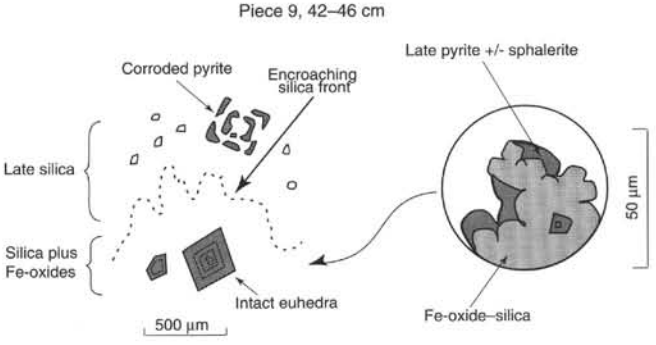
158-957A-3X-1 (Piece 9, 42–46 cm)
Thin section: #1
ROCK NAME: RED CHERT (Type 2)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	20	20–600	Euhedral to anhedral.	Disseminated in chalcedony.
Sphalerite	2	20–200	Anhedral.	In voids, and disseminated in chalcedony. Yellow to orange in transmitted light.
Chalcopyrite	<1	20–200	Anhedral, inclusions.	Disseminated and associated with pyrite and sphalerite.
Marcasite	Trace	10	Inclusions.	In coarse composite pyrite grains.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Chalcedony	68	<5–50	Cryptocrystalline aggregates.	40% associated with Fe-oxides.
Fe-oxides	Trace	<1	Amorphous aggregates.	2–3 mm patches, also in cores of individual silica crystallites.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Isolated voids	10	<2 (mm)	Irregular.	In dense, fine-grained silica.

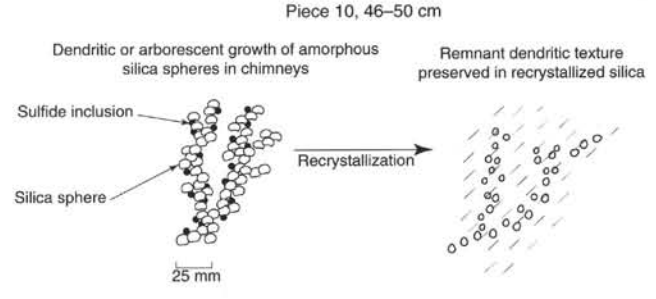
COMMENTS: Massive fine-grained silica replacing Fe-oxides and "diagenetic" pyrite. Diffuse zones of Fe-oxide staining have gradational boundaries with massive, colorless silica. These zones show evidence of replacement by later silica, with almost complete Fe removal. Disseminated pyrite euhedra in Fe-oxide zones are zoned and unaltered, and many have porous cores (indicating in situ growth on porous nucleus). Large disseminated pyrite grains in silica zones are partially replaced by encroaching silica. Abundant ultrafine (<4 μm) pyrite is disseminated throughout the silica and as rims on Fe-oxide/silica, or locally as framboids in Fe-oxides. Minor late pyrite and sphalerite fill or line small void spaces in amorphous silica and Fe-oxides.



158-957A-3X-1 (Piece 10, 46–50 cm)
Thin section: #2
ROCK NAME: GRAY CHERT (Type 3)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	5	<5–500	Euhedral and polycrystalline aggregates.	Fine disseminated pyrite as clouds in chalcedony, coarser grains disseminated throughout.
Sphalerite	Trace	<50	Anhedral.	Disseminated in chalcedony, transparent clear and yellow in transmitted light.
Chalcopyrite	Trace	<25	Anhedral.	Overgrowth on pyrite and disseminated with sphalerite cores.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Chalcedony	90	5–20	Cryptocrystalline aggregates.	Coarser around voids and fractures.
Fe-oxide	Trace	<1	Disseminated, amorphous.	Localized staining of chalcedony.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Pores and voids	5	50–100	Intercrystalline and larger voids.	Intercrystalline, and several voids up to 1 mm.

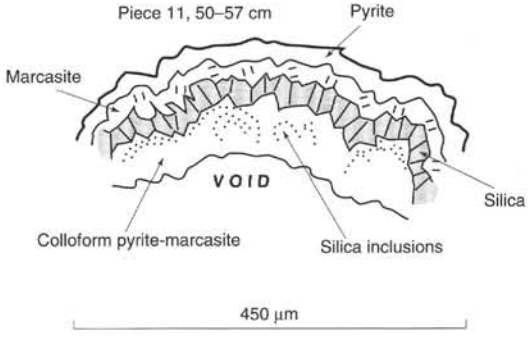
COMMENTS: Massive cryptocrystalline silica with ultrafine inclusions of disseminated sulfide, resulting in a mottled gray color versus red color of Fe-oxide inclusions. Local dendritic (frond-like) growth textures are preserved by the distribution of fine sulfide inclusions. The lack of spheroidal and filamentous texture (typical of silica in hydrothermal chimneys) suggests recrystallization, with ghost textures preserved by fine inclusions. Dull gray patches contain up to 15% ultrafine pyrite.



158-957A-3X-1 (Piece 11, 50–57 cm)
Thin section: #3
ROCK NAME: POROUS MASSIVE PYRITE (Type 5a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	50	<400	Euhedral, colloform, spheroidal.	Aggregates of euhedral crystals and colloform-banded growths.
Marcasite	10	<400	Euhedral.	Replaced by pyrite.
Sphalerite	5	<20	Anhedral.	Inclusions in pyrite-marcasite aggregates (dendritic), and grains in voids.
Chalcopyrite	Trace	<5	Anhedral.	Inclusions in pyrite aggregates and in sphalerite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Fe-oxide	Trace	<1	Coatings.	Local trace amounts.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Coarse, interconnected	35	<5 to 400	In cores of pyrite-marcasite aggregates.	Large interconnected voids (up to 4-mm diameter) between pyrite aggregates.

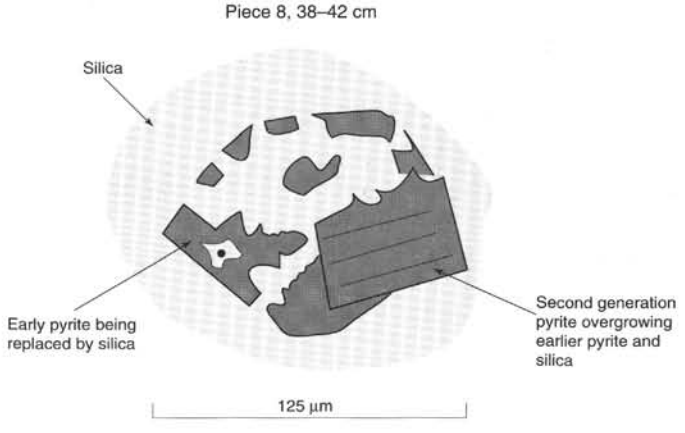
COMMENTS: Porous colloform to granular aggregates of pyrite, with local marcasite and sphalerite. Cores of sulfide aggregates display colloform and spheroidal textures, with high microporosity. These textures are variably recrystallized and overgrown by coarse pyrite aggregates. Marcasite is included within coarse pyrite aggregates (indicating possible inversion of marcasite to pyrite). Sphalerite occurs as dendritic intergrowths, especially in porous pyrite. Sphalerite is rare in euhedral pyrite grains. Sphalerite was also found as small anhedral grains in voids, associated with lesser chalcopyrite. A common texture is colloform pyrite/marcasite rimmed by silica, which in turn is rimmed by marcasite, which is then overgrown by pyrite. Alternation of pyrite and marcasite is common. Euhedral and colloform pyrite are commonly overgrown by marcasite except in silica-rich areas where marcasite is rare.



158-957A-3X-1 (Piece 8, 38–42 cm)
Thin section: #4
ROCK NAME: GRAY SILICA (Type 3)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	5	5–50	Euhedral.	Disseminated grains, rare colloform aggregates.
Chalcopyrite	Trace	<50	Anhedral.	Disseminated grains, inclusions and overgrowth with sphalerite.
Sphalerite	Trace	<50	Anhedral.	Disseminated grains.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Amorphous silica	90	<100	Amorphous, filamentous.	Clear areas in finer granular matrix.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Small voids	5	<500	Irregular, isolated.	Associated with filamentous textures. Abundant desiccation cracks.

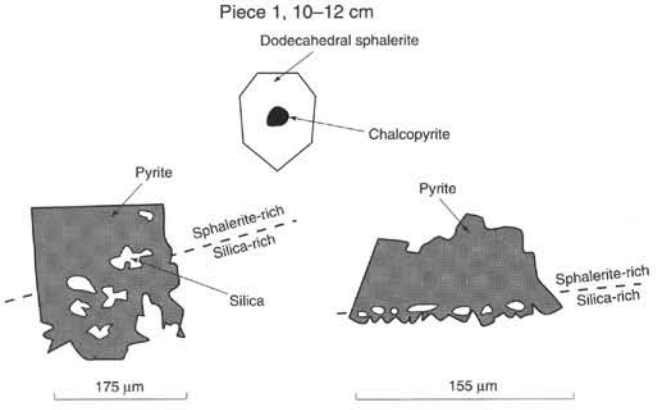
COMMENTS: Pyrite occurs as fine euhedral grains or as irregular colloform aggregates, disseminated throughout section. In areas of cryptocrystalline silica pyrite grains are moderately to highly corroded and replaced by silica. A second generation of pyrite surrounds early corroded pyrite and the replacing silica. Chalcopyrite forms irregularly shaped (polycrystalline) aggregates, partly rimmed by fine-grained sphalerite.



158-957B-1R-2 (Piece 1, 10–12 cm)
Thin section: #5
ROCK NAME: POROUS MASSIVE SPHALERITE (Type 5b) (piece from drill cuttings)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Sphalerite	25		Colloform to euhedral.	Very light hue in transmitted light. Possible wurtzite or pseudomorph (hexagonal crystals).
Pyrite	5	<5–250	Euhedral to colloform.	Enclosed in sphalerite or in silica.
Chalcopyrite	3	100		Inclusions in sphalerite around small conduits.
Fe-oxide	Trace			In Fe-oxide parts of red silica clast.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Amorphous silica	17			Associated with porous sphalerite, also as outer zone, and as a clast enclosed in the section.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	50	0.01–2 mm		Coarse, interconnected between sulfide-silica aggregates. Silica zones much lower porosity.

COMMENTS: Section comprises three distinct parts: (1) porous sphalerite-silica, (2) massive silica zone, and (3) clast of red silica. In the sphalerite-silica zone, complex multiple generations of coarse granular sphalerite grains, overgrowing silica, fine colloform/spheroidal/euhedral pyrite and anhedral chalcopyrite, form a porous structure later rimmed and coated by amorphous silica. Conduits (large pore spaces) are rimmed by chalcopyrite and coarser grained euhedral pyrite, and finally by multiple generations of sphalerite (coarse euhedral to schalenblende type). Pyrite grains in this zone surrounding red, Fe-oxide-rich clasts are predominantly <5 to 25 μm, euhedral to framboidal, and highly corroded and replaced by silica. These may be polycrystalline spherulites, with a hollow core. The euhedral pyrite is generally inclusion-poor (mostly silica with minor sphalerite) and appears to be overgrowing the sphalerite. Some pyrite grains appear to have a marcasite core. The silica zone contains fine disseminated pyrite, sphalerite, and chalcopyrite; is transitional from the sphalerite-silica areas with increasing sphalerite content and decreasing porosity. A few euhedral crystals of quartz are included in the amorphous silica. There is also one cluster of a few (~10) anhedral quartz grains, each as large as 50 μm, with undulatory extinction. Layering of disseminated pyrite is parallel to the margins of the zone, and the outer part is increasingly red Fe-oxide stained, which indicates outward growth. Pyrite in the silica-rich areas and especially in the Fe-oxide clasts is heavily corroded and almost entirely replaced by silica. A Fe-oxide-free halo was observed around the Fe-oxide clasts that is in very sharp contact with the sphalerite-rich material surrounding it. Pyrite grains at this contact are heavily corroded on the silica-rich side and have straight to corroded boundaries on the sphalerite-rich side. Unaltered, yellow to colorless, angular low relief silica fragments are enclosed in amorphous silica, derived from sphalerite-silica matrix, silica rim, and silica clast.



158-957B-3R-1 (Piece 1, 3–6 cm)
Thin section: #6
ROCK NAME: MASSIVE GRANULAR PYRITE (Type 5c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	80	<200	Euhedral.	Recrystallized.
Chalcopyrite	Trace	10–20	Angular.	As small scattered inclusions in pyrite.
Sphalerite	Trace	10	Subrounded.	Small inclusions in pyrite.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Intergranular	20	<1 mm	Irregular, between grains and aggregates.	Very low abundance within aggregates, indicating extensive recrystallization.

COMMENTS: Very coarse-grained aggregates with minor mineralogical or textural variation. Porosity is low within pyrite aggregates, but there are macro-porous areas between these aggregates. Chalcopyrite inclusions are irregular, often angular shaped, which could represent former interstitial grains in pyrite. Sphalerite inclusions are often subrounded and found as cores in euhedral grains. In some cases sphalerite is aligned along former grain boundaries within the pyrite. Grain boundaries between individual pyrite grains are also marked by higher microporosity. In a few cases euhedral but very porous pyrite is present in the center of recrystallized, dense pyrite. Smectite is in interstitial pore spaces in pyrite.

