. 867 and 868	40°13'53", 78°25'41"
32	Leo Detwiller occurrence, west side of Pa. Rte. 867, 853 m northeast of Lafayetteville	40°12'27", 78°26'57"
33	Prospect in Paul Snyder's woods, 730 m east of Pa. Rte. 867, 2.0 km west of Maria, and 2.6 km northeast of Lafayetteville	40°12'59", 78°25'54"
34	Samuel Snyder shafts on Jacob Snyder's farm, 340 m east-southeast of Pa. Rte. 867, 2.8 km northeast of Lafayetteville	40°13'14", 78°25'59"
35	Ira Claar occurrence, about 335 m east of Pa. Rte. 868, 3.0 km northeast of Lafayetteville	40°13'21", 78°25'58"
36	Outcrop on the northwest side of Pa. Rte. 869, 650 m west of Pa. Rte. 36, 1.8 km east of New Enterprise	40°10'20", 78°23'14"
37	South end of the Sara Furnace ganister quarry, just west of the crest of Dunning Mountain	~40°14'10", ~78°27'30"

barite + calcite ± pyrite ± hematite. The paragenesis is consistent throughout the region.

Homogenization temperatures of most of the fluid inclusions in minerals deposited during stages 2, 3, and 4 are around 160° ± 60°C. Temperatures vary most widely in stage 3 minerals and least widely in stage 4 sphalerite. Sulfur isotope temperatures from the two most intimately intergrown sphalerite-galena pairs are 137° and 175°C, in good agreement with homogenization temperatures of fluid inclusions in sphalerite. The salinities of fluids in most inclusions are between 24 and 25 wt % NaCl equivalent and also vary most widely in stage 3 minerals and least widely in stage 4 sphalerite.

The $\delta^{18}O$ values of stage 2 quartz range from +20.0 to +25.7 per mil, yielding calculated $\delta^{18}O$ values of the mineralizing fluids of +5.1 to +11.6 per mil at T = 175° ± 40°C. The $\delta^{34}S$ values of epigenetic sulfide minerals are mostly between +19 and +30 per mil, and the values of sulfate minerals range from +30.0 to +43.2 per mil. The $\delta^{34}S$ values of H_2S in the fluids, calculated from the $\delta^{34}S$ of minerals and the temperature data, remained between +20 and +30 per mil throughout most of the mineralization sequence.

The mineralogical, fluid inclusion, and stable isotope data suggest that the mineralizing fluids originated as connate or formation water brines, similar to mid-continent oilfield waters, and contained sulfur of latest Precambrian to Early Silurian age. Deformation during the Late Pennsylvanian-Early Permian Alleghanian orogeny likely mobilized these fluids from a deep sedimentary basin(s). Fluid flow was probably controlled by structural features, such as thrust faults and cross-structural lineaments, or by porous clastic aquifers. Changes in the redox state of the mineralizing fluids, probably caused by different proportions of sulfides and sulfates in the solutions, appear to be responsible for the observed mineral paragenesis and for banding of sphalerite during stage 4. Deposition of sulfates, carbonates, and fluorite during stages 3 and 6 was probably caused by the influx of an oxidized fluid and/or by mixing of the sulfide-rich brine with sulfate-rich meteoric waters at the sites of deposition. The lead-zinc occurrences in central Pennsylvania show a strong similarity to Mississippi Valley-type lead-zinc deposits with regard to temperature, chemistry, and isotopic composition of the mineralizing fluid.

Sample Locations and Descriptions

The locations and the macroscopic and microscopic descriptions of 101 mineralized rock samples are listed below. Microscopic descriptions are drawn primarily from examinations of unpolished, singly polished, and doubly polished thin sections using transmitted and reflected light microscopes and supplemented by x-ray diffraction analyses. Semi-quantitative chemical compositions of very small mineral inclusions were determined using the energy dispersive system of an electron microprobe.

The list consists of (1) an index of sample numbers arranged by the location numbers used in Figure 1 and Table 1, and (2) a detailed description arranged sequentially by sample number within each of the eight most abundantly mineralized areas in the central Pennsylvania region. An explanation of the code used to number the rock samples is included in the index.

Index of Sample Numbers

Location no., this study (see Fig. 1, Table 1)	Sample no.
1	PA-RS-01-06
2	PA-RS-01-01, PA-RS-01-05
3	PA-RS-01-03
4	PA-RS-01-04
5	PA-SH-01-01 through PA-SH-01-18
6	PA-SH-07-01, PA-RS-07-01
7	PA-SH-09-03, PA-RS-09-02
8	PA-RS-02-16
9	PA-HO-02-01, PA-RS-02-03, PA-RS-02-04, PA-RS-02-10 through PA-RS-02-12
10	PA-SH-02-01 through PA-SH-02-13, PA-RS-02-01, PA-RS-02-14
11	PA-RS-02-02, PA-RS-02-15
12	PA-RS-02-06, PA-RS-02-07, PA-RS-02-09
13	PA-RS-02-08, PA-RS-02-13
14	PA-RS-02-05
15	PA-RS-03-03
16	PA-RS-03-10
17	PA-RS-03-09
18	PA-RS-03-07
19	PA-SH-03-01 through PA-SH-03-06, PA-RS-03-01, PA-RS-03-05, PA-RS-03-11
20	PA-RS-03-02
21	PA-RS-03-04, PA-RS-03-06
22	PA-RS-03-08
23	PA-RS-04-03, PA-RS-04-09
24	PA-RS-04-04, PA-RS-04-06, PA-RS-04-12, PA-RS-04-13
25	PA-RS-04-08, PA-RS-04-10
26	PA-RS-04-02, PA-RS-04-07
27	PA-RS-04-05
28	PA-RS-04-01, PA-RS-04-11
29	PA-RS-05-01, PA-RS-05-03 through PA-RS-05-05
30	PA-RS-05-02
31	PA-RS-06-06, PA-RS-06-07
32	PA-RS-06-11
33	PA-RS-06-02, PA-RS-06-04
34	PA-RS-06-03
35	PA-RS-06-09
36	PA-RS-06-01, PA-RS-06-08
37	PA-RS-06-05

Explanation of sample numbering code: The first letter grouping (here all PA) indicates that all samples were collected in Pennsylvania. The second letter grouping indicates the sample collector (SH = Stephen S. Howe; HO = Hiroshi Ohmoto; RS = Robert C. Smith II). The first number grouping indicates from

which of the eight mineralized areas the sample was collected (01 = Milesburg; 02 = Mapleton; 03 = Birmingham; 04 = South Sinking Valley; 05 = Roaring Spring; 06 = Woodbury; 07 = Julian; 09 = Skytop). The second number grouping is the number of the sample within each mineralized area. For example, sample number PA-RS-02-13 was collected by Robert C. Smith II from the Mapleton area, Huntington County, Pennsylvania. It is the thirteenth sample from Smith's collection of the Mapleton area. The specific location of sample PA-RS-02-13 (the R. Hammon mine) is listed in the detailed description. Sample numbers separated by the word "through" indicate that these two samples and all samples with the second number grouping between these two samples were collected from the location indicated. For example, PA-SH-01-01 through PA-SH-01-18 indicate that samples PA-SH-01-01, PA-SH-01-18, and all samples numbered between 01 and 18 (a total of 18 samples) were collected from Location no. 5.

Detailed Sample Descriptions

Sample no.: PA-SH-01-01
Location: Dumps to the adit at the Schad prospect on the east side of Pa. Rte. 144, 1.29 km south-southeast of the junction of Spring and Bald Eagle Creeks, 1.94 km west of the summit of Trcziyulny Mountain, near Milesburg, Centre Co., Pa. Location 5, this study; occurrence 1, p. 208 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Large, anhedral mass of galena found in a 19 by 16 mm cavity in the sandstone; galena also in veins. Reddish-brown to reddish-orange sphalerite, and pyrite, disseminated in the host and occupying veins. Barite in veins and surrounding breccia fragments; barite also coats drusy quartz. Microscopically, pyrite and arsenopyrite disseminated in the host, particularly in carbonaceous lenses, and as inclusions in later minerals. Euhedral quartz projects from host walls into barite veins; quartz also rims pyrite and contains pyrite inclusions. Barite fills veins and often contains inclusions of host and euhedral quartz fragments. Sphalerite disseminated in the host and occupying veins; sphalerite also contains blebs and slightly oriented laths of chalcopyrite. Galena surrounds quartz euhedra and contains inclusions of pyrite, arsenopyrite, and sphalerite; galena also contains rounded blebs of a Pb-Cu-Sb-As sulfosalt with optical properties similar to bournonite.

