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MINERALOGICAL EXAMINATION OF 82 SAMPLES FROM THE VANGORDA DEPOSIT OF CURRAGH RESOURCES

LAKEFIELD RESEARCH
A DIVISION OF FALCONBRIDGE LIMITED

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April 6th, 1988

Mr. D. Scheding
Curragh Resources
P.O. Box 1000
Faro, Yukon
YOB 1KO

Dear Mr. Scheding:

Please find enclosed three copies of our Mineralogical Examination of 82 Samples from the Vangorda Deposit of Curragh Resources.

Best regards.

Yours truly

LAKEFIELD RESEARCH

Robert S. Salter
General Manager

RSS:jm

Encl.

c.c. - Mr. D. Coleman, Mississauga (1)

Mineralogical Examination of 82

Samples from the Vangorda Deposit of

Curragh Resources

Project No. L.R. 3458A

NOTE:

This report refers to the samples as received.

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April 4, 1988

SUMMARY

Seventy-one polished sections and eleven pol-thin sections were prepared and examined from characteristic ore samples from the Vangorda deposit. Descriptions of the ore minerals, their relationships and liberation characteristics are given. The samples are subdivided into 6 general ore categories based on their pyrite, base metal mineral and barite content.

LAKEFIELD RESEARCH

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General Manager

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INTRODUCTION A suite of 82 samples, selected from 16 holes in the 1987 Vangorda drilling program, was received for ore microscopic examination. The samples were selected to represent the full range of ore types encountered and a selection of alteration regimes for each type. Accompanying the samples was a code sheet identifying the field classification marked on each sample (see reference sheet attached). Of the 82 samples, twelve were requested for polished-thin section examination, the others in polished section only.

Mineralogical descriptions were to be given of the following items in order to allow selective compositing of ore types based both on lithostratigraphic coding and grain size or liberation.

1) Estimates of major sulphide mineral proportions (area %)
2) Frequency and nature of occurrence of minor minerals (including arsenopyrite, native gold, silver sulphosalts, etc.)
3) Frequency and nature of occurrence of potential gangue diluents (graphite, talc, sericite, chlorite, barite, etc).
4) Estimates of value mineral (base metal sulphides, BMS) grain size in microns (range and rough area - weighted mean).
5) Locking characteristics for value minerals (nature of grain boundaries, presence of inclusions or locking within gangue, association of ga/py, sph/py, ga/sph likely to generate locked particles after grinding).
6) Locking of value minerals with non-sulphide gangue (especially graphite, talc, micas, barite, carbonates in thin section)
7) Surface characteristics of value mineral grains, especially with samples annotated "weathered", "sandy" or "oxidized" (are alteration envelopes visible? how deep?)
8) Characterization of sphalerite grains as high, low or medium iron (from colour? in thin section?)

PROCEDURES Of the 12 pol-thin sections requested one (sample 87V-06 at 123.8) was too sulphide-rich for thin section preparation. Seventy-one polished sections and eleven pol-thin sections were prepared and examined. Photomicrographs were taken of representative sulphide textures in the sample suite. X-ray powder diffraction analysis was used to confirm or check the identification of gangue minerals, especially barite, in several samples.

The attached tables give estimated proportions (% area) of minerals in all the sections, estimated liberation of base metal sulphides present in concentrations of more than 1% by area at a nominal grind of 200 mesh, association of BMS locking characteristics with other sulphides, oxides and gangue, and proportions of gangue minerals in the polished thin sections. Field classifications were used as a guide to the subdivision of ore types but for metallurgical purposes the sample suite was broken down into the following broad categories:

Ore Type	Characteristics
A	Low Pyrite (≤ 20%); High BMS (> 10%)
C	Low Pyrite (≤25%); Low BMS (< 10%)
E_1	High Pyrite (> 25%); Low BMS (< 10%)
E_2	High Pyrite (> 20%); High BMS (≥ 10%)
Œ	High Pyrite (> 20%); High BMS (> 10%); Barite
G	Low Pyrite (≤ 20%); High BMS (> 10%); Barite

Figure 25, a plot of % Pyrite vs % BMS (Sphalerite + Galena + Chalcopyrite) illustrates the distribution of the 82 samples among the various categories.