158-957B-4R-1 (Piece 2, 19–21 cm)
Thin section: #7
ROCK NAME: ALTERED BASALT
GRAIN SIZE: Very fine-grained
TEXTURE: Subvariolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPO-SITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None preserved.						
GROUNDMASS						
Plagioclase	0	30	<0.1–1.0		Microlites.	Totally replaced by Fe-oxide and clay minerals.
Olivine	0	1	0.1–0.3			Totally replaced by Fe-oxide minerals and iddingsite.
Undifferentiated	67					Altered to red brown to rare light green clay minerals. Submicroscopic groundmass.

SECONDARY MINERALOGY	PERCENT	REPLACING/FILLING	COMMENTS
Fe-oxide minerals	28	Plagioclase and olivine.	
Smectite	3	Plagioclase and filling/lining vesicles.	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	1–2		0.1–0.2	Smectite.	Round.	Lined with clay minerals.

COMMENTS: Sample is completely altered and exhibits intense Fe-oxide staining.

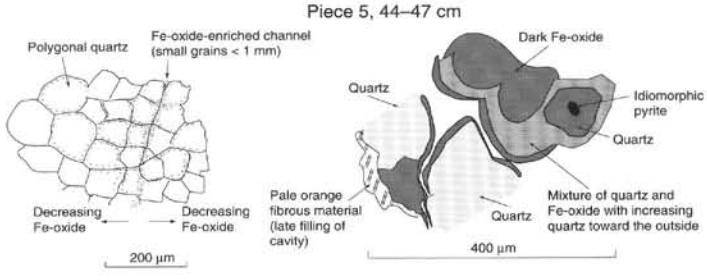
158-957B-4R-1 (Piece 5, 44–47 cm)
Thin section: #8
ROCK NAME: RED AND GRAY CHERT (Type 2)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	2	400	Euhedral.	Mainly in quartz, some grains in Fe-oxide.

NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Chalcedony/Quartz	60	<100	Cryptocrystalline to euhedral.	Transition from chalcedony to quartz.
Fe-oxide	20		Amorphous.	Up to 70% in red silica zones.
Clay minerals	3	<30	Aggregates.	Orange to brown, from altered glass fragments.

VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	15	<500	Irregular, isolated.	Rimmed by quartz.

COMMENTS: Gray silica zones consist of fine-grained chalcedony with patches (often rectangular) recrystallized to quartz aggregates. Quartz also concentrates around voids. Local mottling by red Fe-oxide. High Fe-oxide content in red zone (center) renders silica opaque, although this has an irregular distribution. Red silica zone contains euhedral pyrite and clear quartz areas. Euhedral pyrite in Fe-oxide rich zones is replaced by silica and Fe-oxides. Pyrite grains in the Fe-oxide zone are commonly rimmed by a 5- to 10-μm-wide Fe-oxide free halo. Irregular pieces of brown banded or concentric Fe-oxides (altered glass?) were found enclosed in gray silica. Also irregular pale orange grains with fibrous to dendritic sheet silicate structure (possibly after altered basalt/glass). These patches are concentrated along the boundary between gray chert and Fe-oxides. Within the red chert, zones of polygonal quartz are developed which show Fe-oxide enriched "channels" along grain boundaries. The individual grain size of these Fe-oxides is <1 μm.



158-957B-4R-1 (Piece 7, 51–54 cm)
Thin section: #9
ROCK NAME: ALTERED BASALT
GRAIN SIZE: Very fine-grained
TEXTURE: Subvariolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	<2	<2	0.1–0.4	Fe-rich.	Euhedral.	Replaced by smectite with or without iddingsite.
GROUNDMASS						
Undifferentiated	76					Submicroscopic groundmass.
Plagioclase	0	20	<0.1–0.6		Microlites.	Rare but distinct hopper shaped pseudomorphs. Completely replaced by clay minerals and dusting of Fe-oxide minerals.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite	10	Replacing plagioclase, filling vesicles.	Also filling fractures. Colorless, fibrous smectite.
Iddingsite	5	Replacing plagioclase, filling voids.	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	2	Disseminated.	0.5–1.0	Smectite, iddingsite(?)	Round.	Two elongated vesicles, one segregation vesicle.

COMMENTS: Zoned, red brown halos up to 1 cm thick. One vein, 0.1 to 0.15 mm thick, crosses the section. It is formed of colorless to gray smectite, with iddingsite selvages and black margins, mantled by colorless smectite along an outer red halo.

158-957B-5B-1 (Piece 2, 7–9 cm)
Thin section: #10
ROCK NAME: ALTERED BASALT
GRAIN SIZE: Very fine-grained
TEXTURE: Subvariolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	<<2	<2	0.1–0.5		Euhedral, skeletal.	Totally replaced by smectite, also minor iddingsite.
GROUNDMASS						
Undifferentiated	80–85					Submicroscopic groundmass.
Plagioclase	10	15	<0.1		Skeletal.	Replaced by goethite with dark gray halos.

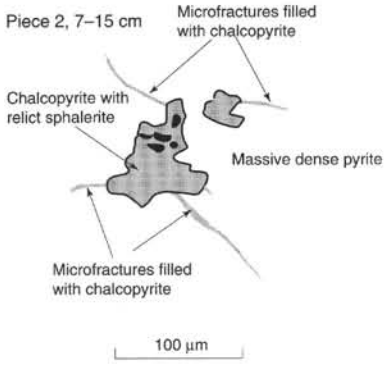
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite	<5	Olivine.	Also in very small voids. Zoned smectite fillings.
Iddingsite	<2	Filling voids.	
Goethite	<10	Filling voids.	Replacing microlitic plagioclase in dark gray halos.

COMMENTS: Completely altered basalt, no fresh material. Strongly oxidized. One smectite-filled vein, hair thin (<0.05 mm).

158-957C-5N-1 (Piece 2, 7–15 cm)
Thin section: #11
ROCK NAME: MASSIVE PYRITE-ANHYDRITE BRECCIA (Type 7a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	55	25–700	Subhedral to euhedral.	As individual grains and as aggregates 1 to 15 mm in size.
Chalcopyrite	10	<5–100	Anhedral to subhedral.	As inclusions in pyrite, as 200-μm rims on pyrite, and as aggregates, sometimes intergrown with (possibly replacing) pyrite.
Sphalerite	Trace	<5–15	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	23	0.2–3 mm	Subhedral to euhedral tabular and radiating.	Intergrown with and interstitial to grains and aggregates of pyrite and chalcopyrite.
Quartz	Trace	5–500	Subhedral to euhedral.	Filling void spaces in some large pyrite aggregates.
Clay(?)	Trace	5–30	Fibrous.	In void spaces within large pyrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	12	10 μm–3 mm	Irregular shapes.	Smaller void spaces in pyrite aggregates, larger between aggregates.

COMMENTS: MACROSCOPIC: This is a single piece with massive pyrite nodules, chalcopyrite within the clasts rich in anhydrite. Microscopic: This section comprises recrystallized pyrite aggregates in a matrix of anhydrite and chalcopyrite aggregates. CLASTS: The pyrite clasts (from several 100 μm to >1.5 cm in diameter) show several generations of pyrite growth. Euhedral pyrite in the center is mantled by a more porous pyrite with abundant chalcopyrite and sphalerite inclusions. Most of the clasts are then rimmed by euhedral pyrite grains. This rim is denser and has fewer inclusions. Porosity in the clasts is probably less than 5%. Chalcopyrite inclusions are between 5 and 100 μm and are often interstitial to pyrite. Sphalerite inclusions are in general smaller (about 20 μm in diameter, ranging to as large as 50 μm). Microfractures in the more porous pyrite are often filled with chalcopyrite and are connected to irregular-shaped inclusions of chalcopyrite replacing sphalerite. Quartz inclusions occur euhedral and subhedral grains (from 5 to 500 μm in diameter). Some void spaces contain fine-grained (5–30 μm long) fibrous clay(?). In some cases, the silica seems to have formed in pore spaces and then started to replace the pyrite. MATRIX: Euhedral anhydrite (up to 3 mm) in places as rosettes. Small pyrite aggregates and aggregates of chalcopyrite (up to 3 mm) occur in the matrix. Irregular-shaped polygonal quartz predates the formation of anhydrite. Porosity in the matrix is close to 30%.



158-957C-5N-1 (Piece 6, 40–49 cm)
Thin section: #12
ROCK NAME: PYRITE-SILICA CLAST FROM MASSIVE PYRITE-ANHYDRITE BRECCIA (Type 7a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	80	20–600	Subhedral to euhedral.	Recrystallized aggregate of intergrown grains.
Chalcopyrite	2	<5–100	Anhedral to subhedral.	As inclusions in pyrite, filling cracks in pyrite, and filling voids.
Sphalerite	Trace	<5–70	Anhedral.	As inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	10	20–200	Subhedral to euhedral.	Partially to completely filling voids in pyrite.
Anhydrite	3	50–1000	Subhedral to euhedral.	Filling voids in pyrite near outer edges of pyrite clast.
Fe-oxide	Trace	<5	Amorphous.	Deep red in transmitted light, with quartz in one or two places. Amorphous strands of 2 μm diameter globules.
Clay(?)	Trace	5-30	Fibrous.	In void spaces in pyrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
		20–1000		In massive pyrite. Quartz or anhydrite fills or partially fills most voids.

COMMENTS: MACROSCOPIC: Massive pyrite-silica clast from drill cuttings with only minor amounts of anhydrite. MICROSCOPIC: The pyrite clast is a recrystallized aggregate of subhedral to euhedral pyrite grains (20–600 μm). Relict boundaries, including some colloform pyrite, can be seen. Chalcopyrite fills 5- to 10-μm-wide cracks, is present as 5- to 100-μm diameter inclusions, and fills 100- to 400-μm-sized voids in pyrite. Quartz replaces pyrite. The clast is rimmed by anhydrite (50 μm to 1 mm in size). Anhydrite, and in places anhydrite plus fibrous clay(?), also fills some spaces near the edges of the clast. Spaces in the center of the clast are filled, or partially filled, with 20- to 200-μm diameter grains of subhedral to euhedral quartz. Crystallinity of quartz varies, with one space containing chalcedony, associated with fine-grained amorphous Fe-oxide. Clay(?) is present in some spaces with quartz, with anhydrite, and on its own. Anhydrite appears to postdate quartz in this section.

158-957C-5N-1 (Piece 7, 49–52 cm)
Thin section: #13
ROCK NAME: MASSIVE PYRITE-ANHYDRITE BRECCIA (Type 7a)

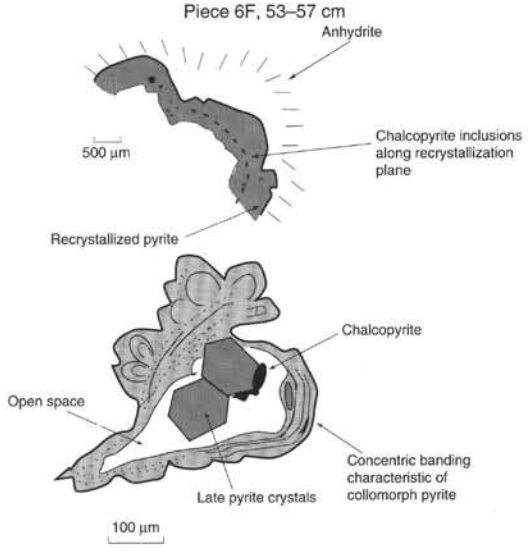
OPPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	60	100–5000	Subhedral to euhedral.	Massive pyrite aggregates.
Chalcopyrite	5	5 to >1000	Anhedral.	Interstitial to pyrite, aggregates.
Sphalerite	Trace	<5–50	Anhedral.	Inclusions in pyrite and overgrowing pyrite in void space.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	25	<400	Euhedral.	Large quartz crystals in contact with anhydrite have irregular grain boundaries (dissolution?).
Anhydrite	Trace	<600	Subhedral to euhedral.	
Fe-oxide	Trace	<50	Amorphous.	Translucent globules in center of pyrite aggregates.
Clay minerals	Trace	<20	Fibrous.	Interstitial in pyrite clasts.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
		10	Subangular.	

COMMENTS: MACROSCOPIC: Massive pyrite-silica clast from drill cuttings, richer in chalcopyrite. MICROSCOPIC: Massive pyrite with interstitial quartz and minor chalcopyrite. Pyrite grain boundaries are visible due to microporosity and little quartz inclusions. Euhedral quartz is replacing the pyrite. Chalcopyrite is mainly interstitial to pyrite and also often associated with microfractures in the pyrite. In one case, four generations of pyrite growth are present. Euhedral pyrite is overgrown by porous pyrite, which itself is overgrown by a thin porous(?) layer of quartz (<10 μm). The next layer consists of porous pyrite with some sphalerite inclusions. The whole assemblage is then overgrown by recrystallized, dense, euhedral pyrite.

158-957C-7N-1 (Piece 6F, 53–57 cm)
Thin section: #14
ROCK NAME: NODULAR SILICEOUS PYRITE-ANHYDRITE BRECCIA (Type 7c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	<50–500	Euhedral.	Nodular aggregates (as large as 13 mm) and grains in matrix. Size range is for the matrix grains.
Chalcopyrite	20	<400	Anhedral.	Coarse aggregates (as large as 10 mm) with pyrite inclusions and rims, interstitial between pyrite in matrix, and as filling in nodular clasts.
Sphalerite	Trace	20	Inclusions.	In pyrite or chalcopyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	25	400–2000	Euhedral.	Fine-grained aggregates enclose pyrite and chalcopyrite. Coarser tabular crystals in large voids. Mainly in voids within pyrite clast.
Quartz	5	80	Euhedral.	
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Clasts	10	<100	Intergranular.	Between pyrite aggregates in individual clasts.
Matrix				Not estimated due to anhydrite plucking from section.