Sample no.: PA-SH-01-02
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Galena occupying fractures and surrounding breccia fragments of host; galena also coats reddish-orange to orange-brown sphalerite, the latter also in veins. Barite in veins. Pyrite disseminated in the host and filling veins. Very minor drusy quartz. Anglesite or cerussite coating galena; native sulfur coating sphalerite.

Sample no.: PA-SH-01-03
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Galena in veins and as anhedral masses. Greenish-brown to brownish-orange sphalerite in veins up to 1 mm thick and filling vugs. Pyrite disseminated in the host and in veins up to 3 mm thick that are cut by sphalerite veins. Barite in veins and vugs. Tiny drusy quartz. Microscopically, pyrite and arsenopyrite occur as inclusions in sphalerite

and galena. Sphalerite contains inclusions of euhedral quartz. Galena fills fractures in and replaces margins of sphalerite. Some veins still open.

Sample no.: PA-SH-01-04
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone, highly brecciated
Description: Brown to reddish-brown to red to brownish-orange sphalerite in veins and surrounding breccia fragments of host. Minute pyrite crystals disseminated in the host and in veins. Barite coating drusy quartz and in veins that are cut by sphalerite and pyrite veins. Very minor galena. Microscopically, pyrite and arsenopyrite in blocky aggregates and bladed intergrowths, disseminated in the host, and as inclusions in sphalerite. Both the aggregates and the intergrowths are highly fractured; the fractures are penetrated by sphalerite. Chalcopyrite and galena fill fractures in and replace sphalerite. Galena also replaces the pyrite-arsenopyrite aggregates.

Sample no.: PA-SH-01-05
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone, highly brecciated
Description: Pyrite disseminated in the host, in veins, and lining the margins of the breccia fragments of host but not filling the open space between fragments entirely. Minute barite and quartz crystals in subparallel veins and around breccia fragments. Melanterite coating one portion of the pyrite. Microscopically, pyrite and arsenopyrite occur as disseminations and in highly fractured intergrowths. Quartz in veins and breccia opened by the intense fracturing. Barite occupies later veins but is less commonly found in the open space between breccia fragments.

Sample no.: PA-SH-01-06
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host, as aggregates, and in vugs and subparallel veins. Barite in the centers of veins with pyrite or in veins cutting pyrite veins. Minor reddish-brown to orange sphalerite disseminated in host. Galena disseminated in host or in veins lined by pyrite. Native sulfur coating sphalerite and galena. Microscopically, pyrite, arsenopyrite, and very minor pyrrhotite occur in aggregates that were brecciated later. Quartz fills these fractures and contains inclusions of pyrite and arsenopyrite; the quartz itself was fractured and inclusions occur in sphalerite and galena. Barite also contains inclusions of pyrite and arsenopyrite. Sphalerite was deposited, and later fractured also. Chalcopyrite and galena filled fractures in and replaced margins of sphalerite, the chalcopyrite selectively replacing certain

zones of the sphalerite. Chalcopyrite also occurs as blebs, laths, and stringers in sphalerite. Galena contains rounded blebs of a Pb-Cu-Sb-As sulfosalt with optical properties similar to bournonite, particularly in the vicinity of chalcopyrite. Minor covellite at a contact between chalcopyrite and chalcopyrite-replaced sphalerite.

Sample no.: PA-SH-01-07
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Galena and reddish-brown to reddish-orange sphalerite in vugs and veins. Pyrite disseminated in the host, in nodules, and in veins. Barite in small, anhedral masses and lining vugs. Minor drusy quartz.

Sample no.: PA-SH-01-08
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host and in veins. Quartz and barite lining vugs; barite also on fracture surfaces, slickensided on one surface. Sphalerite perched on top of or imbedded in barite, and in veins with galena. Microscopically, pyrite and arsenopyrite are disseminated in the host, in aggregates, and in veins; both minerals were fractured. Colorless to white quartz in veins that were also fractured. Sphalerite occupies fractures in pyrite and arsenopyrite and it contains inclusions of pyrite and euhedral quartz; it was also fractured. Galena fills fractures in pyrite, arsenopyrite, and sphalerite, and it replaces sphalerite along these fractures.

Sample no.: PA-SH-01-09
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host and in aggregates. Dark grayish-brown to orange sphalerite in veins and surrounding breccia fragments of the host. Galena masses with curved cleavage. Minor barite and drusy quartz. Native sulfur and smithsonite coating sphalerite. Microscopically, pyrite and arsenopyrite are disseminated in host and occur as inclusions in spahlerite.

Sample no.: PA-SH-01-10
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Microscopically, pyrite and arsenopyrite occur in aggregates.

Sample no.: PA-SH-01-11
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone

Description: Galena in anhedral masses and as euhedra disseminated in the host. Barite and quartz in veins. Orange to orangish-brown sphalerite in the centers of barite and quartz veins. Pyrite disseminated in the host. Anglesite, limonite, and jarosite coating portions of the sample.

Sample no.: PA-SH-01-12
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Galena occupying fractures and surrounding breccia fragments of the host. Greenish-brown to orangish-red to reddish-orange sphalerite and galena in veins. Barite coating euhedral quartz. Pyrite disseminated in the host. Native sulfur near sphalerite.

Sample no.: PA-SH-01-13
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone, highly brecciated
Description: Pyrite as disseminations and larger masses in the host. Red to reddish-orange to reddish-brown sphalerite surrounding breccia fragments of the host, as do quartz, minor barite, and very minor galena. Microscopically, pyrite and arsenopyrite are disseminated in host, and they are often highly fractured with fragments of host and quartz in their cores. Sphalerite fills fractures in pyrite and arsenopyrite, along with galena, and contains inclusions of euhedral quartz. Barite veins contain inclusions of host fragments, quartz, and sulfides.

Sample no.: PA-SH-01-14
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone, brecciated
Description: Galena with curved cleavage in veins and surrounding breccia fragments of the host, intergrown with reddish-brown to brown to less-common brownish-orange sphalerite. Both the galena and the sphalerite are coated with tiny, colorless quartz crystals. The reddish-brown sphalerite cuts across older, gray quartz veins while the orange sphalerite lines an occasional vug containing galena. Barite veins also cut across gray quartz veins but predate sphalerite veins. Minor pyrite disseminated in the host. Microscopically, both quartz and sphalerite contain brecciated fragments of the host. Sphalerite is brecciated near its contact with 2- to 3-mm-thick galena veins. Galena fills fractures in and replaces sphalerite at their contact; it also contains many inclusions of sphalerite. Chalcopyrite also fills fractures in and replaces sphalerite.

Sample no.: PA-SH-01-15
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone

Description: Reddish-orange to orange to yellowish-green sphalerite and galena fill vugs and veins, the latter cutting across pyrite veins. Pyrite also disseminated in the host. White quartz and barite also in veins. Microscopically, disseminations of pyrite occasionally in "trains"; pyrite also in aggregates with arsenopyrite and as inclusions in sphalerite. Both sphalerite and galena penetrate a large, fractured pyrite crystal. Orange sphalerite has fractures filled by galena; some contacts are embayed.

Sample no.: PA-SH-01-16
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone, brecciated
Description: Reddish-brown to purplish-brown to grayish-brown sphalerite intergrown with galena and pyrite, all in veins and surrounding breccia fragments of the host. Colorless to white quartz and barite in veins and lining vugs. Some pyrite disseminated in the host. Limonite staining. Miscroscopically, pyrite, arsenopyrite, and minor pyrrhotite occur in intensely fractured, blocky aggregates and fibrous intergrowths; the fractures are filled by sphalerite. Euhedral quartz and sphalerite contain inclusions of pyrite and arsenopyrite. Chalcopyrite and galena fill fractures in and replace spahlerite. Very thin veins of barite contain sphalerite inclusions.