RESULTS Tables 1 and 2 summarize the results of mineralogical examination in terms of mineral proportions and estimated liberation at a nominal grain size of 200 mesh. Distributions of all samples are plotted in Figures 26 to 30, (% Pyrite vs % Sphalerite + % Galena + % Chalcopyrite) showing samples with high arsenopyrite (>2%), presence of gold/electrum and tetrahedrite, high chalcopyrite (>2%), high magnetite (≥ 10%) and high pyrrhotite + marcasite (≥10%).

Descriptions of the textural relationships of ore minerals are given on the following pages and are illustrated in Figures 1 to 24.

Tables 3 to 8 give estimates of mineral proportions and liberation characteristics for each sample within the 6 major ore categories.

CONCLUSIONS The sample suite consists of major pyrite, sphalerite, galena, pyrrhotite/marcasite and magnetite with minor amounts of chalcopyrite, arsenopyrite, tetrahedrite, native gold and electrum. Host rocks to the mineralization consist of quartzites, carbonaceous quartzites and barite-bearing quartzites with variable amounts of carbonate.

The ores have been classified into 6 categories depending on the concentration of pyrite, of BMS (sphalerite + galena + chalcopyrite) and presence or absence of barite. Variations exist among the 6 categories in terms of liberation characteristics. At a grain size of 200 mesh, estimates of free and composite grains of sphalerite are about 45% and 55% respectively. The majority (~ 40%) of composite grains are with pyrite and gangue. Similar estimates for chalcopyrite and galena indicate ~ 30% free grains at 200 mesh and ~ 50% associated with pyrite and gangue.

An estimate of the iron content of sphalerite was obtained by measuring its unit cell edge by x-ray powder diffraction. The FeS content of 23% (≡14.6% Fe) should be checked by electron probe analysis to give a more reliable figure for metallurgical balance purposes.

Trace amounts only of tetrahedrite and native gold or electrum are present in a few sections. The native gold/electrum usually occurs with galena or chalcopyrite within massive pyrite.

"Weathered" or "oxidized" samples show no effects of sulphide oxidation. The porous textures appear to have formed by dissolution of barite with no oxidation of the adjoining sulphides.

Figures 26 to 30, illustrating the distribution of higher than average contents of pyrrhotite + marcasite, magnetite, chalcopyrite, arsenopyrite, native gold/electrum and tetrahedrite, show that there is wide distribution of these various minerals among all of the ore types.

PYRITE

The major sulphide (between 25% and 30% overall) occurs in three distinctive textures a) as massive anhedral masses with small intergranular patches of gangue or base metal sulphides (Figure 1), b) as semi-massive subhedral to anhedral grains with intergranular BMS and gangue (Figure 2), and c) as scattered disseminated grains, often coarse and highly corroded especially when surrounded by BMS (Figure 3). Occasional euhedral grains with sharp boundaries (see Figure 1) are present, other grains show fracturing and replacement by BMS (Figure 4).

A fourth texture which is present in only a few sections is illustrated in Figures 5 and 6. Secondary pyrite shows penetration along fractures and grain boundaries in magnetite or pyrrhotite. This texture is likely due to late stage sulphidization.

Sphalerite is the major base metal sulphide and averages between 8% and 10% of the total sulphides in the suite. It is usually honey-brown in colour (Figure 7) with an FeS content of about 23% (≡ 14.6% Fe). This was determined by measuring its unit cell by x-ray powder diffraction (Debye-Scherrer camera) and using the plot from Skinner et al's paper* of unit cell versus wt% FeS. This single measurement should be confirmed by other means, especially by electron probe analysis, if a more reliable Fe content is required for metallurgical balance purposes.