COMMENTS: MACROSCOPIC: representative for 22-cm-long subunit within nodular pyrite-anhydrite breccia. In this subunit pyrite is dominant (70%–80%). Massive pyrite-silica clasts in anhydrite matrix. Chalcopyrite is abundant especially in this sample. MICROSCOPIC: CLASTS: Euhedral pyrite with disseminated chalcopyrite. Most of the chalcopyrite is interstitial between the pyrite crystals, and may comprise as much as 40% of the clast. In places are remnant textures after colloform pyrite. Textures indicate recrystallization, and some chalcopyrite is aligned along cracks or the limits of this recrystallization. The outer part of the biggest and (in the center) most chalcopyrite-rich clast is euhedral and lacks chalcopyrite inclusions. This may represent later overgrowth of the clast. Quartz is rare in voids within the clast. Several smaller clasts show intergrowth with quartz and have only rare to no chalcopyrite inclusions. MATRIX: Dominantly anhydrite with disseminated pyrite and chalcopyrite, and large chalcopyrite aggregates. Fine pyrite grains display colloform structure; the remainder is euhedral. Quartz is rare in the matrix.



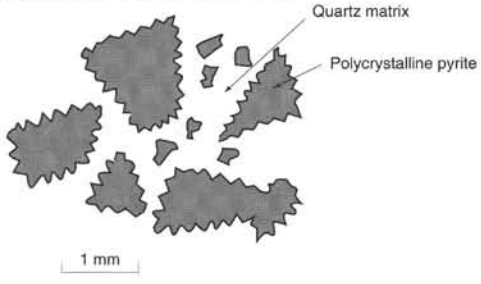
158-957C-7N-1 (Piece 8D, 110–117 cm)
Thin section: #15
ROCK NAME: NODULAR SILICEOUS PYRITE-ANHYDRITE BRECCIA (Type 7c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	35	200	Euhedral and polycrystalline clasts.	Clasts of euhedral, recrystallized pyrite aggregates.
Chalcopyrite	5	10–100	Anhedral.	Inclusions in pyrite clasts; also with anhydrite in matrix.
Sphalerite	Trace	<5–50		Inclusions in euhedral pyrite, often aligned along growth faces. Also in chalcopyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	45	300	Polycrystalline aggregates.	As clasts, containing disseminated pyrite and Fe-oxide. Variable crystallinity between chalcedony (cores) and coarse quartz (usually rims).
Anhydrite	15	500	Euhedral laths.	As cement to pyrite and silica clasts.
Fe-oxide	Trace	<2	Amorphous.	Locally disseminated in poorly crystalline chalcedony and quartz clasts.
Smectite(?)	Trace	<2		Inclusions localized in poorly crystalline chalcedony-quartz and interstitial to pyrite clasts.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
				Not estimated because of plucking in section.

COMMENTS: MACROSCOPIC: This section is typical for lighter colored pieces of this type. MICROSCOPIC: CLASTS: Nodular clasts up to 8 mm composed of polycrystalline pyrite aggregates, often in a quartz matrix. Recrystallization of pyrite and quartz results in irregular grain contacts within clasts. Chalcopyrite fills voids in clasts and also rims some clasts. Quartz forms polycrystalline assemblages, associated with pyrite. MATRIX: Pyrite occurs as euhedral crystals in anhydrite matrix. Chalcopyrite is an interstitial precipitate. Isolated quartz crystals (clastic?) also occur in the matrix (most abundantly near the silica clasts). Some euhedral quartz grains show zonation and in colloform or banded textures are found in some areas within the polycrystalline matrix. Note that the coarse anhydrite matrix has very few disseminated sulfide inclusions (contrast this with anhydrite typical of black smoker chimneys).

Piece 8D, 110–117 cm

Contact between pyrite and quartz matrix is very sharp, but irregular due to recrystallization of quartz.



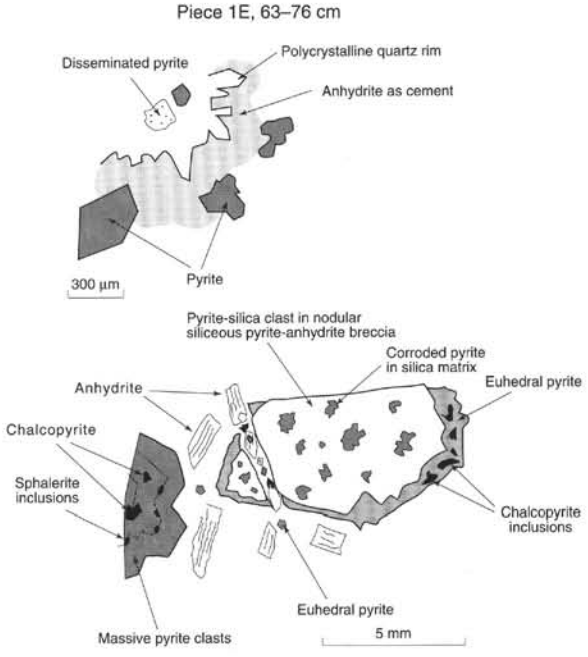
158-957C-7N-2 (Piece 1E, 63–76 cm)
Thin section: #16
ROCK NAME: NODULAR SILICEOUS PYRITE-ANHYDRITE BRECCIA (Type 7c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	<700	Euhedral and clasts.	Dominantly euhedral in matrix and polycrystalline.
Chalcopyrite	10	<500	Euhedral to polycrystalline.	Inclusions in pyrite and void filling.
Sphalerite	Trace	5–50		Inclusions enclosed in polycrystalline pyrite fragments, commonly distributed along grain boundaries.

NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Anhydrite	40	<1500	Euhedral.	Breccia matrix.
Quartz	10	100	Euhedral.	Matrix in the pyrite clasts and disseminated in veins.

VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
				Not estimated because of plucking in section.

COMMENTS: CLASTS: Two clast types are present in this section. Massive pyrite clasts occur as massive polycrystalline aggregates. They exhibit a porous core with some sphalerite and abundant chalcopyrite inclusions and a recrystallized outer part with no sphalerite or chalcopyrite inclusions. Quartz inclusions are rare. In some cases, colloform textures within the pyrite are preserved. Pyrite-silica clasts are massive and consist of irregularly shaped and corroded pyrite aggregates in a quartz matrix associated with fine-grained pyrite. The pyrite-silica clasts as a whole are rimmed by euhedral pyrite with abundant chalcopyrite inclusions. The biggest pyrite-silica clast in this section is crosscut by an anhydrite-chalcopyrite-pyrite vein. MATRIX: Euhedral anhydrite, polycrystalline aggregates of chalcopyrite, euhedral pyrite, and coarser grained euhedral quartz are constituents of the matrix. Anhydrite is overgrowing all other phases. Texture and mineralogy are similar to thin section from 158-957C-7N-1 (Piece 8D, 110–117 cm) (#15).



158-957B-7N-2 (Piece 1I, 99–119 cm)
Thin section: #17
No slide made, material exhausted in preparation.

158-957C-11N-1 (Piece 3A, 20–23 cm)
Thin section: #18
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	15	100	Euhedral.	Grains as large as 1 mm, and aggregates to 3 mm.
Chalcopyrite	Trace	20		Disseminated inclusions in pyrite.

NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz	60	~100	Euhedral and polycrystalline.	Well crystallized around pyrite grains. Remainder is transitional to chalcedony.
Anhydrite	5	400	Euhedral.	Rims around pyrite grains, and as 0.5-mm veinlet.
Smectite(?)	Trace	<5	Fibrous.	In micropores within large pyrite clast.

VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
		20		

COMMENTS: MACROSCOPIC: This sample is crosscut by late anhydrite veinlets, representative of light gray pieces. MICROSCOPIC: Pyrite aggregates enclosed in anhydrite, within a quartz matrix. Quartz occurs as fine- to coarse-grained aggregates. Coarser grained quartz occurs in voids or at pyrite-quartz boundaries. Pyrite grain boundaries in contact with quartz are irregular, due to quartz replacement, but contacts to anhydrite are sharp and well formed (anhydrite commonly seen to occupy space between pyrite and quartz). A second generation of pyrite occurs as fringes or agglomerates on chalcopyrite and in anhydrite. Note that mineral described as smectite could be very fine-grained gypsum.

158-957C-11N-2 (Piece 9, 127–131 cm)
Thin section: #19
ROCK NAME: MASSIVE ANHYDRITE VEIN (Type 11)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	Trace	30–300	Subhedral to euhedral.	Intergrown with and included in anhydrite.
Chalcopyrite	Trace	150	Subhedral.	In area of plucked anhydrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	100*	20–2000	Subhedral to euhedral.	>50% was plucked during thin section preparation.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	N/A			

COMMENTS: MACROSCOPIC: Massive banded crustiform anhydrite vein. MICROSCOPIC: Section is badly plucked, making it difficult to distinguish relationships among grains. 90% of sulfide present is pyrite. Only one large grain of chalcopyrite was observed. Some anhydrite grains contain large fluid inclusions with large vapor bubbles. *Percentages are relative to what remains after plucking.

158-957C-12N-2 (Piece 12, 98–100 cm)
Thin section: #20
ROCK NAME: PYRITE-SILICA-ANHYDRITE BRECCIA (Type 8)

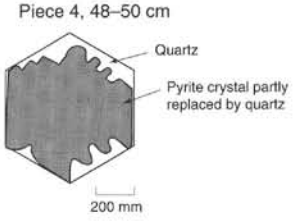
OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	10–800	Euhedral.	Euhedral aggregates as large as 8 mm. Quartz inclusions in porous grains.
Chalcopyrite	Trace	<800	Subhedral.	Coarse aggregates.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz/chalcedony	50	20–500	Subhedral to euhedral.	Polycrystalline aggregates.
Anhydrite	10	<1000	Tabular to subhedral.	Mineral proportion excludes anhydrite vein.
Smectite	Trace	<5	Fibrous aggregates.	In micropores within pyrite clasts.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
				Not estimated because of plucking in section.

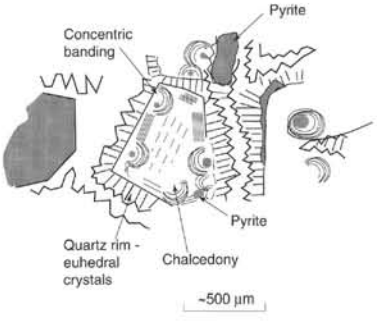
COMMENTS: MACROSCOPIC: Representative of contact to anhydrite-chalcopyrite vein. MICROSCOPIC: Irregular aggregates of euhedral pyrite, and chalcedony-quartz aggregates with complex, commonly intergrown relations. Minor anhydrite, which increases in amount toward a coarse anhydrite vein in part of section. Coarse chalcopyrite aggregates are associated with this vein. Relatively high proportions of chalcedony, with coarser euhedral quartz around margins, commonly projecting against pyrite aggregates with crystal apices penetrating into pyrite crystal. Sparse coarser grained euhedral quartz (0.5 mm in diameter) is enclosed in chalcedony-quartz aggregates. Anhydrite is interstitial to quartz aggregates, especially between quartz and pyrite aggregates.

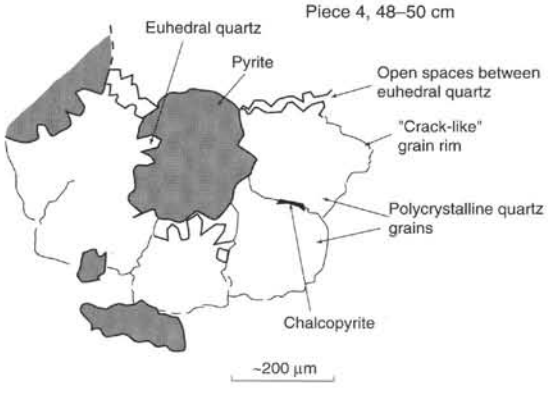
158-957C-15N-4 (Piece 4, 48–50 cm)
Thin section: #21
ROCK NAME: NODULAR PYRITE-SILICA BRECCIA (Type 9b)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	25	1000	Euhedral to anhedral.	Polycrystalline grains disseminated in quartz.
Chalcopyrite	Trace	20–250	Anhedral.	Disseminated in pyrite and interstitial between quartz grains.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	65	20–200	Euhedral and colloform.	Concentric layers overgrown by euhedral quartz
Smectite(?)	Trace	20	Anhedral, fibrous.	As tiny nuclei of concentric quartz layers and as inclusions(?) in porous pyrite.
Fe-oxide	Trace	50	Anhedral to subhedral.	In pyrite grain without quartz and disseminated in quartz.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	10			

COMMENTS: Quartz forms polycrystalline aggregates with regular size distribution (200 μm). Open space between these aggregates is filled with euhedral crystals. Grain boundaries are often crack-like in places with anhedral chalcopyrite. Commonly, the pyrite grains show a 20-μm-thick rim of euhedral quartz with the quartz tips pointing inward. Therefore, pyrite appears to be late and interstitial to the quartz. This texture may also be due to quartz recrystallization after the formation of the pyrite. Nevertheless, some pyrite grains seem to be replaced by quartz. Commonly, the quartz exhibits concentric (botryoidal) layering, which is then overgrown by euhedral quartz. Some of the concentric aggregates display a brownish nucleus, which could be smectite(?). Clay minerals (smectite?) are also present in microporous cores of some pyrite clasts. Concentric quartz layers are crosscut by late quartz veins or end abruptly, which seems to reflect brecciation of this quartz.