Sample no.: PA-SH-01-17
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Dark reddish-brown to purplish-brown to grayish-brown sphalerite intergrown with galena having curved cleavage in a large vein that horsetails to many smaller veins. These veins cut earlier barite and colorless quartz veins. Pyrite is disseminated in the host and in veins. Microscopically, galena fills fractures in and replaces sphalerite. Minor chalcopyrite disseminated in the host.

Sample no.: PA-SH-01-18
Location: Same as PA-SH-01-01
Host rock: Tuscarora Sandstone
Description: Veins containing galena, reddish-brown to orange to greenish-brown sphalerite, barite, pyrite, and minor euhedral quartz. Native sulfur coating sphalerite. Microscopically, pyrite and arsenopyrite are disseminated in the host and in aggregates. Pyrite euhedra are fractured and the fractures are filled by sphalerite, chalcopyrite, and galena. Most of the chalcopyrite post-dates the sphalerite but there are a few subhedral inclusions of chalcopyrite in sphalerite. Galena fills fractures in and replaces margins of sphalerite. Covellite in contact with galena.

Sample no.: PA-RS-01-01
Location: Roadcut on north side of Interstate Rte. 80, 1.6 km northwest of the Pa. Rte. 26 exit, Curtin Gap, near Milesburg, Centre Co., Pa. Location 2, this study; occurrence 5, p. 208 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host. Quartz, pyrite, orangish-red sphalerite, and large, bladed crystals of barite on fracture surface that may have been a wall of a vug or open vein. Quartz post-dates disseminated pyrite but is capped by finely crystalline pyrite. Barite contains inclusions of pyrite and sphalerite.

Sample no.: PA-RS-01-03
Location: Approximately 1.6 km east of Milesburg Gap, 533 m north-northwest of the crest of Trcziyulny Mountain, 548 m south-southwest of the Milesburg Reservoir. Location 3, this study; occurrence 6, p. 208 in Smith (1977).
Host rock: Tuscarora Sandstone, hematitic
Description: Dense, nodular dissemination of pyrite surrounded by a whitish reduced zone in hematitic portion of the host. Barite on a fracture surface.

Sample no.: PA-RS-01-04
Location: 350 m southeast of an unnamed reservoir, 900 m north-northeast of Trcziyulny Mountain, near Milesburg, Centre Co., Pa. Location 4, this study; occurrence 3, p. 208 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Fibrous barite, generally with poorly developed cleavage.

Sample no.: PA-RS-01-05
Location: Roadcut between the east and west lanes of Interstate Rte. 80, 1.6 km northwest of the Pa. Rte. 26 exit, Curtin Gap, near Milesburg, Centre Co., Pa. Location 2, this study; occurrence 5, p. 208 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Barite and pyrite from a 30-mm-thick vein, pyrite on the vein walls. Very minor quartz and melanterite with the pyrite.

Sample no.: PA-RS-01-06
Location: Upper portion of scree slope on the northeast side of Lamb's Gap, 2.3 km southeast of Bullit Run beneath U.S. Rte. 220, near Milesburg, Centre Co., Pa. Location 1, this study; occurrence 7, p. 208 in Smith (1977).
Host rock: Tuscarora Sandstone, hematitic
Description: Barite, heavily stained with limonite, with minor quartz in tiny vugs and veinlets in the barite.

Sample no.: PA-SH-02-01
Location: East end of cut by Conrail railroad tracks, 1.3 km southeast of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 10, this study; occurrence 7, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Rich coatings of pyrite, some crystals in unusual spindle-shaped aggregates, on fracture surfaces; pyrite also disseminated in the host. White quartz and sphalerite coating fracture surfaces and filling veins. Galena is associated with the sphalerite.

Sample no.: PA-SH-02-02
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host, coating fractures, and as masses occupying the centers of veins generally 2 to 3 mm thick but occasionally widening to 8 mm. White to gray quartz lines vein walls, but post-galena 1-mm-long drusy quartz crystals line vugs along with tiny pyrite euhedra. Reddish-orange sphalerite in vein centers but a yellowish-green variety is associated with galena. Galena has curved cleavage. Minor native sulfur associated with the reddish-orange sphalerite.

Sample no.: PA-SH-02-03
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Gray to white quartz lining walls of a 7-mm-thick vein to a thickness of 4 mm. Pyrite lining portions of vein where quartz is absent; it is also disseminated in the host. Reddish-orange sphalerite intimately associated with galena having curved cleavage. Coatings of native sulfur and smithsonite. Microscopically, there are a number of quartz veins and most are barren of sulfides. Pyrite is slightly fractured. Very minor galena fills fractures in and replaces margins of sphalerite.

Sample no.: PA-SH-02-04
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Orange sphalerite in veins, surrounded by white to colorless quartz. One 3-mm-thick vein is filled with 2-mm-long quartz crystals yet the vein is still about 60% open. Pyrite disseminated in the host, in aggregates, and in veins. Abundant coatings of native sulfur on the sphalerite. Microscopically, there are a number of quartz veins, most barren of sulfides. Pyrite and euhedral quartz as inclusions in sphalerite. Very minor galena disseminated in the host.

Sample no.: PA-SH-02-05
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone, with greenish-gray shale chips
Description: Grayish-white quartz, orange to orangish-brown sphalerite, and pyrite on fracture surfaces. Pyrite is also disseminated in the host and in veins. Quartz in many subparallel veins and one cross-cutting vein, with and without pyrite. Native sulfur near sphalerite. Limonite and jarosite staining. Microscopically, pyrite is disseminated in the host, lines vugs, and occupies portions of quartz veins; the disseminated pyrite is especially fractured. Quartz lines veins with sphalerite in the centers. Sphalerite contains inclusions of euhedral quartz.

Sample no.: PA-SH-02-06
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host, as modified cubes in aggregates, and occasionally in vein centers. Quartz coating fracture surfaces and in subparallel veins. Weathered orange-brown to unweathered pale red sphalerite on fracture surfaces, on top of pyrite. Minor native sulfur coating sphalerite.

Sample no.: PA-SH-02-07
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Orange to red sphalerite and pyrite as modified cubes and spindle-shaped aggregates in veins. Gray to white quartz in veins, surrounding the sphalerite and pyrite; quartz also filling tiny vugs and as druses. Native sulfur coating sphalerite, especially the orange variety. Microscopically, fractured pyrite is disseminated in the host. There are numerous intersecting quartz veins, many barren of sulfides but some containing sphalerite in their centers.

Sample no.: PA-SH-02-08
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host and as rich coatings of modified cubes and pyritohedrons, individually or as aggregates, on subparallel fracture surfaces, on top of white quartz. Quartz also in veins.

Sample no.: PA-SH-02-09
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone, unusually dark gray in color.
Description: Pyrite disseminated in the host and coating two fracture surfaces, mixed with and apparently overlying white quartz. Two, very small, orange sphalerite crystals on one fracture surface. Yellowish-green jarosite and an unidentified greenish-gray clay-like alteration near the pyrite.

Sample no.: PA-SH-02-10
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone, unusually fine-grained
Description: White to grayish-white quartz lining intersecting veins less than 1 mm thick. Orangish-red sphalerite in the centers of quartz veins, generally as isolated crystals, and on fracture surfaces with galena. Pyrite as individual crystals and aggregates disseminated in the host.

Sample no.: PA-SH-02-11
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone, with greenish-gray shale chips
Description: Mineralization occurs in one 2- to 3-mm-thick vein and on several fracture surfaces with a variety of orientations. White quartz lines the vein and it is occasionally vuggy. Orange to orangish-brown sphalerite occurs near the center of the vein, and on several fracture surfaces with galena. Very minor pyrite is disseminated in the host, with the largest crystals associated with the shale chips. Native sulfur coats some of the sphalerite. Microscopically, sphalerite contains inclusions of pyrite and quartz.

Sample no.: PA-SH-02-12
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Galena with slightly curved cleavage coating fracture surface. Weathered yellow to orange sphalerite on a different portion of the same fracture surface, some of the sphalerite slickensided. Pyrite disseminated in the host. Much limonite and jarosite staining and some anglesite or cerussite.