158-957C-15N-2 (Piece 1B, 12–15 cm)
Thin section: #22
ROCK NAME: SILICIFIED WALLROCK BRECCIA (Type 10a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	5–1000	Subhedral.	Disseminated in altered basalt clasts, as a late phase at the center of quartz veins and in quartz breccia matrix.
Chalcopyrite	Trace	5	Anhedral.	Inclusions in pyrite.
Sphalerite	Trace	5–20	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	50	5–200	Anhedral to euhedral.	Replaces basalt fragments, cements basalt clasts, and in 20–600 μm veins with pyrite.
Clay minerals	10	25–100	Fibrous, platy aggregates.	Yellow to tan to brown. Interstitial in altered basalt clasts and quartz crystals.
Chlorite	Trace	25–50	Spherulitic aggregates.	Green, anomalous brown to blue interference colors, overgrowths on quartz vein and cement.
Anhydrite	Trace	500	Anhedral.	Late phase with pyrite in quartz breccia cement and vein.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	1	100	Irregular.	Interstitial in breccia matrix and veins.

COMMENTS: MACROSCOPIC: Contains one 0.5 × 1.0 cm altered basalt clast with buff-colored, fine-grained matrix. Breccia matrix appears representative of at least 80 cm of core. Small and large (as large as 1 cm) pyrite nodules in a matrix of white and gray quartz. MICROSCOPIC: Altered large (1 cm across) basalt clast and smaller fragments in a quartz plus pyrite matrix. Basalt clasts are totally recrystallized, but some areas retain relict igneous textures (subvariolitic to interstitial). In other areas only ghosts of basalt clasts remain, and their basaltic character is inferred from the presence of tan clay minerals, granular quartz, and quartz pseudomorphs of olivine phenocrysts. Clasts are cemented and veined by euhedral to subhedral quartz overgrowths and interstitial, late(?) pyrite.

158-957C-14N-1 (Piece 2, 18–20 cm)
Thin section: #23
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	10–1000	Anhedral.	Clasts are aggregates of recrystallized fine-grained pyrite.
Chalcopyrite	Trace	5–20 (500)	Anhedral.	Inclusions in pyrite, void fillings in quartz and aggregates.
Sphalerite	Trace	5–15	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	40	5–200	Anhedral-euhedral.	Cementing and replacing pyrite clasts.
Anhydrite	(20)	50–1000	Anhedral-euhedral laths.	Late veins and pore filling.
Smectite	Trace	5–20	Fibrous aggregates.	Fills pores in pyrite clasts.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	10	50–1000	Irregular.	Mainly from plucked anhydrite.

COMMENTS: MACROSCOPIC: Representative of a 10-cm-long unit enclosed in massive pyrite-chalcopyrite. MICROSCOPIC: Most anhydrite plucked during sectioning. Variably sized dense and porous pyrite clasts cemented and replaced by quartz matrix. Alternatively, pyrite may be filling space in quartz-lined vugs. Euhedral quartz crystals are common in a more massive quartz matrix. These crystals often show zonation, whereas the more massive quartz exhibits banded textures (band width 5 μm). Anhydrite forms late veins and also surrounds dense pyrite clasts.

158-957C-14N-2 (Piece 1D, 41–44 cm)
Thin section: #24
ROCK NAME: MASSIVE PYRITE-CHALCOPYRITE (Type 5) (anhydrite vein selvage)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	80	<1 cm	Nodular aggregates.	Concentric, colloform growth, spherulitic.
Chalcopyrite	5	20–2500	Anhedral aggregates.	Interstitial within and among pyrite nodules, inclusions in pyrite.
Sphalerite	Trace	5–20	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	12	up to 500	Anhedral.	Interstitial among the pyrite nodules.
Quartz	3	up to 200	Anhedral-subeuhedral.	Filling pore space in pyrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
				A lot of material has been plucked during processing.

COMMENTS: MACROSCOPIC: Massive pyrite with minor chalcopyrite and interstitial anhydrite. MICROSCOPIC: Section consists of nodular pyrite aggregates commonly with colloform growth bands (10–20 μm width) overgrown by chalcopyrite aggregates in a matrix of anhydrite. Colloform pyrite itself with a core of euhedral pyrite is the nucleus for denser recrystallized pyrite aggregates. Chalcopyrite seems deeply altered (polishing problems?) and is replacing pyrite. At least three generations of euhedral pyrite are recognizable due to their separation by very thin (1–2 μm) layers of sphalerite. Pyrite along anhydrite veinlets is very dense and shows almost no inclusions. Anhydrite was the last mineral to precipitate.

158-957C-16N-2 (Piece 3C, 34–36 cm)
Thin section: #25
ROCK NAME: SILICIFIED WALLROCK BRECCIA (Type 10a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	5–500	Subhedral to euhedral.	Grain boundaries are plucked so it is difficult to determine if they are corroded or not.
Chalcopyrite	Trace	<30–100	Anhedral.	Inclusions in pyrite and small interstitial grains in pores.
Sphalerite	Trace	<30	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	40	5-400	Equant to euhedral.	Locally finely banded.
Smectite	10	~200	Frond-like	Aggregates.
Anhydrite	5	10–1 mm	Subhedral.	Filling fractures.
Chlorite	Trace	<5	Euhedral.	Needles and spherulitic aggregates.
Talc(?)	Trace	50–200	Subhedral.	Aggregates.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	5			Much of the void space is due to plucking during polishing which very likely has also significantly modified pre-existing void spaces.

COMMENTS: MACROSCOPIC: Representative for the lower part of the hole. Similar to thin section 158-957C-15N-2 (Piece 1B) (#22) but pyrite is enriched over silica. Clasts of very fine-grained pyrite-silica (light gray) embedded in darker silica with coarse-grained pyrite aggregates. MICROSCOPIC: Chlorite occurs in fine knots adjacent to the altered wallrock clasts. Smectite forms frond-like aggregates of grains replacing the altered wallrock. Anhydrite occurs as subhedral to euhedral grains filling millimeter-scale fractures. It appears to be late in the history of the rock and seems to overgrow quartz. Pyrite-anhydrite grain-grain boundaries are straight and uncorroded. The altered wallrock clasts are rimmed by euhedral quartz with an elongated c-axis perpendicular to the clast boundary. Fractures in the clasts are lined with quartz. Pyrite in the wallrock is mostly euhedral whereas that in the recrystallized matrix has lightly to moderately corroded grain boundaries.

158-957C-16N-2 (Piece 1B, 6–8 cm)
Thin section: #26
ROCK NAME: SILICIFIED WALLROCK BRECCIA (Type 10a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	500	Anhedral to subhedral.	Polycrystalline aggregates.
Chalcopyrite	5	5–50	Anhedral.	Included in pyrite; filling open space.
Sphalerite	Trace	<5–50	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	48	100	Subhedral to euhedral, colloform.	Banded chalcedony with euhedral grains of quartz oriented with elongation axis perpendicular to banded, colloform chalcedony surface, and to surfaces of pyrite aggregates.
Anhydrite	2	50	Subhedral to euhedral.	In vein; plucked during thin section preparation.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	5	5–200		Open spaces in veins from plucking(?).

COMMENTS: MACROSCOPIC: Massive pyrite and nodular pyrite-silica clasts in pyrite-silica-chalcopyrite matrix. MICROSCOPIC: Two silica-pyrite clasts separated by a vein of anhydrite (although most anhydrite is plucked). Chalcopyrite lines parts of the vein, is present as inclusions in pyrite (in places replacing sphalerite), and fills open spaces. Cores of clasts are quartz and pyrite. Most of the quartz is banded colloform (band width 2.5–5 μm) with abundant sulfide microinclusions (<1 μm) between growth stages. Quartz seems to have recrystallized to euhedral clear quartz surrounding pyrite nodules and commonly replacing the pyrite. Several generations of pyrite are present. Outer portions of clasts contain greater proportions of pyrite relative to quartz.

158-957C-7N-1 (Piece 6G, 59–61 cm)
Thin section: #27
ROCK NAME: NODULAR SILICEOUS PYRITE-ANHYDRITE BRECCIA (Type 7c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	50	100–1 mm	Euhedral to anhedral.	Polycrystalline aggregates.
Chalcopyrite	10	5–200	Anhedral.	Enriched in matrix. Some small (5 μm) inclusions in pyrite.
Sphalerite	Trace	5	Anhedral.	Small inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	10(?)		Anhedral.	In interstitial spaces among the pyrite clasts (as matrix?).
Quartz	5(?)	20–320	Anhedral.	The two transparent minerals touch but they do not replace each other, and they are rarely mixed (i.e., some areas are exclusively formed by anhydrite, others by quartz).
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	25(?)			

COMMENTS: Much of the sample has been lost during thin sectioning. Hence, the percentages are with (?), and the thin section looks very porous. The section contains a 5-mm silicified basalt clast, altered to quartz, clay minerals, and pyrite, but locally retains relict igneous textures. Some large pyrite clasts show clear replacement of pyrite by quartz; this appears to progressively isolate pyrite domains surrounded by quartz.

158-957E-2R-1 (Piece 2, 6–8 cm)
Thin section: #28
ROCK NAME: MASSIVE SULFIDE (Type 5)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	200–1500	Subhedral or colloform.	Concentric bands and spherulitic aggregates.
Chalcopyrite	13	<5–50	Anhedral.	Interstitial among pyrite and between alternating colloform pyrite bands.
		>200	Polycrystalline aggregates.	
Sphalerite	Trace	<10	Anhedral.	Small inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	2	200	Euhedral.	As rim along pyrite and also interstitial in pyrite.
Quartz	2	25–400	Anhedral aggregates, subhedral to euhedral.	Rarely elongated. In interstices among pyrite aggregates, and rarely isolated in pyrite. Some euhedral crystals in pyrite.
Chlorite	3	<20	Fibrous.	Anomalous birefrigence colors (blue to brown), filling voids (40 μm in diameter) in pyrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	40		Angular when in pyrite.	

COMMENTS: Most of the sample consists of colloform and concentric aggregates of pyrite with interstitial chalcopyrite. Chalcopyrite is deeply pitted due to the polishing. The primary porosity of pyrite is difficult to judge due to the polishing. Quartz seems concentrated in a 3-mm-sized fragment associated with pyrite. The texture and mineralogy resemble that of clasts of pyrite-silica breccias elsewhere. Pyrite associated with the quartz fragment shows no or few chalcopyrite or sphalerite inclusions, but euhedral quartz inclusions are common. The contact with the surrounding chalcopyrite-bearing pyrite is sharp. Chalcopyrite is present as small anhedral inclusions in pyrite or along cracks but mainly as irregular aggregates up to 1 mm in diameter. Sphalerite inclusions generally occur lining former pyrite grain boundaries. Chlorite generally fills void space within pyrite aggregates (up to 900 μm). Chlorite is also interstitial to quartz.

158-957F-2N-1 (Piece 5, 28–30 cm)
Thin section: #29
ROCK NAME: MASSIVE GRANULAR PYRITE (Type 5c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	80	100 to 1 mm	Subhedral.	Massive aggregates.
Chalcopyrite	7	500	Euhedral to subhedral.	Interstitial to pyrite, and small (20 μm in diameter) grains disseminated in pyrite.
Sphalerite	1	5–25	Anhedral.	Disseminated in pyrite, numerous grains.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	Trace	50	Subhedral.	Polycrystalline aggregates (400 μm across) in pyrite.
Anhydrite	2	<800	Anhedral.	Filling pore spaces in pyrite, associated with sphalerite.
Amorphous silica	Trace			Filling open spaces, late.
Clay	Trace		Fibrous aggregates.	In pores in pyrite aggregates.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	10			Central part of section lost during thin section preparation.

COMMENTS: MACROSCOPIC: Massive granular pyrite (probably a clast from nodular pyrite breccia) with chalcopyrite and local quartz enclosed in pyrite. Late anhydrite partly coats the sample and is present in vugs. MICROSCOPIC: Porous, partly recrystallized pyrite. Colloform texture is partly preserved, but no marcasite was observed. Central zone of chalcopyrite aggregates, associated with minor anhydrite (mostly plucked during sectioning). Chalcopyrite and anhdrite also present in smaller pores within pyrite aggregates. Chalcopyrite locally replaces pyrite. Sphalerite commonly replaced by chalcopyrite. Late amorphous silica partly filling voids, contains fine (10–50 μm in diameter) euhedral pyrite grains and dustings of fine, fibrous clay mineral.

158-957F-1N-1 (Piece 10C, 66–67 cm)
Thin section: #30
ROCK NAME: NODULAR PYRITE BRECCIA (Type 6a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	50–1 mm	Euhedral to anhedral.	Grains and nodular aggregates up to 5 mm in diameter.
Chalcopyrite	2	20–1 mm	Anhedral.	Small inclusions in pyrite, and large interstitial crystal aggregates.
Sphalerite	Trace	10	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	ND	500	Euhedral.	Sometimes as radial aggregates.
Quartz	Trace	50	Euhedral.	In pyrite clasts and interstitial to pyrite aggregates.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	ND			

COMMENTS: MACROSCOPIC: Nodular pyrite breccia with clasts of massive granular pyrite, porous pyrite, and granular chalcopyrite up to 1.5 cm in diameter, in a fine-grained pyrite-anhydrite matrix. Characteristic of the uppermost breccias in cores from Holes 957F and 957G. MICROSCOPIC: Fine to coarse pyrite aggregates (locally with in diameter chalcopyrite) in coarse anhydrite matrix. Three types of pyrite clast are present: (1) rounded, with porous cores, which seem to be partly corroded; (2) rounded and porous grains with late nonporous pyrite generations at their outer rim; and (3) clasts with outer euhedral pyrite (crystals up to 500 μm in diameter). These grains are generally less porous than Types 1 and 2, and contain rare quartz grains.
ND = Not estimated because of plucking during section preparation.