Sample no.: PA-SH-02-13
Location: Same as PA-SH-02-01
Host rock: Tuscarora Sandstone
Description: Large mass of galena, about 5 mm in diameter, lying within a 17 mm wide by 70 mm long cavity in the host. Small drusy quartz crystals line the cavity in some places and there is some clay/limonite around the galena. Pyrite in veins and disseminated in the sandstone. Very weathered sphalerite on fracture surfaces and in veins.

Sample no.: PA-HO-02-01
Location: Roadcut on the northeast side of U.S. Rte. 22, 500 m east-southeast of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 9, this study; occurence 6, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Breccia and several veins up to 22 mm thick comprise fairly large vein system, mostly filled by galena with curved cleavage. Small masses of greenish-brown sphalerite are associated with the galena but tend to lie along vein walls and rim host clasts. Pyrite in many veins. Plumbojarosite and anglesite or cerussite coating galena.

Sample no.: PA-RS-02-01
Location: East end of cut by Conrail railroad tracks, 1.3 km southeast of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 10, this study; occurrence 7, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host. Pyrite, quartz, and reddish-orange to orangish-brown sphalerite in veins and on fracture surfaces. Pyrite stringers are offset by the quartz veins which are themselves offset by sphalerite veins. A few, tiny pyrite crystals sprinkled on euhedral quartz and sphalerite. Some jarosite on weathered surfaces. Microscopically, highly fractured pyrite occurs as inclusions in quartz and sphalerite; the latter two minerals also fill fractures in and replace cores of pyrite crystals. Sphalerite contains inclusions of euhedral quartz and it is also fractured. Very minor galena replaces sphalerite adjacent to the fractures.

Sample no.: PA-RS-02-02
Location: Ganister quarry, 825 m north-northeast of Scrub Run, 1.1 km south-southeast of the triangle in Mapleton, Huntingdon Co., Pa. Location 11, this study; occurrence 8, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Pyrite disseminated in the host. Quartz, pyrite, reddish-orange to ruby red sphalerite on a fracture surface. Some sphalerite capping quartz. Yellowish, powdery coating on quartz and pyrite, likely jarosite, and an unidentified dark greenish-gray, very soft, platy mineral coating some of the sphalerite and quartz, especially in vugs.

Sample no.: PA-RS-02-03
Location: Roadcut and drill hole on the northeast side of U.S. Rte. 22, 500 m east-southeast of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 9, this study; occurrence 6, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone, highly brecciated
Description: Of the sphalerite mineralization, about 85% is a dark reddish-brown variety lining margins of breccia fragments and filling open space between fragments and 15% is a reddish-orange to red variety, coarser-grained than the brown sphalerite, that fills open space between breccia fragments and vugs. Cryptocrystalline and drusy quartz. Single, minute chalcopyrite crystal on drusy quartz. Yellow to yellowish-brown limonite/jarosite coating fracture surfaces. Microscopically, euhedral quartz projects into sphalerite. The brown sphalerite, especially, contains inclusions of pyrite.

Sample no.: PA-RS-02-04
Location: Same as PA-RS-02-03

Host rock: Rose Hill Shale
Description: Pyrite, galena, and yellowish-brown sphalerite on fracture surfaces. Microscopically, pyrite crystal cores contain shale fragments and are fractured. Quartz fills fractures in the pyrite but is rarely fractured itself, although quartz euhedra occur as inclusions in sphalerite. Sphalerite also replaces pyrite. Galena fills hairline fractures in sphalerite and occurs in the centers of some white quartz veins.

Sample no.: PA-RS-02-05
Location: In a pipeline, 400 m southwest of the summit of Silver Mine Knob, near Mapleton, Huntingdon Co., Pa. Location 14, this study; occurrence 13, p. 190 in Smith (1977).
Host rock: Bloomsburg Formation
Description: Large pyrite mass, mostly coated with acicular melanterite.

Sample no.: PA-RS-02-06
Location: West end of ganister quarry, 60 m northeast of the Scrub Run reservoir, 1.6 km south of the triangle in Mapleton, Huntingdon Co., Pa. Location 12, this study; occurrence 9, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Gray, yellow, and colorless quartz, red to reddish-brown sphalerite, and galena on fracture surfaces. The gray and yellow quartz are early but the colorless quartz occasionally contains inclusions of sphalerite and galena. Very minor pyrite disseminated in the host.

Sample no.: PA-RS-02-07
Location: Same as PA-RS-02-06
Host rock: Tuscarora Sandstone
Description: Galena, warped but generally cubic, in masses and veins surrounding large, euhedral quartz, with amber-colored sphalerite on the surface of galena.

Sample no.: PA-RS-02-08
Location: R. Hammon mine, 120 m south-southeast of the creek junction in Querry Gap, near Mapleton, Huntingdon Co., Pa. Location 13, this study; occurrence 10, p. 190 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Dark golden-brown to orangish-brown sphalerite removed from drusy quartz along fractures in the host.

Sample no.: PA-RS-02-09
Location: Same as PA-RS-02-06
Host rock: Tuscarora Sandstone
Description: +35 mesh concentrate of galena, reddish-brown sphalerite, quartz, and minor pyrite.

Sample no.: PA-RS-02-10
Location: About 3 m northwest of the drill hole on the northeast side of U.S. Rte. 22, 500 m east-southeast of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 9, this study; occurrence 6, p. 189 in Smith (1977).
Host rock: Rose Hill Shale, sandy laminae
Description: White quartz lining vein walls, surrounding yellow, finely-crystalline sphalerite, with dark brownish-gray to black sphalerite in the center of the vein. Finely crystalline pyrite in some fractures. Microscopically, pyrite occurs as aggregates in dense bands. Yellow sphalerite contains euhedral quartz inclusions.

Sample no.: PA-RS-02-11
Location: Same as PA-RS-02-10
Host rock: Rose Hill Shale
Description: Pyrite in aggregates.

Sample no.: PA-RS-02-12
Location: Same as PA-RS-02-10
Host rock: Rose Hill Shale, sandy laminae
Description: Pyrite richly disseminated in the host and in lesser amounts on fracture surfaces. Pyrite may coat white quartz that also occurs on fracture surfaces. Very minor melanterite.

Sample no.: PA-RS-02-13
Location: R. Hammon mine, 120 m south-southeast of the creek junction in Querry Gap, near Mapleton, Huntingdon Co., Pa. Location 13, this study; occurrence 10, p. 190 in Smith (1977).
Host rock: Tuscarora Sandstone, with green shale chips
Description: Pyrite disseminated in the host and coating white to gray quartz on fracture surfaces. Microscopically, the pyrite is slightly fractured.

Sample no.: PA-RS-02-14
Location: East end of cut by Conrail railroad tracks, 1.3 km southeast of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 10, this study; occurrence 7, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Orange sphalerite in veins and on fracture surfaces. Pyrite disseminated in the host. Jarosite coating weathered surface of host. Microscopically, sphalerite contains inclusions of pyrite and quartz.

Sample no.: PA-RS-02-15
Location: Ganister quarry, 825 m north-northeast of Scrub Run, 1.1 km south-southeast of the triangle in Mapleton, Huntingdon Co., Pa. Location 11, this study; occurrence 8, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone, carbonaceous and containing shale chips.

Description: Pyrite disseminated in the host and on fracture surfaces. Euhedral quartz on fracture surfaces, also. Ruby-red to reddish-orange sphalerite and galena cap the euhedral quartz. Only the pyrite mineralization seems associated with the carbonaceous material and shale chips.

Sample no.: PA-RS-02-16
Location: Ganister quarry, 1.2 km east of the junction of Smith Run and Juniata River, near Mapleton, Huntingdon Co., Pa. Location 8, this study; occurrence 5, p. 189 in Smith (1977).
Host rock: Tuscarora Sandstone
Description: Concentrates of greenish-yellow, yellowish-orange, reddish-orange, and orangish-brown sphalerite, galena, pyrite, and white quartz from veins and fracture surfaces.