158-957G-1N-1 (Piece 3, 12–14 cm)
Thin section: #31
ROCK NAME: MASSIVE GRANULAR PYRITE (Type 5c)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	45	10 to >1000	Euhedral or colloform.	Complex, microporous growth textures of colloform and spheroidal material, variably recrystallized.
Chalcopyrite	3	<300	Anhedral.	Inclusions in microporous pyrite, and interstitial to aggregates. Also enclosed in quartz with pyrite.
Sphalerite	1	<10 to 200	Anhedral.	Large grains enclosed in colloform pyrite, and small inclusions associated with chalcopyrite in colloform aggregates.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz/chalcedony	15	to 400	Aggregates and euhedral.	Aggregates of chalcedony and quartz, and large euhedral grains, within pyrite. Undulose extinction of large crystals, also concentric (growth?) banding.
Hematite	Trace	5–25	Hexagonal.	Irregular aggregates or discrete hexagonal crystals (25 μm across) within quartz.
Anhydrite	Trace		Anhedral.	Isolated in quartz matrix.
Smectite (?)	Trace		Fibrous or platy aggregates.	In micropores within pyrite. Could be gypsum.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	36			

COMMENTS: MACROSCOPIC: Massive granular pyrite from a rounded, 6-cm-diameter piece, probably a clast from massive pyrite breccia. Clasts from Section 158-957G-1N-1 are unusual in that some display evidence of primary growth textures, not obscured by recrystallization. MICROSCOPIC: three zones: (1) Primary core of coarse-grained pyrite aggregates with quartz (chalcedonic) and a trace of chalcopyrite. (2) Overgrowth by sequential growth layers of colloform and euhedral pyrite (now recrystallized). (3) Microporous, recrystallized colloform and spheroidal pyrite, locally overgrowing sphalerite, with sphalerite and chalcopyrite inclusions.

158-957E-4R-1 (Piece 3, 13–16 cm)
Thin section: #32
ROCK NAME: SILICIFIED WALLROCK BRECCIA (Type 10a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	20	10–3000	Anhedral.	As small (10–100 μm in diameter) isolated crystals, or as large coarse-grained aggregates.
Chalcopyrite	Trace	<10		Inclusions in pyrite.
Sphalerite	Trace	<<10		Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz/Chalcedony	30	<10 to 700	Anhedral.	Large crystals surround pyrite and altered basalt. Elsewhere, finer aggregates transitional to chalcedony.
Silicified, altered basalt	30			Made up of silica with abundant disseminated tan-colored clay minerals (<1 μm, fibrous).
Anhydrite	Trace	<50	Anhedral.	Rare inclusions in quartz, or in interstices between quartz or pyrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	20	200–800	Irregular.	Lined by coarse euhedral quartz.

COMMENTS: MACROSCOPIC: Light gray, silicified wallrock sample, with quartz-rich areas and fine, disseminated pyrite. Fractured, some fractures filled by pyrite. MICROSCOPIC: Altered basalt clasts with disseminated pyrite, enclosed in a matrix of quartz and pyrite aggregates. The basalt clasts display subvariolitic textures. The sharp angular outlines of the clasts are rarely seen, but most clasts have been "exploded" by quartz and chalcedony-filled fissures, making the original outline hard to see. Some of the quartz may have originally been basalt, now totally replaced. Some pyrite grains contain inclusion zones (trails?) of quartz. Chalcopyrite and sphalerite inclusions in pyrite are very small and rare (compared with higher in section and in cores from Hole 957C).

158-957E-11R-1 (Piece 9, 42–49 cm)
Thin section: #33
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	55	5 μm to 6 mm	Anhedral.	Recrystallized aggregates with inclusions and pores.
Chalcopyrite	5	10 μm to 2 mm	Anhedral to subhedral.	Overgrowing pyrite, and interstitial between pyrite and quartz aggregates. Inclusions in pyrite.
Sphalerite	Trace	<5–20	Anhedral.	Inclusions in pyrite.
Pyrrhotite	Trace	<5	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz/chalcedony	30	<10–350	Anhedral to euhedral, elongated.	Matrix and inclusions in pyrite. Polycrystalline aggregates, grading from chalcedony.
Smectite	5	<5–25	Platy, fibrous aggregates.	Alone in interstitial voids in pyrite and quartz.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
		5	Intergrain.	Hard to determine which voids are due to plucking.

COMMENTS: MACROSCOPIC: Dark gray pyrite-silica breccia with local light gray and tan clasts of altered basalt.The sample is representative of the matrix between altered basalt fragments. The term "matrix" becomes synonymous with "gray quartz-pyrite veins" at this depth. MICROSCOPIC: Fine- to coarse-grained pyrite grains and aggregates (with minor chalcopyrite) in a matrix of quartz with low visible pore space. Common 50- to 500-μm patches of smectite plus fine-grained granular quartz and pyrite may be highly altered basalt fragments. Pyrite shows small anhedral inclusions of sphalerite and pyrrhotite. Also present is an unidentified phase that is light gray (lighter than spalerite), has moderate to high anisotropy, and exhibits weak pleochroism.

158-957E-14R-1 (Piece 11, 52–55 cm)
Thin section: #34
ROCK NAME: CHLORITIZED BASALT BRECCIA (Type 10b), WITH QUARTZ-PYRITE VEINS

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	20	100–2 mm	Euhedral.	Large crystals up to 2 μm in veins, and 100 μm disseminated in basalt.
Chalcopyrite	5	<300	Anhedral.	Interstitial between pyrite crystals in veins, and inclusions in pyrite (10 μm).
Sphalerite	Trace	10	Anhedral.	Small inclusions in pyrite.
Pyrrhotite	Trace	<20	Anhedral.	Inclusion in pyrite from the vein.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz	30	<100	Euhedral.	In the veins, and partly replacing basalt.
Chlorite	30	<<10	Aggregates.	Green and brown chlorite replacing crystalline and glassy basalt, anomalous blue and first-order yellow interference colors.
Colorless clay	Trace	100–200	Irregular vugs.	Second-order green interference colors.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	15			

COMMENTS: Chalcopyrite is enriched in the main vein as a late mineral, and in small veinlets perpendicular to the main one in the altered basalt. Quartz replaces plagioclase microlites. The fine-grained groundmass is replaced by brown chlorite. Olivine phenocrysts are replaced by and vesicles filled with colorless, low birefringence phyllosilicate (chlorite?). Clasts cut by 4-mm-wide quartz plus pyrite vein; numerous other quartz and quartz plus pyrite veins cut half of the clast causing more intensive silicification.

158-957E-18R-1 (Piece 5, 25–27 cm)
Thin section: #35
ROCK NAME: CHLORITIZED BASALT BRECCIA (Type 10b)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	15	10–100	Euhedral.	
Sphalerite	Trace	10	Anhedral.	Rare inclusions in pyrite.
Leucoxene	Trace	10	Anhedral to euhedral.	Disseminated in altered basalt. Euhedral crystals are probably leucoxene recrystallized to sphene.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz	30	10–300	Anhedral to euhedral.	In veins replacing plagioclase, replacing groundmass.
Brown chlorite	50	<10	Aggregates.	Replacing plagioclase and groundmass.
Colorless clay	Trace		Fibrous.	Replacing olivine phenocrysts, high birefringence.
Colorless clay	Trace		Spherules.	Replacing plagioclase phenocryst, low birefringence.
Fe-oxide/ oxyhydroxide	Trace	100–150	Fine-grained aggregates.	In breccia matrix.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	5			Most voids are related to the veins.

COMMENTS: Pyrite is disseminated in chloritized basalt, but most often occurs in the quartz veins and as discontinuous (100 μm) rims around the basalt clasts. A centimeter-wide breccia is composed of chloritized and silicified glass and basalt fragments cemented by quartz, and bounded on one side by large chloritized basalt clast and by a silicified basalt clast on the other. Clasts are cut by numerous 10–300 μm quartz and quartz plus pyrite veins.

158-957H-1N-1 (Piece 13, 60–61 cm)
Thin section: #36
ROCK NAME: POROUS NODULAR PYRITE BRECCIA (Type 6a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	77	500	Anhedral to euhedral.	Coarse recrystallized aggregate, with local microporous areas showing trace of primary collomorphic texture.
Chalcopyrite	2	10	Anhedral.	On outside and in voids within pyrite aggregate, and as inclusions in pyrite crystals.
Sphalerite	Trace	5	Anhedral.	Inclusions in pyrite, rare.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Chalcedony	4	10	Fibrous, partly recrystallized.	Filling pore spaces in pyrite aggregate.
Smectite	2	5	Fibrous.	Filling pore spaces.
Anhydrite	Trace	20	Euhedral.	Localized to outer part of the aggregate, with chalcopyrite.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	15	10–200		

COMMENTS: MACROSCOPIC: Massive granular pyrite piece, similar in texture and mineralogy to Samples 158-957H-1N-1, Pieces 2 and 3. MICROSCOPIC: Most of the pyrite is recrystallized, with small chalcopyrite inclusions. In some places relict textures of colloform pyrite are visible. Anhydrite is confined to one side of the section; chalcopyrite is associated with this and is most abundant as overgrowths around the edge of the pyrite aggregate. Chalcopyrite and anhydrite may therefore be late, possibly part of a matrix that enclosed the pyrite aggregate. Unusually fibrous aggregates of chalcedony partly fill the open spaces, and contain high birefringent, fibrous aggregates that are probably smectite.

158-957H-1N-1 (Piece 13, 61–62 cm)
Thin section: #37
ROCK NAME: POROUS NODULAR PYRITE BRECCIA (Ttpe 6a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	25	120	Euhedral to anhedral.	
Chalcopyrite	19	<70	Anhedral.	Interstitial in pyrite.
Sphalerite	1	2–5	Anhedral.	At the core of euhedral pyrite.
Hematite	Trace	2	Anhedral.	At the core of pyrite.
Unidentified mineral	Trace	5–20	Euhedral.	Disseminated in euhedral pyrite, orange under crossed nicols, strong relief hematite (?).
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Anhydrite	50	3 mm	Euhedral.	As cement around euhedral pyrite and pyrite aggregates.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	5	80		

COMMENTS: MACROSCOPIC: Pyrite breccias with anhydrite veining and clasts of primary sulfides (porous, very fine-grained pyrite-chalcopyrite) characteristic of Cores 158-957H-1N-1 to 3N-1. MICROSCOPIC: Fine- to coarse-grained euhedral pyrite and pyrite-chalcopyrite aggregates in a matrix of coarse-grained, low-porosity anhydrite. Pyrite in the matrix occurs as individual euhedral grains or as polycrystalline anhedral aggregates with abundant chalcopyrite. Two generations of pyrite are visible in the chalcopyrite-pyrite polycrystalline grains. The first generation is at the core of the grains and contains sphalerite and hematite. The second generation forms an outer rim of euhedral crystals after chalcopyrite. Along the contacts the late pyrite seems to be partly replaced and corroded by chalcopyrite.

158-957H-3N-1 (Piece 1, 5–7 cm)
Thin section: #38
ROCK NAME: POROUS NODULAR PYRITE BRECCIA (Type 6a)

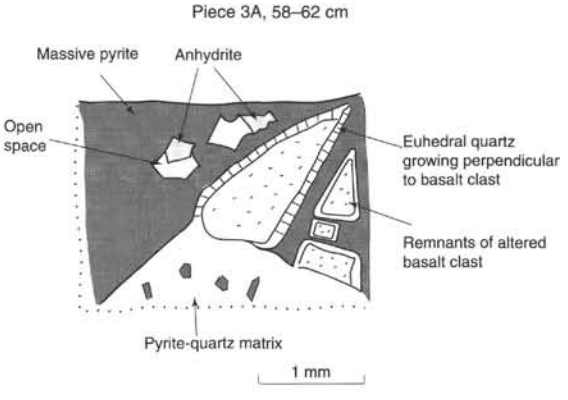
OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	50	400	Euhedral to anhedral aggregates.	
Marcasite	23	5–30	Euhedral.	Associated with pyrite in colloform bands.
Sphalerite	2	40	Euhedral to anhedral.	Disseminated in pyrite, or as bands (20 μm thick) in colloform pyrite. Hexagonal crystals.
Chalcopyrite	Trace	10	Anhedral.	Associated with sphalerite in pyrite-marcasite, or disseminated. Individual anhedral grains in pyritic part.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Opal	Trace		Amorphous.	In some open spaces in pyrite.
Fe-oxide	Trace	<10		On outer surface and in open spaces.
Clay	Trace	<10		At the core of euhedral pyrite aggregates and associated with sphalerite, filling areas up to 600 μm.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	25	20–300		Elongate open spaces between the colloform bands, and interstitial spaces in pyrite.

COMMENTS: MACROSCOPIC: Unusually massive pyrite sample. Coarse- to medium-grained massive pyrite aggregates (clasts?) overgrown by a matrix of porous, colloform pyrite-marcasite, associated with sphalerite. MICROSCOPIC: (1) Pyrite aggregates. Coarse-grained euhedral pyrite and rounded pyrite aggregates with some late marcasite overgrowths into void spaces. Minor sphalerite occurs as late crystals with chalcopyrite and marcasite in the open spaces. (2) Colloform zone. Multiple colloform bands of polycrystalline pyrite-marcasite alternate with coarse to fine sphalerite (yellow in transmitted light). Some iron-rich dark sphalerite occurs at the core of the colloform or spherulitic pyrite/marcasite.

158-957H-5N-2 (Piece 3A, 58–62 cm)
Thin section: #39
ROCK NAME: SILICIFIED WALLROCK BRECCIA (Type 10a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	60	100	Euhedral to anhedral.	In matrix, as massive clasts, and in veins.
Chalcopyrite	Trace	5–10	Anhedral.	Disseminated in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	27	20–300	Anhedral to euhedral.	In matrix and clasts, inclusions in pyrite.
Clays	5	<5		Filling void space in pyrite.
Anhydrite	2	1.5 mm	Euhedral.	Late filling open space.
Fe-oxide	Trace	<5	Anhedral.	Disseminated in quartzitic clast.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	5			Most open spaces are filled with quartz.

COMMENTS: MACROSCOPIC: Large clasts (to 3 cm) of rounded, silicified wallrock in a porous matrix of pyrite and silica. Late coarse-grained anhydrite in voids. Clasts include altered, silicified basalt, red and gray silica, and massive pyrite. MATRIX: The matrix is a mixture of fine-grained pyrite and quartz. Pyrite in the matrix is anhedral (corroded and replaced by quartz, with abundant euhedral quartz inclusions) or subhedral to euhedral (with only few quartz inclusions). Quartz in general is inclusion-rich which gives it a "dirty" appearence. Euhedral quartz shows fewer inclusions and rare zonation. Late anhydrite is found in open spaces of massive pyrite, in late cracks, and rarely interstitial to the pyrite-quartz matrix. ALTERED BASALT CLASTS: A large basalt clast (1 cm) is exploded and partly replaced by a network of quartz-pyrite veinlets. Pyrite dominates the vein assemblage and shows a porous core in places. Quartz forms an irregular outer rim (5–10 μm) around the pyrite and grows perpendiculer to the basalt clast (20–50 μm). Two strongly corroded basalt clasts with only minor relics of basaltic texture are present. In these clasts pyrite is filling and replacing the quartz along small veinlets and cracks. PYRITE CLASTS: Angular massive pyrite (2.5 mm across) with corroded boundaries at the contact to the matrix. Aggregates show indications of recrystallization (individual grain sizes commonly > 400 μm) and are overgrown by a thin layer of more porous pyrite (50–100 μm). SILICA CLASTS: Fine-grained chalcedonic quartz with abundant Fe-oxides (6 × 2 mm), fractured and filled with quartz from the surrounding quartz-pyrite matrix. Clays are in the altered basalt but also in dirty quartz with Fe-oxides. Matrix and clasts are rimmed (in places clearly veined) by massive pyrite that seems to be the same generation as those in the basaltic clasts.



158-957H-8N-1 (Piece 14, 94–96 cm)
Thin section: #40
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

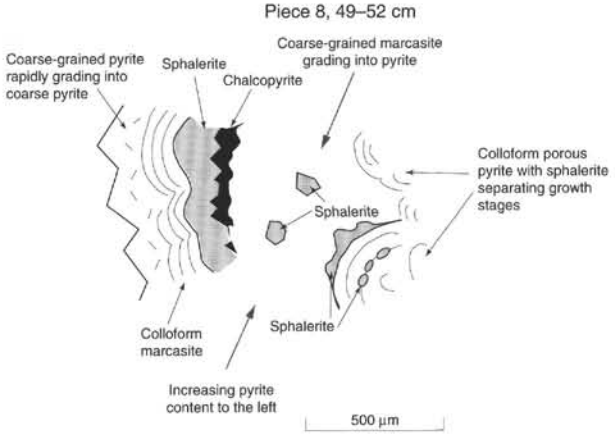
OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	60	10–150	Euhedral.	Isolated crystals in quartz and larger aggregates.
Chalcopyrite	5	20–40	Anhedral.	Disseminated grains in quartz.
Sphalerite	Trace	10	Anhedral.	In the outer pyrite rim.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Chalcedony	28	30	Euhedral.	Cement and veins, in pyrite clasts.
Anhydrite	2	1.5 mm	Euhedral.	As late crystals in cement with chalcopyrite; no quartz associated with anhydrite.
Hematite	Trace		Euhedral, hexagonal plates.	In late interstices after chalcopyrite, pyrite, and anhydrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	5			

COMMENTS: MACROSCOPIC: Pyrite-silica breccia typical of this core. Nodular, fine-grained pyrite clasts and small (1–3 mm) chalcopyrite aggregates in a matrix of gray silica with fine disseminated pyrite. CLASTS: Three pyrite clast types are present. A large pyrite aggregate (1 cm in diameter) is fractured and rimmed by chalcedony. This chalcedony is also rimming other pyrite grains throughout the section. The chalcedony rim is very regular (5 to 10 μm thick) with individual fibers growing perpendicular to the pyrite and is cross-cutting the pyrite and displacing the fragments. It also seems to replace the pyrite along grain boundaries. This pyrite aggregate consists of individual pyrite grains with a grain size up to 400 μm and is recrystallized. A second type is also recrystallized but is not affected by fracturing. The third pyrite clast type is porous, is colloform in places, and shows irregular boundaries to the matrix if not rimmed by a late pyrite overgrowth. One of these pyrite clasts may be recrystallized dendritic pyrite, partly replaced by silica. MATRIX: Chalcopyrite is enriched in the matrix and is interstitital to chalcedony and pyrite. One side of the section is covered with a regular outer pyrite rim (50 μm thick) enriched in sphalerite and chalcopyrite, with chalcopyrite overgrowing the pyrite. Quartz is rare, inclusion-rich, and mainly concentrated in a small band along the pyrite rim at the outer part of the section.

158-957I-1N-1 (Piece 8, 49–52 cm)
Thin section: #41
ROCK NAME: POROUS MASSIVE PYRITE (Type 5a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	35	5–150	Colloform, rare euhedral.	Rare spheroidal aggregates (10–30 μm) when protruding into void space.
Marcasite	40	100–150	Subhedral to anhedral.	
Sphalerite	5	10–150	Anhedral to subhedral.	Disseminated in coarse marcasite and pyrite, rimming colloform pyrite.
Chalcopyrite	Trace	<5–80	Anhedral.	Between outer sphalerite and inner pyrite/marcasite.
Bornite	Trace	<5	Anhedral.	Replacing chalcopyrite along grain boundaries.
Covellite	Trace	<5	Anhedral.	Replacing chalcopyrite along grain boundaries.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	20			

COMMENTS: Pyrite and marcasite are intimately intergrown. Pyrite is found as colloform aggregates (several generations) with no sphalerite or chalcopyrite inclusions. Different generations of colloform pyrite are separated by sphalerite. This early pyrite is overgrown by intimately intergrown fine-grained colloform marcasite-pyrite where marcasite is dominant. Coarse-grained (150 μm) marcasite was observed filling void spaces between early pyrite aggregates. The marcasite content decreases outward and pyrite increases. These coarser generations are associated with sphalerite and chalcopyrite where sphalerite is mainly overgrowing the chalcopyrite. In some cases, chalcopyrite seems to replace sphalerite. The grain size increases throughout the growth sequence, and each generation ends with the precipitation of chalcopyrite and then sphalerite. Remnants of framboidal pyrite are rare and commonly aligned.



158-957I-1N-1 (Piece 12, 75–76 cm)
Thin section: #42
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	33	10–1300	Euhedral to subhedral.	Concentric growth zones in euhedral grains. 30–50 μm colloform rims on chalcopyrite or pyrite.
Chalcopyrite	3	20–1000	Anhedral.	Aggregates and overgrowths on pyrite.
Sphalerite	Trace	<20	Inclusions.	In pyrite grains.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz/chalcedony	57	30–100	Anhedral to euhedral. <470	Fine- to coarse-grained aggregates as matrix. Some coarse euhedral grains.
Clay mineral	2	<5	Aggregates.	In small voids within pyrite aggregates.
Fe-oxide	Trace	<10	Anhedral.	In center of pyrite crystals.
VOID SPACE	PERCENT	SIZE (μm) 5	MORPHOLOGY	COMMENTS

COMMENTS: Euhedral pyrite, euhedral to collomorphic pyrite aggregates, and chalcopyrite aggregates in a matrix of quartz-chalcedony. Pyrite is variably intergrown (replaced?) by chalcopyrite. There are at least two generations of pyrite: before and after chalcopyrite deposition. The later generation of pyrite forms thin (<100 μm) rims on some aggregates. Clay mineral is brown in transmitted light, with faint sheaf-like texture, medium birefringence (second-order purple), and parallel extinction. It is observed filling void spaces in half of a single pyrite aggregate, where it is associated with small (75 μm) anhedral quartz. In the other half of the same pyrite aggregates, the voids are filled by dirty quartz. It is therefore proposed that this pyrite-quartz-clay mineral aggregate is a silicified, pyritized basalt clast. Traces of Fe-oxides are observed in the center of euhedral pyrite grains. Remnants of clasts are visible due to the presence of pyrite rims surrounding sulfide-poor, fine-grained quartz. Chalcedony is only present in the matrix and not in the clast remnants.

158-957J-1X-1 (Piece 3, 15–17 cm)
Thin section: #43
ROCK NAME: RED AND GRAY CHERT (Type 2)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	20	2–110	Euhedral.	Disseminated in silica as euhedral grains and aggregates.
Sphalerite	Trace	2–20	Anhedral to euhedral.	Very rare inclusions in pyrite and some euhedral crystals (up to 125 μm) in silica.
Marcasite	Trace	50	Euhedral.	Associated with pyrite in aggregates.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Chalcedony	25	10	Spherulitic.	Matrix. Rimming pyrite clasts.
Quartz	15	50 length	Anhedral to euhedral.	Matrix. Euhedral grains in chalcedonic matrix.
Clay minerals	8	up to 50	Fibers = sections of plates.	Associated with the Fe-oxide and oxyhydroxides and chalcedony. Clays are also at the center of quartz grains.
Fe-oxides	6	<2		Disseminated in red silica.
Amorphous silica	5	—	Spherulitic.	Commonly coating quartz.
Hematite	1	2	Anhedral.	Aggregates up to 10 μm.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	20	20–500		

COMMENTS: MACROSCOPIC: Low porosity red chert, with local darker Fe-oxide patches. Sharp to gradational contact with more porous gray chert containing locally abundant Fe-disulfides. MICROSCOPIC: Major silica phases are chalcedony and quartz, which seem to have been the result of replacement of amorphous silica. The replacement can be progressive by increasing of crystal grain sizes, but in some cases large grains of quartz are disseminated in a very fine-grained chalcedonic matrix. Most of the quartz grains fall in a narrow grain-size distribution from 30 to 50 μm and show zonation. These areas are patchy throughout the section and also only contain euhedral pyrite aggregates of a specific very small grain size (<15 μm). The pyrite grain size in the other areas varies widely. Pyrite often occurs as disseminated euhedral grains in rounded grains of quartz or chalcedony, in the gray silica matrix, or as polycrystalline assemblages containing euhedral quartz. The smallest grains are euhedral; the larger grains are often corroded and partly replaced by silica. Small grains or aggregates of hematite are disseminated in the red silica and are probably due to recrystallization of Fe-oxides. Marcasite is present in pyrite aggregates, but locally it is seen as acicular crystals disseminated in gray silica, and resembles pyrrhotite replacement. Many large sphalerite crystals were removed during polishing. Late amorphous silica occurs in the gray chert embedding pyrite and/or Fe-oxide-bearing chalcedony and quartz. A bright yellow, fibrous, thread-like clay mineral is abundant in the red chert associated with Fe-oxides and silica.

158-957K-1X-1 (Piece 2, 10–12 cm)
Thin section: #44
ROCK NAME: POROUS MASSIVE PYRITE (Type 5a) WITH BLACK CHERT

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	30	5–200	Anhedral to collomorphic.	Fine spherulitic inclusions in the dark amorphous silica, and aggregates between silica.
Marcasite	10	<40	Anhedral to euhedral.	Mixed with pyrite in the cement, but also as individual late layers of large crystals.
Sphalerite	Trace	<50	Anhedral.	Orange in transmitted light. Inclusions in pyrite aggregates and in late colorless amorphous silica.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Amorphous silica	50		Filamentous.	Two generations, one is black with "dust" inclusions, the second is colorless, as late rims and fracture fills around the sulfides and silica.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	10	10–500		

COMMENTS: MACROSCOPIC: Black and gray silica enclosed in porous pyrite-marcasite and crosscut by bands of pyrite-marcasite and sphalerite. Fine-grained marcasite, sphalerite, and silica are associated with 0.5-mm tubular (biogenic?) structures. MICROSCOPIC: Most of the section is amorphous silica with unusual textures and abundant dusty black inclusions, which give the black color to the sample. In several places dendritic silica enriched in inclusions is preserved. Biogenic(?) structures (diameter 700 μm) are preserved as silicified and pyritized walls (20 μm). Close to these textures are many transverse sections and one longitudinal section of worm tubes (70 μm diameter). The early silica with abundant trace fossils was later brecciated and cemented by a regular rim of colorless amorphous silica. Commonly the fractured border is lined with pyrite, then with marcasite and colorless silica. Most sulfides occur as cement around the dark silica clasts. The dark silica may have incorporated some pelagic sediment or have silicified pelagic sediments.

158-957K-1X-1 (Piece 4, 21–23 cm)
Thin section: #45
ROCK NAME: POROUS MASSIVE PYRITE (Type 5a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Marcasite	40	<300	Subhedral.	Commonly elongated, forming thick layers.
Pyrite	15	<5–150	Spherulitic.	Colloform.
Sphalerite	Trace	20	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Amorphous silica	20		Filamentous.	Some clear remnants of a primary filamentous texture.
Fe-oxide	Trace	70	Anhedral aggregates.	In pore space.
Goethite	Trace			Partly filling some pore spaces.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	25			

COMMENTS: Colloform pyrite-marcasite with abundant amorphous silica. Small late marcasite veins (100 μm thick) cut the early marcasite bands and attest to multiple stages of formation. Marcasite commonly forms 1-mm monominerallic bands of coarse crystals (300 to 500 μm) with an inner pyrite band. In many places, collomorph pyrite forms regular dirty spherules in a coarser marcasite matrix.