Sample no.: PA-SH-03-01
Location: Main underground workings of the Keystone mine, 2.0 km southeast of the intersection of Pa. Rtes. 453 and 550, near Birmingham, Blair Co., Pa. Location 19, this study; p. 89 in Smith (1977).
Host rock: Uncertain. Limestones of the Black River or Chazy Groups according to Moebs and Hoy (1959), Stonehenge Limestone or Warrior Formation, according to Smith (1977).
Description: The specimen is almost entirely sulfides, with stylolites preserved. Most of the sample is brown to reddish-brown to yellowish-brown sphalerite in large masses, with lesser amounts of orangish-red sphalerite associated with calcite. Galena occurs as small masses within the brown sphalerite. Pyrite in masses and veins. Gray to white, coarsely crystalline calcite. Smithsonite and anglesite or cerussite coat most of the sample. Microscopically, the limestone was intensely stylolitized and brecciated. Pyrite, and lesser amounts of arsenopyrite, occur in aggregates, many as inclusions in younger minerals. The aggregates were fractured and quartz was deposited, with pyrite inclusions particularly abundant near the quartz margins. Calcite then filled veins and replaced the host. Sphalerite fills fractures in and replaces pyrite, arsenopyrite, and calcite; it also contains inclusions of these minerals and quartz. The sphalerite is intensely fractured itself and was penetrated by a second, minor stage of calcite. Galena was then deposited, occasionally around a core of radially arranged euhedral quartz, filling fractures in and replacing margins of sphalerite; it contains inclusions of all older minerals. The galena is rimmed by jordanite.

Sample no.: PA-SH-03-02
Location: Same as PA-SH-03-01
Host rock: Same as PA-SH-03-01

Description: The limestone was stylolitized and brecciated. Orange to pale brown sphalerite disseminated in the host and in veins cutting across veins and breccia-fillings of calcite. Very minor pyrite disseminated in host. A 2-mm-diameter mass of galena enclosed within an 8-mm-diameter mass of sphalerite. Much white to gray, coarsely crystalline calcite in veins and surrounding breccia fragments of the host, crosscut by stylolites. Microscopically, sphalerite contains inclusions of pyrite and calcite. Euhedral quartz surrounded by sphalerite.

Sample no.: PA-SH-03-04
Location: Same as PA-SH-03-01
Host rock: Same as PA-SH-03-01
Description: Sample almost entirely sulfides. Reddish-brown sphalerite intimately intergrown with galena and with grayish-white calcite. Smithsonite and hydrozincite coating one surface. Microscopically, arsenopyrite surrounds pyrite.

Sample no.: PA-SH-03-05
Location: Same as PA-SH-03-01
Host rock: Same as PA-SH-03-01
Description: Yellowish-brown to deep reddish-brown sphalerite widely scattered on fracture surfaces, on top of calcite, or in veins. Widely disseminated pyrite in or between calcite crystals. White to gray calcite, occasionally with curved cleavage, throughout specimen, usually surrounding breccia fragments of the host or replacing the host. Very minor galena, partly surrounded by sphalerite.

Sample no.: PA-SH-03-06
Location: Same as PA-SH-03-01
Host rock: Same as PA-SH-03-01
Description: Reddish-orange-brown sphalerite widely scattered on fracture surfaces and lining 2-mm-thick veins filled by calcite. Much gray to white calcite on fracture surfaces and in veins, and more rarely perched on top of sphalerite near galena. A few crystals of galena, totally enclosed by sphalerite. Microscopically, pyrite and arsenopyrite are disseminated in the host and occur as inclusions in sphalerite. Pyrite also occurs in colloform-like layers, separated by sphalerite, concentrically about a pyrite core. An early stage of calcite was deposited, with rhombs and other fragments containing very abundant hematite needles; some of the rhombs are replaced, particularly near their margins, by sphalerite. Some calcite appears to have replaced small portions of euhedral quartz. Sphalerite contains inclusions of the host and all older minerals. A second, very minor calcite stage penetrates and replaces some sphalerite. Galena and jordanite are intergrown. Galena is altered to anglesite or cerussite.

Sample no.: PA-RS-03-01
Location: Same as PA-SH-03-01
Host rock: Same as PA-SH-03-01
Description: Sample almost entirely sulfides. Reddish-brown to yellowish-brown sphalerite intergrown with galena. Microscopically, sphalerite appears to have replaced the host, preserving stylolites; it also contains inclusions of the host, pyrite, and quartz euhedra, with some of the quartz containing pyrite aggregates in their cores. Sphalerite occasionally replaces pyrite along concentric zones. Galena fills small fractures in sphalerite; galena also contains small, rounded blebs of jordanite. The galena is very slightly altered to cerussite or anglesite.

Sample no.: PA-RS-03-02
Location: Roadcut on the southeast side of Elk Run Road, 3.1 km south-southwest of the intersection of Pa. Rtes. 453 and 550, near Birmingham, Blair Co., Pa. Location 20, this study; p. 89 in Smith (1977).
Host rock: Bellefonte Dolomite, silicified
Description: Yellowish-orange-brown sphalerite and white calcite as very thin crusts. Smithsonite and hydrozincite alteration. Microscopically, sphalerite occurs in veins alone or in the centers of calcite-lined veins, and more rarely in veins cutting across calcite veins. Very tiny euhedral pyrite disseminated in the host and in the calcite veins near the vein walls. Smithsonite alteration has bladed to acicular habit.

Sample no.: PA-RS-03-03
Location: Roadcut on the northeast side of Pa. Rte. 453, 189 m northwest of the intersection of Pa. Rte. 453 and Honest Hollow Road, in Huntingdon Co., near Birmingham, Blair Co., Pa. Location 15, this study; p. 89 in Smith (1977).
Host rock: Nittany Dolomite
Description: Brown to orangish-golden-yellow sphalerite on fracture surfaces and in subparallel veins up to 5 mm thick. Gray to colorless, coarsely crystalline dolomite filling the more distal ends of veins and surrounding sphalerite occasionally. Some smithsonite and hydrozincite alteration. Microscopically, pyrite occurs in ovoids and as euhedra disseminated in the host, concentrated near the margins of clasts of host dolostone (apparently an intraformational conglomerate). Dolomite that fills veins and surrounds breccia fragments of the host contains inclusions of pyrite and embayed quartz euhedra; the dolomite is itself embayed by sphalerite. Fine-grained yellow sphalerite precedes reddish-brown sphalerite, but there is some later yellow sphalerite also. The sphalerite is slightly fractured and penetrated by galena and late-stage calcite.

Sample no.: PA-RS-03-04
Location: Roadcut on the southwest side of Pa. Rte. 453, 66 to 105 m southeast of the expansion joint in the Pa. Rte. 453 bridge over Little Juniata River, near Birmingham, Blair Co., Pa. Location 21, this study; p. 89 in Smith (1977).
Host rock: Bellefonte Dolomite
Description: White calcite in thin stringers and veins alone or in the distal ends of sphalerite veins or surrounding sphalerite. Orange sphalerite in veins and yellowish-green sphalerite more commonly associated with stylolites but also in veins. Some stylolites crosscut calcite veins.

Sample no.: PA-RS-03-05
Location: North end of the main underground workings of the Keystone mine, 2.0 km southeast of the intersection of Pa. Rtes. 453 and 550, near Birmingham, Blair Co., Pa. Location 19, this study; p. 89 in Smith (1977).
Host rock: Uncertain. Limestones of the Black River or Chazy Groups according to Moebs and Hoy (1959), Stonehenge Limestone or Warrior Formation according to Smith (1977).
Description: Yellowish-greenish-brown sphalerite almost entirely replacing the host, with minor galena within the sphalerite. Calcite on fracture surfaces near calcite. Microscopically, subhedral pyrite and arsenopyrite are disseminated in the host and occur as inclusions in all younger minerals. Quartz was then deposited and is embayed by euhedral calcite containing hematite needles; the calcite itself is embayed by sphalerite. Sphalerite also replaces pyrite and preserves stylolites; it is slightly fractured. Galena is intergrown with jordanite, particularly near the former's margins; jordanite also fills some hairline fractures in the galena. Barite fills some hairline fractures in sphalerite and galena. Galena is slightly altered to anglesite or cerussite.