158-957K-2N-1 (Piece 9, 37–38 cm)
Thin section: #46
ROCK NAME: MASSIVE GRANULAR PYRITE (Type 5c)

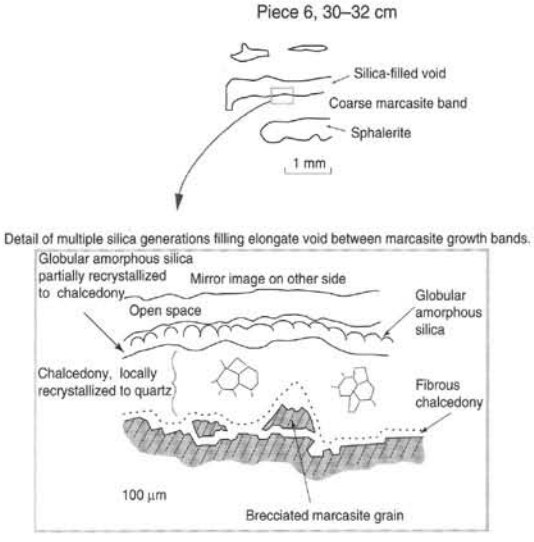
OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	49		Anhedral to collomorphic.	Recrystallized polycrystalline aggregates.
Marcasite	20	up to 400	Anhedral to euhedral.	Overgrowth on pyrite aggregates, and in an outer banded zone, alternating with pyrite.
Chalcopyrite	10	10 to >500	Anhedral.	Partly fills void spaces within pyrite aggregates, partly replacing pyrite.
Sphalerite	1	5–50	Anhedral.	Individual grains disseminated in pyrite, less common in marcasite.
Bornite	Trace	<5	Anhedral.	With digenite replacing chalcopyrite.
Digenite	Trace	<10	Anhedral.	Replacing chalcopyrite.
Covellite	Trace	<5	Anhedral.	Replacing chalcopyrite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	20			

COMMENTS: MACROSCOPIC: Porous, granular pyrite with banded pyrite-marcasite rim. Characteristic of most samples in this interval. MICROSCOPIC: Porous pyrite aggregates, some with collomorphic textures preserved in the core. Chalcopyrite occurs interstitial to porous pyrite aggregates, as inclusions in pyrite, or as a rim separating euhedral pyrite and marcasite. Sphalerite occurs mainly as inclusions within pyrite aggregates, usually associated with chalcopyrite, but inclusions have also been found in euhedral pyrite. This assemblage is then overgrown by later, coarse marcasite with minor coarse pyrite. Chalcopyrite inclusions in the coarse-grained marcasite are rare. Some sphalerite has been found. Chalcopyrite separating early pyrite and coarse-grained marcasite shows a thin (5 μm) rim of digenite, bornite, and covellite. Chalcopyrite enclosed by pyrite only rarely shows this replacement. The outer edge of the section consists of a thick, banded zone of alternating pyrite and marcasite, consisting of coarse euhedral to fine colloform sequential overgrowth layers. Pyrite layers contain rare marcasite, sphalerite, and chalcopyrite inclusions.

158-957K-3X-1 (Piece 6, 30–32 cm)
Thin section: #47
ROCK NAME: MASSIVE PYRITE (Type 5)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	40	<400	Anhedral to euhedral.	Polycrystalline aggregates with marcasite. Local euhedral aggregates with quartz.
Marcasite	35	<50–800	Anhedral to euhedral.	Coarse polycrystalline aggregates. Bladed euhedral growth into voids, overgrown by more marcasite.
Sphalerite	8	50–400	Euhedral.	Intergrowths with pyrite-marcasite. Yellow in transmitted light, with dark brown to opaque cores.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz-chalcedony	7	<100	Anhedral.	Fibrous chalcedony lines some voids, with quartz-chalcedony overgrowths, and late amorphous silica.
Amorphous silica	Trace			Partly fills some voids, late.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	10	>500	Between banded growth layers.	Low within sulfide aggregates.

COMMENTS: MACROSCOPIC: Massive pyrite cut by colloform pyrite-marcasite and granular sphalerite bands. Marcasite locally fractured and brecciated, with silica filling fractures. MICROSCOPIC: Coarse polycrystalline pyrite-marcasite bands, locally with sphalerite, crosscut and overgrow a porous structure of pyrite-marcasite, sphalerite, and silica. Single "nodular" structure (clast?) of euhedral pyrite and quartz. Silica locally fills elongate voids between pyrite-marcasite growth bands. Complex relations between silica types (see sketch example), with evidence of multiple stages of precipitation and recrystallization. Coarse-grained pyrite is locally brecciated (related to the silica precipitation?).



158-957K-3X-1 (Piece 7, 33–34 cm)
Thin section: #48
ROCK NAME: MASSIVE PYRITE (Type 5)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Marcasite	40	<50–400	Anhedral to euhedral bladed.	Polycrystalline aggregates (with pyrite), preserving remnants of collomorphic bands and spheroidal textures.
Pyrite	35	50 to <400	Euhedral, anhedral, framboidal.	Coarse to very fine polycrystalline aggregates, intergrown with marcasite. Locally framboidal in cores of marcasite aggregates. Rare euhedral grains grow into voids.
Sphalerite	4	20–350	Anhedral to euhedral.	Yellow in transmitted light, some with opaque cores. Grains within pyrite-marcasite aggregates, and coarse euhedral intergrowths between colloform banded pyrite-marcasite.
Chalcopyrite	Trace	50	Anhedral.	Rare inclusions within coarse sphalerite.
NONOPAQUE MINERALOGY	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
Quartz	4	<40	Anhedral.	Localized aggregates forming 50-μm lining of some void spaces (recrystallized after amorphous silica?).
Amorphous silica	2			In some voids within banded and porous pyrite-marcasite.
Fe-oxides	Trace	<5	Amorphous flakes.	Confined to one side of sample, on outside and in voids.
Unidentified mineral	Trace	<60	Anhedral.	Colorless, moderate relief, very high birefringence. Occurs in voids associated with sphalerite.
VOID SPACE	**PERCENT**	**SIZE (μm)**	**MORPHOLOGY**	**COMMENTS**
	15	<2 to 6 mm		Sheet-like voids between collomorphic growth bands.

COMMENTS: MACROSCOPIC: Zoned porous massive pyrite. Core of porous massive to granular pyrite-marcasite with local sphalerite and silica (I). Overgrown by a 3–4 mm band of colloform pyrite-marcasite (II). Further overgrowth of coarse sphalerite, and porous, spongy, fine-grained pyrite-marcasite (III), now coated by Fe-oxide. MICROSCOPIC: Complex intergrowths of polycrystalline pyrite and marcasite, in variable proportions, forming structure of colloform growth bands, with lesser sphalerite and silica. (I) Colloform pyrite-marcasite (possibly on highly porous silica-sphalerite foundation; not well preserved). Pyrite-marcasite is intergrown with sphalerite, which is locally replaced by later pyrite-marcasite. (II) Alternating 500–800 μm bands of pyrite and marcasite. (III) Coarse euhedral sphalerite overgrown by porous pyrite-marcasite-silica. Evidence of marcasite inversion to pyrite, and also recrystallization of pyrite, marcasite, and amorphous silica.

158-957B-4R-1 (Piece 8, 55–62 cm)
Thin section: #49
ROCK NAME: SPARSELY OLIVINE PHYRIC BASALT
GRAIN SIZE: Fine to submicroscopic
TEXTURE: Subvariolitic (sheaf-like)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	3	5	0.07–0.55		Euhedral.	Commonly in glomerophyric aggregates.
GROUNDMASS						
Matrix	60	60				Submicroscopic, apparently fresh.
Plagioclase	20	25	0.1		Microlites.	Reasonably fresh.
Olivine	0	5	0.02–0.05		Skeletal.	Completely replaced by colorless smectite.
Ti-magnetite	?	5	<0.005			Very fine grained, appears to be partially to completely altered, but grain size is too small to distinguish alteration products.
Glass	Trace					Completely replaced by colorless smectite.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite			Two varieties, one colorless, with medium birefringence and large, elongated sections, and a second type that is pale tan with low birefringence, and very fine grained.
Pyrite			Associated with altered, glomerophyric olivine. Also rare very small grains in matrix, possibly related to small fractures.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	1	Random.	0.1–0.7	See comments.	Circular.	Filled with iddingsite along walls, and with pale tan smectite.

COMMENTS: Description above refers to relatively unaltered core. This sample also has a complex, layered alteration halo. A 2-mm-thick outer brown rim is rich in submicroscopic Fe-oxide minerals. This rim grades to dark brown or black inward from the margin of the sample. The oxide minerals stain and replace plagioclase microlites. This rim also contains the pale tan smectite in a fibrous mat. An inner red halo is 2 mm thick and comprises iddingsite, Fe-oxide/oxyhydroxide minerals, and pale tan smectite (also in a fibrous mat).

158-957M-1R-2 (Piece 7, 34–36 cm)
Thin section: #50
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	20	0.01–5 mm	Subhedral to euhedral.	
Chalcopyrite	8	0.01–2 mm	Subhedral to euhedral.	Fine grains and aggregates in matrix, rimming basalt clasts.
Covellite	Trace	5	Euhedral.	Oxidation rim around chalcopyrite in contact with quartz.

NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz	70	0.01–0.5 mm	Anhedral to subhedral.	Replacing and cementing basalt clasts.
Brown clay	2	0.01–0.1 mm	Aggregates.	Replacing basalt clasts.

COMMENTS: 2-mm to 1-cm silicified basalt clasts replaced by quartz, brown clay (chlorite or illite), and pyrite. Clasts are rimmed by 0.2- to 1-mm chalcopyrite rim. Matrix consists of 10- to 400-μm, anhedral to subhedral quartz intergrown with 10-μm to 1-mm subhedral grains and aggregates of pyrite plus 50-μm to 2-mm subhedral to euhedral grains and aggregates of chalcopyrite. 100- to 200-μm veins of chalcopyrite cut pyrite rims on basalt clasts. Silicified basalt clasts comprise 45% of the thin section.

158-957M-3R-1 (Piece 30, 134–136 cm)
Thin section: #51
ROCK NAME: PYRITE-SILICA BRECCIA (Type 9a)

OPAQUE MINERALOGY	PERCENT	SIZE	MORPHOLOGY	COMMENTS
Pyrite	45	0.1–2 mm	Anhedral to euhedral, colloform.	
Chalcopyrite	10			Filling voids, interstitial to quartz and as inclusions in pyrite, and locally pseudomorphs(?) after pyrite.
Marcasite	5	0.1–0.5 mm	Anhedral to subhedral.	Intergrown with pyrite.
Sphalerite	Trace	5	Anhedral.	Inclusions in pyrite, rare in marcasite.

NONOPAQUE MINERALOGY	PERCENT	SIZE	MORPHOLOGY	COMMENTS
Chalcedony	1		Fibrous.	Late, partly filling open spaces after quartz.
Quartz	33	0.05–1 mm	Equant to euhedral.	Matrix.
Clay minerals	1		Anhedral.	Local brown coloration in quartz.

VOID SPACE	PERCENT	SIZE	MORPHOLOGY	COMMENTS
	5			

COMMENTS: Intergrowths of pyrite and marcasite line vugs and pores with, generally, pyrite forming euhedral overgrowths on marcasite. These areas have several phases (up to 4) of pyrite growth in which euhedral terminations in the cavity may have cubic overgrowth on dodecahedral grains and vice versa. Pyrite in the quartz forms aggregates and individual anhedral to euhedral grains, commonly with inclusions of quartz and chalcopyrite. Locally, pyrite grain boundaries are serrated and indented indicating dissolution. In places, pyrite grains and aggregates of grains are fractured and the fractures have been filled with quartz. Many pyrite grains have colloform cores. Chalcopyrite locally pseudomorphs pyrite and has subsequently been overgrown by a later phase of pyrite. However, in general, chalcopyrite occurs in filled or partially filled vugs and pore spaces, or occurs interstitial to quartz. Even in these latter occurrences, pyrite clearly overgrows the chalcopyrite.

158-957M-9R-1 (Piece 5, 24–26 cm)
Thin section: #52
ROCK NAME: SPARSELY OLIVINE PHYRIC BASALT
GRAIN SIZE: Fine
TEXTURE: Intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	1	3	0.2–0.5		Euhedral.	Partially replaced by smectite and chlorite in less altered core. Totally altered to smectite or chlorite in chloritized rim.
GROUNDMASS						
Olivine	0	10	<0.1		Euhedral.	Totally replaced by smectite/chlorite.
Plagioclase	40	60	0.2–1.2		Lath.	Slightly altered.
Glass	0	2				
Unidentified matrix	15	27				
Clinopyroxene	5	<0.16			Anhedral to elongated.	Unaltered.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite	20	Vesicles, olivine.	
Chlorite	17	Vesicles, olivine, groundmass.	
Fe-oxides/ Fe-oxyhydroxides	5–10		Disseminated throughout matrix and occurs with olivine.
Pyrite	<2	0.05–1 mm	In chloritized rim.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	1	Random.	0.5–6.0	Smectite/ chlorite.	Round.	Vesicles partially and completely filled.

COMMENTS: Sample displays two concentric halos, about 10 mm thick, around a less altered core. The outer greenish halo is about 5 mm thick, in which the basalt is 60% to 70% altered. Olivine is replaced by talc (or a high birefringence, colorless smectite) near crystal margins and iddingsite/Fe-oxyhydroxides at the center of crystals. Matrix is totally replaced by a green to tan phyllosilicate (probably a mixed layer chlorite-smectite). Pyrite occurs as corroded anhedral crystals, 50 to 100 μm in diameter, disseminated in the altered matrix, olivine crystals, and vesicles.