Sample no.: PA-RS-03-06
Location: Roadcut on the southwest side of Pa. Rte. 453, 99 m southeast of the expansion joint in the Pa. Rte. 453 bridge over Little Juniata River, near Birmingham, Blair Co., Pa. Location 21, this study; p. 89 in Smith (1977).
Host rock: Bellefonte Dolomite
Description: Anhedral nodules and vermiform lumps of pyrite between breccia fragments of the host. Gray dolomite. Microscopically, the pyrite is all framboidal, the framboids about 20 μm in diameter, and is associated with black organic matter, generally between clasts of the host dolostone (possibly an intraformational conglomerate).

Sample no.: PA-RS-03-07
Location: Outcrop on the southwest side of the Pennsylvania Railroad tracks, 350 m southeast from the underpass of the Honest Hollow Road beneath the railroad, near Birmingham, Blair Co., Pa. Location 18, this study; p. 89 in Smith (1977).
Host rock: Mines Dolomite, cherty and highly brecciated.

Description: Isolated masses and 0.1-mm-thick veins of galena; galena also coats calcite on a few fracture surfaces. Calcite surrounds breccia fragments of the host and fills subparallel veins.

Sample no.: PA-RS-03-08
Location: Roadcut on the southwest side of Pa. Rte. 453, 160 m southsoutheast of the expansion joint in the Pa. Rte. 453 bridge over Little Juniata River, near Birmingham, Blair Co., Pa. Location 22, this study; p. 89 in Smith (1977).
Host rock: Bellefonte Dolomite
Description: Greenish-yellow sphalerite. White quartz.

Sample no.: PA-RS-03-09
Location: Roadcut on the northeast side of Pa. Rte. 453, 160 to 200 m southeast of the intersection of Pa. Rte. 453 and Honest Hollow Road, in Huntingdon Co., near Binghamton, Blair Co., Pa. Location 17, this study; p. 89 in Smith (1977).
Host rock: Mines Dolomite
Description: Yellowish-brown sphalerite in subparallel veins. Galena and dolomite. Minor smithsonite and plumbojarosite. Microscopically, pyrite is disseminated in the host. Dolomite surrounds breccia fragments of the host and fills thin cross-cutting veins; it also embays euhedral quartz projecting from vein walls. Sphalerite occupies centers of veins and replaces the more poorly crystalline pyrite; the sphalerite is altered to smithsonite.

Sample no.: PA-RS-03-10
Location: Roadcut on the northeast side of Pa. Rte. 453, 149 m southeast of the intersection of Pa. Rte. 453 and Honest Hollow Road, in Huntingdon Co., near Birmingham, Blair Co., Pa. Location 16, this study; p. 89 in Smith (1977).
Host rock: Stonehenge Limestone, stylolitized
Description: Yellowish-brown sphalerite and minor galena with curved cleavage in the center of a 6-mm-thick, calcite-lined vein. Also many, much thinner, subparallel calcite veins. Calcite is fractured and brecciated. Microscopically, no sulfides are concentrated along stylolites. Pyrite occurs as disseminations in the host and as inclusions in sphalerite. Tiny quartz euhedra near vein walls are partially replaced by calcite. Sphalerite contains inclusions of host fragments and embayed calcite; it was later fractured. Galena fills the fractures in the sphalerite and contains inclusions of calcite and sphalerite.

Sample no.: PA-RS-03-11
Location: Dumps to the Keystone mine, 2.0 km southeast of the intersection of Pa. Rtes. 453 and 550, near Birmingham, Blair Co., Pa. Location 19, this study; p. 89 in Smith (1977).
Host rock: Uncertain. Limestones of the Black River and Chazy Groups according to Moebs and Hoy (1959), Stonehenge Limestone or Warrior Formation, according to Smith (1977).
Description: Yellow to yellowish-brown sphalerite surrounding breccia

fragments of the host and in veins. Calcite and galena. Microscopically, pyrite is disseminated in the host. Calcite surrounds breccia fragments and fills veins; it is occasionally crosscut by stylolites. Sphalerite in veins and along stylolites, occasionally replacing pyrite euhedra almost entirely. Galena fills very thin veins and occurs near stylolites.

Sample no.: PA-RS-04-01
Location: South shaft of the Mary Isett prospect, 1.2 km northeast of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 28, this study; occurrence G, p. 128 in Smith (1977).
Host rock: Loysburg Formation, dolomitic limestone at the base of the Milroy Member, brecciated.
Description: Galena, golden-brown sphalerite, and dolomite surround breccia fragments of the host and fill many subparallel veins. Minor yellowish-green sphalerite as crusts on fracture surfaces. Pyrite disseminated in the host, occasionally in ovoids. Microscopically, subhedral to euhedral pyrite is disseminated in the host, as aggregates in ovoids, and as inclusions, along with arsenopyrite, in sphalerite and galena. Quartz fills very thin veins and is embayed by dolomite. Dolomite inclusions occur in sphalerite and galena. Sphalerite has red and yellow zones separated by a concentration of pyrite inclusions. Fractures in sphalerite are filled by galena.

Sample no.: PA-RS-04-02
Location: Albright occurrence, 1.1 km south-southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 26, this study; occurrence A, p. 127 in Smith (1977).
Host rock: Loysburg Formation, dolomitic limestone of the Milroy Member.
Description: Galena with slightly curved cleavage in a mass with yellowish-brown to reddish-brown sphalerite and bladed to fibrous barite. Microscopically, minor euhedral pyrite and arsenopyrite occur as inclusions in barite.

Sample no.: PA-RS-04-03
Location: Dumps to the Ramey shaft, 960 m northwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 23, this study; occurrence E, p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite
Description: Pyrite nodule, 10 mm wide by 5 mm thick; original length unknown but about 20 mm.

Sample no.: PA-RS-04-04
Location: Dumps to the northwest Bridenbaugh occurrence, 760 m west-southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 24, this study; occurrence D, p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite

Description: Galena and barite, partially coated by smithsonite. Removed from a barite nodule.

Sample no.: PA-RS-04-05
Location: Dumps to the Crissman occurrence, 300 m south-southeast of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 27, this study; occurrence F, p. 128 in Smith (1977).
Host rock: Loysburg Formation, limestone at the base of the Clover Member.
Description: Very intergrown euhedral dolomite and barite in veins. Minor galena masses. Microscopically, very minute pyrite crystals are disseminated in the host. Euhedral quartz surrounding breccia fragments of the host and as inclusions in barite, dolomite, and galena. Reticulated masses of barite are kinked and crosscut by crystals of dolomite. Galena contains inclusions of the host, barite, and dolomite. Interlocking crystals of jordanite project into galena from the latter's margins. Galena is altered to cerussite or anglesite and very minor sphalerite is altered to smithsonite.

Sample no.: PA-RS-04-06
Location: Dumps to the northwest Bridenbaugh occurrence, 760 m west-southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 24, this study; occurrence D, p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite, laminated
Description: Large mass of dolomite cut by a 3-mm-thick vein of greenish-brown sphalerite, with an "altered" zone between the dolomite and sphalerite. Minor galena at the contact between dolomite and sphalerite. Microscopically, sphalerite contains a few anhedral pyrite and euhedral quartz inclusions. The "altered" zone consists of fine-grained dolomite, sphalerite altered to smithsonite, and galena altered to cerussite or anglesite.

Sample no.: PA-RS-04-07
Location: Dumps to the Albright occurrence, 1.1 km south-southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 26, this study; occurrence A, p. 127 in Smith (1977).
Host rock: Loysburg Formation, dolomitic limestone of the Milroy Member.
Description: Specimen is about 70% dark golden-brown spahlerite, 15% barite, and 15% galena with curved cleavage. Microscopically, pyrite and aresenopyrite are disseminated in the host and occur as inclusions in sphalerite and galena. Dolomite and barite were deposited next. Sphalerite replaces pyrite; sphalerite is fractured, the fractures penetrated by galena, accompanied by some replacement; sphalerite is partially altered to smithsonite. A second barite-dolomite stage filled fractures in sphalerite and contains inclusions of all

earlier minerals; the barite contains inclusions of hematite as rosettes and hexagonal plates. Galena is highly altered to anglesite or cerussite.