158-957M-9R-1 (Piece 12, 76–79 cm)
Thin section: #53
ROCK NAME: CHLORITIZED BASALT
GRAIN SIZE: Very fine
TEXTURE: Subvariolitic (sheaf-like)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPO-SITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	1	10	0.1–0.5		Skeletal to euhedral.	Totally replaced by phyllosilicates. Euhedral crystals have a few relict cores.
Plagioclase	30	30	0.05–0.25		Microlites.	Essentially unaltered.
Ti-magnetite	5	5	<0.005–0.02		Skeletal.	Appears homogeneous, hence either unaltered or completely maghemitized.
GROUNDMASS						
Matrix	50					Submicroscopic. Intensely altered to phyllosilicates.
Glass	5					Totally replaced by phyllosilicates.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite/chlorite			Mixed layer phyllosilicate, pale green to tan, with low birefringence.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	1	Random.	0.09–0.3	See comments.	Circular, zoned.	From wall to center, filled with green, then brown, then pale green, then colorless phyllosilicates.

COMMENTS: Thin section contains a 0.2- to 0.5-mm-thick vein bordered on both sides with 2- to 2.5-mm-thick halos. The veins appear to have crack-seal textures. VEIN: Green phyllosilicate (mixed layer chlorite/smectite) predominantly along selvages but also in center of vein. Colloform opal displaying growth bands, mostly at center but also along selvages. The opal locally grades into anhedral quartz crystals as large as 0.15 mm in length. Pyrite occurs as anhedral to subhedral crystals or crystal aggregates, 0.01 mm in diameter to the entire width of the vein. Another, thinner vein, about 0.025 mm thick, of the same green phyllosilicate runs parallel to and merges with the larger vein. HALOS: These have diffuse boundaries with the host rock. The basalt is about 80% altered in the halos. Olivine, plagioclase, and matrix are replaced by green to tan phyllosilicates with disseminated anhedral corroded pyrite (average size = 0.025 mm), but grains as large as 0.3 mm occur in olivine pseudomorphs.

158-957M-10R-1 (Piece 6, 33–35 cm)
Thin section: #54
ROCK NAME: ALTERED BASALT
GRAIN SIZE: Very fine to submicroscopic
TEXTURE: Subvariolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPO-SITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	10	10	0.08–0.5		Microlites.	Fresh.
Olivine	5	8	0.06–0.2			Fresh except in alteration halo.
Ti-magnetite	5	5	0.005–0.15		Skeletal.	Homogenous, they do not appear to be altered, but fine grain size makes identification difficult.
GROUNDMASS						
Matrix	75	75				

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite	2	In vesicles and voids.	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	2	Random.	0.1	Smectite.	Circular.	Several miarolitic voids as much as 0.4 mm across are filled with smectite.

COMMENTS: This sample also has a red alteration halo on one corner of the thin section. It is 2 mm thick, with a red margin and brown interior. In this halo, olivine is completely replaced by iddingsite and illite(?). Plagioclase is essentially fresh. Some plagioclase microlites are stained/replaced by orange to brown Fe-oxyhydroxide minerals. Vesicles are lined with Fe-oxyhydroxide minerals as well. One 0.05- to 0.1-mm-thick vein is filled with pale yellow to tan fibrous phyllosilicates (probably smectite) plastered onto the outer margin of the halo.

158-957M-10R-1 (Piece 9, 60–62 cm)
Thin section: #55
ROCK NAME: ALTERED BASALT
GRAIN SIZE: Submicroscopic
TEXTURE: Varioliotic (coalesced varioles)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPO-SITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	10	10	0.1–0.6		Microlites.	Apparently unaltered.
Olivine	4	8	0.05–0.25		Skeletal to euhedral.	Skeletal crystals in the matrix are completely replaced by smectite. Euhedral larger crystals occur in glomerophyric aggregates and are only partially replaced.
GROUNDMASS						
Matrix	75					
Glass	10					Submicroscopic, interstitial between varioles.

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite	4	Olivine.	Phenocrysts partially replaced, skeletal crystals partially replaced.
Pyrite	Trace		Very small grains in interstitial glass between varioles.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	Trace		0.25	Smectite.	Circular.	

COMMENTS: This sample also contains a red alteration halo, 2 mm thick, on three sides of the sample. In this halo, varioles are dark brown and vesicles are orange brown. Olivine is replaced by Fe-oxyhydroxide minerals and smectite. Cracks are filled with Fe-oxide and oxyhydroxide minerals. One vesicle is filled with Fe-oxyhydroxide minerals and an elongated pyrite crystal. The section also contains a 0.05- to 0.1-mm-thick vein filled with pale green tan, fibrous phyllosilicates near the outer margin of the red halo.

158-957M-10R-1 (Piece 19, 129–131 cm)
Thin section: #56.
ROCK NAME: ALTERED PILLOW BASALT RIM
GRAIN SIZE: Submicroscopic to very fine
TEXTURE: Holohyaline to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPO-SITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0	8	0.002–0.02		Euhedral.	Glomerophyric aggregates and a few isolated crystals.
Plagioclase	0	Trace	<0.25		Microlites.	
Clinopyroxene	Trace					
Spinel	Trace					
GROUNDMASS						
Varioles	>90					
Glass						

SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING	COMMENTS
Smectite/chlorite	98		Filling vesicles, replacing minerals and the interstitial glass between varioles.
Chalcedony	1		Fibrous crystal aggregates in the center of vesicles.
Fe-oxide/ Fe-oxyhydroxide	1	Replaces silicates.	Replacing primary phases and with clay near selvages.
Pyrite	Trace		Disseminated.
Chalcopyrite	Trace		In a 0.04-mm-thick vein, altered to Fe-oxide minerals, in turn, altered to Fe-oxyhydroxide minerals.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	2		0.12–2.4	Smectite.	Circular.	Filled with smectite along vesicle walls (to 0.025 mm thick) and chalcedony(?) or mixed layer phyllosilicates in center.

COMMENTS: Thin cracks (<0.01 mm) are present, filled by clay minerals (mixed layer smectite/chlorite?). Larger cracks (as thick as 0.06 mm) in glassy outer rim contain secondary sulfide minerals.

158-957N-1W-1 (Piece 2, 11–12 cm
Thin section: #57
ROCK NAME: DARK GRAY CHERT (Type 2)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	7	<10–300	Euhedral, rare colloform.	Aggregates and grains within silica matrix.
Digenite	2	<150	Anhedral.	Grains partly to completely replacing chalcopyrite. Rarely with spindle lamellae of bornite.
Chalcopyrite	1	<5–150	Anhedral.	Grains commonly overgrow and replace pyrite. Also interstitial to quartz matrix, as thin "veinlets" along grain boundaries.
Sphalerite	Trace	<50	Anhedral.	Rare grains overgrowing pyrite. Inclusions in chalcopyrite and pyrite.
Bornite/Chalcocite	Trace	<50		Intergrowths replacing chalcopyrite, associated with digenite.
Covellite	Trace	<5		Intergrowths associated with digenite.
Hematite	Trace	<5		Inclusions in euhedral pyrite, associated with sphalerite inclusions.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz-Chalcedony	80	<100	Anhedral aggregates.	Cryptocrystalline chalcedony aggregates, grading to coarser anhedral quartz.
Amorphous silica	Trace	200 μm	Aggregates.	Rounded aggregates, enclosed in quartz-chalcedony.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
		10-<1 mm	Irregular.	Between rounded aggregates of quartz-chalcedony matrix.

COMMENTS: Euhedral pyrite grains and aggregates, associated with chalcopyrite, in a matrix of fine-grained quartz-chalcedony. Chalcopyrite occcurs by replacement of pyrite, and as discrete grains. Most has subsequently been altered to a bornite-digenite-covellite assemblage. Chalcopyrite between quartz grains (localized) is less altered. Within the matrix of quartz-chalcedony, minor Fe-oxide locally stains the silica. In one place, Fe-oxides reveal ghost textures after 50-μm globular amorphous silica, now recrystallized. Macro-scale textures in matrix are nodular masses of quartz-chalcedony (only minor, very fine-grained pyrite) with coarse pyrite distributed around them.

158-957N-1W-1 (Piece 4, 23–25 cm
Thin section: #58
ROCK NAME: PYRITE-SILICA-ANHYDRITE BRECCIA (Type 8)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	48	100–800	Euhedral to anhedral.	Disseminated in quartz and anhydrite.
Chalcopyrite	7		Anhedral.	Large aggregates interstitial between pyrite grains.
Sphalerite	Trace	5–(20)	Anhedral.	Inclusions in pyrite.
NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Quartz	18			
Anhydrite	10	to 500	Euhedral.	Polycrystalline assemblages in matrix.
Fe-oxide	Trace	50	Anhedral.	Inclusion of a red mineral at the core of one pyrite grain.
Brown clay minerals	2		Anhedral.	Aggregates in quartz, in millimeter-sized areas.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
		10	Large millimeter-sized open spaces.	Uncertain estimate, due to loss of anhydrite from section.

COMMENTS: Pyrite occurs as disseminated euhedral crystals or as polycrystalline, recrystallized aggregates. Some grains are porous and contain numerous quartz inclusions; others are very homogeneous and chalcopyrite inclusions (up to 50 μm) are common. In a single grain, tiny grains of sphalerite are at the porous center and larger chalcopyrite inclusions are at the less porous outer part. Anhydrite contains euhedral quartz crystals and seems to be late related to quartz, but no mutual replacement is observed. Anhydite forms polycrystalline aggregates and is not disseminated in quartz. The clay aggregates in quartz may represent completely altered basalt clasts, but no basaltic texture was observed.

158-957M-2R-1 (Piece 4, 18–20 cm
Thin section: #59
ROCK NAME: POROUS MASSIVE PYRITE-MARCASITE (Type 5a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Marcasite	45	20–100	Subhedral to euhedral.	Lines vugs.
Pyrite	30	20–200	Collform to euhedral.	In cores of growth bands and lines vugs.
Sphalerite	5	5–100	Anhedral.	Yellow to orange in transmitted light. In pyrite-marcasite aggregates and as late growth in vugs.
Chalcopyrite	Trace	<2	Inclusions.	Rare, in sphalerite grains.
VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	20	to 10 mm	Elongate, irregular.	Large voids between growth bands of pyrite-marcasite.

COMMENTS: Multiple generations of colloform and polycrystalline pyrite and marcasite, overgrowing and including sphalerite, to form a collomorphic banded texture. Cores of growth bands are generally microporous colloform pyrite (possibly from inversion of a marcasite precursor). The later stage consists of coarse euhedral marcasite lining voids, with sphalerite overgrowth. Locally, euhedral pyrite occurs as the last phase to line voids. Sphalerite occurs as grains within pyrite-marcasite aggregates, and as fine clouds of inclusions in colloform pyrite.

158-957O-2R-1 (Piece 5, 22–24 cm)
Thin section: #60
ROCK NAME: NODULAR PYRITE-ANHYDRITE BRECCIA (Type 7b)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	50	up to 200	Anhedral to euhedral.	Recrystallized.
Chalcopyrite	10		Anhedral.	
Sphalerite	Trace	<15	Anhedral.	Rare grains disseminated in euhedral pyrite.

NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Anhydrite	30	500 μm	Euhedral.	Filling open spaces.

VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	10			

COMMENTS: Pyrite forms millimeter-sized aggregates of euhedral crystals, commonly rounded and highly porous. Chalcopyrite is enriched in the pores of the clasts. Many grains, now recrystallized, have remnants of previous colloform textures. A second group of pyrite aggregates is better crystallized and less porous with minor chalcopyrite inclusions. Anhydrite is interstitial but only partially fills the open spaces. In some places, chalcopyrite is enriched along cracks or grain boundaries in the pyrite and has a replacement contact with pyrite.

158-957P-8-R1 (Piece 7, 27–31 cm)
Thin section: #61
ROCK NAME: POROUS MASSIVE PYRITE (Type 5a)

OPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Pyrite	70	50–400	Euhedral.	Most pyrite looks primary.
Chalcopyrite	10		Anhedral.	Interstitial between pyrite crystals, or less common as inclusions in pyrite.
Sphalerite	3	20 to 100	Anhedral.	Small inclusions in pyrite and in chalcopyrite (see comments below).
Pyrrhotite	2	up to 300 long	Euhedral.	Late in open spaces.
Marcasite	Trace	30	Anhedral.	Locally abundant along a late crack.

NONOPAQUE MINERALOGY	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
Clay minerals	Trace		Anhedral.	Light brown clay is locally interstitial between pyrite.
Amorphous silica	Trace		Anhedral.	In some open spaces.

VOID SPACE	PERCENT	SIZE (μm)	MORPHOLOGY	COMMENTS
	15			

COMMENTS: Most pyrite seems to be primary precipitate as euhedral crystals, but locally remnants of colloform pyrite are present. Sphalerite is disseminated as small grains in pyrite, where they commonly are aligned along crystallographic planes. However, most sphalerite is concentrated in chalcopyrite as disseminated grains and commonly as long contorted bands. Sphalerite is also seen as a narrow rim at the contact between chalcopyrite and pyrrhotite. Pyrrhotite forms large euhedral crystals in the open spaces; some anhedral grains are as 5 μm inclusions in pyrite. Some pyrite crystals are corroded and partly replaced by chalcopyrite along their border. Even if pyrrhotite is late, locally clear evidence exists of replacement by the euhedral pyrite.