Sample no.: PA-RS-04-08
Location: Dumps to the southeast Bridenbaugh occurrence, 760 m southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 25, this study; occurrence D, p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite, laminated
Description: Galena in veins, with minor amounts of quartz and dolomite; galena is altered to cerussite. Limonite, smithsonite, and jarosite coat portions of the sample.

Sample no.: PA-RS-04-09
Location: Dumps to the Ramey shaft, 960 m northwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 23, this study; occurrence E., p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite
Description: Two specimens. The first is a 25-mm-diameter nodule of barite, dolomite, and galena, with much smithsonite alteration. The second is a 15-mm-diameter mass of yellowish-brown sphalerite altered to smithsonite, with minor barite and galena. Microscopically, the first sample contains intergrown euhedra of barite and slightly younger dolomite. Sphalerite was deposited next, followed by galena which contains inclusions of dolomite, barite, and sphalerite. The galena, and the inclusions of sphalerite in it, were tightly fractured, the fractures filled by carbonate gangue and/or alteration minerals.

Sample no.: PA-RS-04-10
Location: Dumps to the southeast Bridenbaugh occurrence, 760 m southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 25, this study; occurrence D, p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite, laminated
Description: Mass of white, fibrous barite.

Sample no.: PA-RS-04-11
Location: South shaft of the Mary Isett prospect, 1.2 km northeast of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 28, this study; occurrence G, p. 128 in Smith (1977).
Host rock: Loysburg Formation, dolomitic limestone at the base of the Milroy Member.
Description: Three specimens. The first contains round, 6- to 12-mm-diameter, and oval, 1-mm by 3- to 6-mm, nodules of pyrite in the centers of brecciated fragments of a limestone intraformational conglomerate. Smaller nodules of golden-brown sphalerite also present. Sphalerite, pyrite, dolomite, and minor quartz in veins, some crosscut by stylolites (the dolomite and quartz veins). The second specimen

has quartz and dolomite surrounding golden-brown sphalerite and galena in veins. The third specimen contains quartz and dolomite veins that cut pyrite nodules; the centers of the veins are filled by yellowish-brown sphalerite. Microscopically, anhedral to subhedral pyrite and euhedral arsenopyrite occur as disseminations in the host and along stringers associated with sinuous carbonaceous areas, possibly former stylolites. Quartz lines many veins, surrounds breccia fragments of the host, and is disseminated in the coarser-grained portions of the host. Dolomite fills veins and surrounds breccia fragments, some of the rhombs replacing quartz; dolomite is intensely fractured. Sphalerite was deposited next, in veins, occasionally lining vein walls where dolomite has broken away, and surrounding breccia fragments; bands in the sphalerite generally go from yellow to red outwards from crystal cores and are outlined by inclusions of host, pyrite, arsenopyrite, and dolomite. Sphalerite also replaces some of the dolomite rhombs. A channel dissolved in the yellow- and red-banded sphalerite truncates many bands and inclusion "trains"; the channel is filled with colorless sphalerite. The sphalerite is also fractured and these fractures filled by galena. Galena occupies veins and surrounds breccia fragments; it also contains inclusions of all earlier minerals. Jordanite associated with dolomite in a mass of sphalerite. Galena is slightly altered to anglesite or cerussite.

Sample no.: PA-RS-04-12
Location: Dumps to the northwest Bridenbaugh occurrence, 760 m west-southwest of the 1053-ft (321-m) bench mark in Culp, Blair Co., Pa. Location 24, this study; occurrence D, p. 128 in Smith (1977).
Host rock: Uppermost Bellefonte Dolomite, laminated
Description: A 43 mm by 35 mm barite nodule with included quartz rosette and needles; the barite is rather fibrous.

Sample no.: PA-RS-04-13
Location: Same as PA-RS-04-12
Host rock: Same as PA-RS-04-12
Description: Barite nodules, 2 to 13 mm in diameter, with minor imbedded quartz needles. Trace sphalerite.

Sample no.: PA-RS-05-01
Location: New Enterprise Stone and Lime Co. quarry, 1.4 km northwest of the junction of Pa. Rtes. 36 and 164 east of Roaring Spring, 500 m northeast of the junction of Pa. Rte. 867 and combined Pa. Rtes. 36 and 164, and 900 m southeast of the junction of Halter and Plum Creeks in McKee Gap, Blair Co., Pa. Location 29, this study; occurrence 1, p. 115 in Smith (1977).
Host rock: Bellefonte Dolomite (?)

Description: Pale bluish-greenish-white celestite, with very minor quartz and strontianite in vugs in the celestite, in a large vein. Microscopically, pyrite is disseminated in the host near the contact with the celestite vein, as are tiny euhedral quartz crystals. The celestite contains inclusions of the host.

Sample no.: PA-RS-05-02
Location: E. Carper limonite mine, 400 m east-southeast of the junction of Pa. Rte. 867 and combined Pa. Rtes. 36 and 164, 1.4 km southeast of the junction of Halter and Plum Creeks in McKee Gap, Blair Co., Pa. Location 30, this study; occurrence 3, p. 115 in Smith (1977).
Host rock: Probably the base of the Bellefonte Dolomite, although it has been mapped as the Axemann Limestone. May be from horizon of Axemann Limestone where the Bellefonte Dolomite prevails (Smith, 1977).
Description: Limonite nodules pseudomorphous after pyrite, with pyrite in their cores.

Sample no.: PA-RS-05-03
Location: Same as PA-RS-05-01, along the north face.
Host rock: Bellefonte Dolomite, siliceous, 206 ± 8 m beneath the lowest limestone of the Milroy Member of the Loysburg Formation.
Description: Greenish-yellowish-brown and yellowish-orangish-brown sphalerite in pods and nodules in the host. The host was replaced first by dark gray jasperoid, then by light gray jasperoid. Later euhedral quartz lined vugs. Coarsely crystalline dolomite deposited later still. Smithsonite alteration.

Sample no.: PA-RS-05-04
Location: Same as PA-RS-05-01
Host rock: Bellefonte Dolomite
Description: Yellowish-orange and peach-colored sphalerite surrounded by colorless to white to gray jasperoid and coating portions of the host. White to gray dolomite in numerous intersecting and occasionally offsetting veins and surrounding breccia fragments of the host; some of the dolomite veins reach widths of 2 mm and offset quartz veins.

Sample no.: PA-RS-05-05
Location: Same as PA-RS-05-01
Host rock: Probably uppermost Bellefonte Dolomite
Description: Gypsum, with some portions coated with thin crusts of calcite.

Sample no.: PA-RS-06-01
Location: Outcrop on the northwest side of Pa. Rte. 869, 650 m west of Pa. Rte. 36, 1.8 km east of New Enterprise, near Woodbury, Bedford Co., Pa. Location 36, this study; occurrence g, p. 151 in Smith (1977).

Host rock: Upper Bellefonte Dolomite, silicified
Description: Yellow-gray to golden-brown sphalerite, white dolomite, and very minor pyrite in fractures in dark to light gray chert. Dark gray chert changed to light gray chert along minute fractures. Some of the sphalerite and pyrite are concentrated along stylolites preserved by silicification. Microscopically, the silicification of the host is somewhat incomplete. Large masses of dolomite occur in veins separated from the chert by a zone of incomplete silicification. Disseminated pyrite in silicified and unsilicified host. Sphalerite occasionally in tiny vugs in the chert and dolomite; it also replaces pyrite margins.

Sample no.: PA-RS-06-02
Location: Prospect in Paul Snyder's woods, 730 m east of Pa. Rte. 867, 2.0 km west of Maria, and 2.6 km northeast of Lafayetteville, near Woodbury, Bedford Co., Pa. Location 33, this study; occurrence b, p. 150 in Smith (1977).
Host rock: Mines Dolomite
Description: Pale yellow to yellowish-orange sphalerite on fracture surfaces, in very thin veinlets, and disseminated in gray chert. Very minor pyrite disseminated in the chert. Trace quartz. Smithsonite and hydrozincite alteration.

Sample no.: PA-RS-06-03
Location: Samuel Snyder shafts on Jacob Snyder's farm, 340 m east-southeast of Pa. Rte. 867, 2.8 km northeast of Lafayetteville, near Woodbury, Bedford Co., Pa. Location 34, this study; occurrence a, p. 150 in Smith (1977).
Host rock: Middle to upper Bellefonte Dolomite, dark gray to black, brecciated.
Description: Pale yellow to minor reddish-brown to golden-brown sphalerite, white, coarsely crystalline calcite, gray dolomite, slightly fibrous barite, and galena surrounding breccia fragments of the host and filling veins. Microscopically, intense stylolitization and brecciation were followed by pyrite deposition, as disseminations in the host, surrounding breccia fragments, and lining vein walls. Calcite surrounding breccia fragments, in veins, and in fractures in pyrite; the calcite is brecciated itself, pulled away from vein walls, with the centers of veins opened. Sphal. then filled veins and surrounded breccia fragments, beginning with reddish-brown to golden-brown sphalerite and ending with much more abundant yellow sphalerite; the reddish-brown sphalerite rims and replaces pyrite while the yellow sphalerite contains inclusions of the host, pyrite, and calcite. A second stage of pyrite deposition occurred before or during deposition of the yellow sphalerite. The sphalerite was mildly fractured and pulled away from some vein walls. A second, minor, stage of calcite deposition fills centers of veins and fractures in sphalerite. Galena fills fractures in calcite and sphalerite. Some of the veins are still open in their centers.

Sample no.: PA-RS-06-04
Location: Prospect in Paul Snyder's woods, 730 m east of Pa. Rte. 867, 2.0 km west of Maria, and 2.6 km northeast of Lafayetteville, near Woodbury, Bedford Co., Pa. Location 33, this study; occurrence b, p. 150 in Smith (1977).
Host rock: Mines Dolomite, highly brecciated
Description: Weathered galena, reddish-brown sphalerite, and white to gray dolomite in veins. Very minor pyrite disseminated in the host. Microscopically, pyrite occurs as disseminations and in dolomite veins, more rarely surrounding breccia fragments; it is replaced by two generations of sphalerite: red sphalerite in cores and slightly later reddish-brown sphalerite in fractures and rimming pyrite. Galena surrounds breccia fragments and fills fractures, more rarely in rhomb-shaped cavities in dolomite; it is slightly altered to anglesite or cerussite. Late calcite fills hairline fractures in dolomite.

Sample no.: PA-RS-06-05
Location: South end of the Sara Furnace ganister quarry, just west of the crest of Dunning Mountain, near Woodbury, Bedford Co., Pa. Location 37, this study.
Host rock: Tuscarora Sandstone, very carbonaceous
Description: Pyrite disseminated in the host and on two fracture surfaces. Jarosite coating some surfaces.

Sample no.: PA-RS-06-06
Location: Scott Smith prospect, 107 m east of Pa. Rte. 867 over Potter Creek, 2.0 km south-southwest of the junction of Pa. Rtes. 867 and 868, near Woodbury, Bedford Co., Pa. Location 31, this study; occurrence j, p. 151 in Smith (1977).
Host rock: Probably Nittany Dolomite, stylolitized and brecciated
Description: Dolomite lines vein walls and penetrates the distal ends of veins. Greenish-yellow to yellowish-orange to brown sphalerite surrounding breccia fragments of the host and filling veins, the brown and yellowish-orange sphalerite lining vein walls and filling distal ends of veins. Very minor calcite fills hairline veins through breccia fragments. Very minute pyrite crystals perched on top of the sphalerite. Microscopically, the host was intensely stylolitized and brecciated. Pyrite is concentrated along stylolites, disseminated in the host, and surrounding breccia fragments; it is fractured. Minor quartz veining. Dolomite surrounds breccia fragments and fills veins; it embays some of the quartz. Sphalerite then surrounds breccia fragments and fills veins, with earlier, reddish-brown sphalerite replacing and rimming pyrite and later, yellow sphalerite enclosing pyrite; sphalerite also penetrates fractures in dolomite and contains many dolomite inclusions. Very minor galena fills fractures in sphalerite, as does late calcite.

Sample no.: PA-RS-06-07
Location: Same as PA-RS-06-06
Host rock: Same as PA-RS-06-06
Description: Dolomite surrounds breccia fragments and fills veins, as does reddish-orange-brown and yellowish-orange sphalerite, and both contain inclusions of the host. Galena with the same crystallographic orientation over several centimeters surrounds breccia fragments of the host and fills very thin veins. Late-stage calcite fills hairline fractures. Microscopically, pyrite is disseminated in the host. Minor quartz is embayed by dolomite. The late-stage calcite penetrated dolomite and sphalerite.

Sample no.: PA-RS-06-08
Location: Outcrop on the northwest side of Pa. Rte. 869, 650 m west of Pa. Rte. 36, 1.8 km east of New Enterprise, near Woodbury, Bedford Co., Pa. Location 36, this study; occurrence g, p. 151 in Smith (1977).
Host rock: Upper Bellefonte Dolomite, brecciated
Description: Greenish-yellow to grass green sphalerite in a clot with white dolomite. Dolomite contains tiny fragments of the host.

Sample no.: PA-RS-06-09
Location: Ira Claar occurrence, about 335 m east of Pa. Rte. 868, 3.0 km northeast of Lafayetteville, near Woodbury, Bedford Co., Pa. Location 35, this study; occurrence c, p. 150 in Smith (1977).
Host rock: Upper Bellefonte Dolomite, intraformational conglomerate, cherty and brecciated.
Description: White calcite, very minor yellow to yellowish-orange sphalerite, and galena with curved cleavage surrounding breccia fragments of the host, in that temporal order. Thin smithsonite crusts.

Sample no.: PA-RS-06-11
Location: Dry creek gully at the Leo Detwiller occurrence, west side of Pa. Rte. 867, 853 m northeast of Lafayetteville, near Woodbury, Bedford Co., Pa. Location 32, this study; occurrence i, p. 151 in Smith (1977).
Host rock: Bellefonte Dolomite, calcareous
Description: Very pale bluish-white celestite in a 32-mm-diameter nodule within the host. Minor fluorite on the celestite.

Sample no.: PA-SH-07-01
Location: Dumps to ganister quarry, 1.4 km south-southeast of U.S. Rte. 220 in Julian, Centre Co., Pa. Location 6, this study.
Host rock: Tuscarora Sandstone
Description: Barite crystals, up to 14 mm in length, on fracture surfaces, on top of very fine-grained quartz druses, and in subparallel veins up to 2 mm thick. Quartz in vugs; slickensided on one surface. Unidentified spherulitic

blebs of a very soft, pale bluish-gray mineral on fracture surfaces near the barite. Much limonite and hematite staining.

Sample no.: PA-RS-07-01
Location: Same as PA-SH-07-01
Host rock: Tuscarora Sandstone, limonite-stained
Description: Occasionally fibrous barite in veins, vugs, and interstices between drusy quartz crystals. Minor quartz in veins subparallel to barite veins. Corkite coats several fracture surfaces. Microscopically, some of the quartz cuts across the barite. A few subhedral pyrite crystals are scattered in the barite.

Sample no.: PA-SH-09-03
Location: Roadcut on the northeast side of U.S. Rte. 322, 700 m northwest of the intersection of U.S. Rte. 322 and Pa. Rte. 550 at Buffalo Run, just south of the crest of Bald Eagle Mountain at Skytop, Centre Co., Pa. Location 7, this study.
Host rock: Bald Eagle Formation, medium-grained sandstone, graywacke, and conglomerate, with brownish-olive-green shale chips.
Description: Two quartz veins, 1- to 2-mm thick, roughly perpendicular to bedding, approach each other and open on to a common fracture surface. Fine-grained pyrite aggregates in the host. Microscopically, the quartz veins are still partially open.

Sample no.: PA-RS-09-02
Location: Same as PA-SH-09-03
Host rock: Same as PA-SH-09-03
Description: Pyrite disseminated in the host and on fracture surfaces. Very minor coatings of melanterite and jarosite.

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