It forms mutual boundary relationships with galena, especially in the common "network" textures observed in type G and GE ores. Figure 8 illustrates the pervasive nature of sphalerite/galena throughout granular barite in sample 87V-17 at 27.0. The corrosive nature of the galena/sphalerite is also illustrated in the irregular pyrite rims in the photomicrographs.

In addition to its intimate, fine grained association with galena (Figure 8) and pyrite (Figure 2), sphalerite may also be intimately intergrown with gangue (Figure 9). Overall, its association at the 200 mesh size (Table 2) shows about 40-45% liberated grains, ~ 20% associated as composite grains with each of pyrite and gangue, and 10% with galena.

* Effect of FeS on the Unit Cell Edge of Sphalerite: A. Revision. B.J. Skinner, P.B. Barton Jr., G. Kullerud. Econ. Geol. Vol 54. P. 1040 1959.

A few sections only display fine exsolution chalcopyrite in sphalerite (Figure 10). For the most part, the sphalerite is not "diseased" and should produce a low copper-bearing zinc concentrate.

Galena, the next most abundant BMS, averages between 4% and 5% for the total sample suite. It displays textures similar to those of sphalerite including intergranular patches within pyrite and gangue and replacement blebs in pyrrhotite (Figure 6) and magnetite (Figure 11). Figure 12 illustrates typical streaky development of galena along grain boundaries in gangue and Figure 13 is a galena/sphalerite rich sample enclosing rounded and corroded grains of pyrite and gangue.

By comparison to sphalerite, galena is generally finer grained and hence less liberated (< 30%) at the nominal 200 mesh size. Overall it is associated mainly with gangue (25-30%), pyrite and sphalerite (~20%). It forms more replacement textures after pyrite than sphalerite (see Figure 9) and rarely contains fibrous gangue as illustrated in Figure 14. This texture was seen in only a few sections and is not representative of the gangue/galena relationship.

Chalcopyrite forms just over ~ 1% of the total sulphides. It occurs mainly with galena, often as intergranular streaks and patches in pyrite or gangue (see Figures 12, 15 and 16). Similar to galena, it is ~30% liberated at 200 mesh and would form composite grains mainly (< 30%) with pyrite and gangue. Less than 10% is closely associated with sphalerite, rarely as fine exsolution blebs as illustrated in Figure 10.

Pyrrhotite/Marcasite.Fresh pyrrhotite occurs in similar relationships to the other base metal sulphides (Figures 6, 16 and 17). Marcasitization of the pyrrhotite ranges from 0% to 100% and starts off as streaky layers formed along basal planes of the pyrrhotite (Figure 17). An example of complete marcasitization is shown in Figure 15 where the intergranular pyrrhotite has been completely altered. Fresh pyrrhotite, accompanied by sphalerite and galena has penetrated fractured pyrite in Figure 4.

Arsenopyrite occurs in 36 of the 82 samples examined. It generally occurs in amounts of less than 1/2% but one sample 87V-07 at 45.3 contains more than 10%. It is generally subhedral to euhedral (Figures 15 and 18) and is often enclosed by or attached to pyrite. The very coarse grains illustrated in Figure 18 (sample 87V-05 at 94.4) are less common than the smaller blocky grains in Figure 15 (sample 87V-25 at 244.9).

Magnetite forms almost 4% of all opaque minerals in the suite. It is invariably blocky, usually coarse grained and often replaced by sphalerite, galena, marcasite or secondary pyrite (Figures 5, 11, 17 and 19). It is interstitial to blocky pyrite and is often fractured and penetrated by gangue (Figures 17 and 19).

Tetrahedrite occurs in trace amounts only in 8 sections. It occurs with chalcopyrite and galena in textures indicative of mutual boundary relationships. The grain size of the tetrahedrite is generally small as illustrated in Figure 20. The sample with the highest content of tetrahedrite (< 1%) is 87V-09 at 134.5.

Native Gold/Electrum

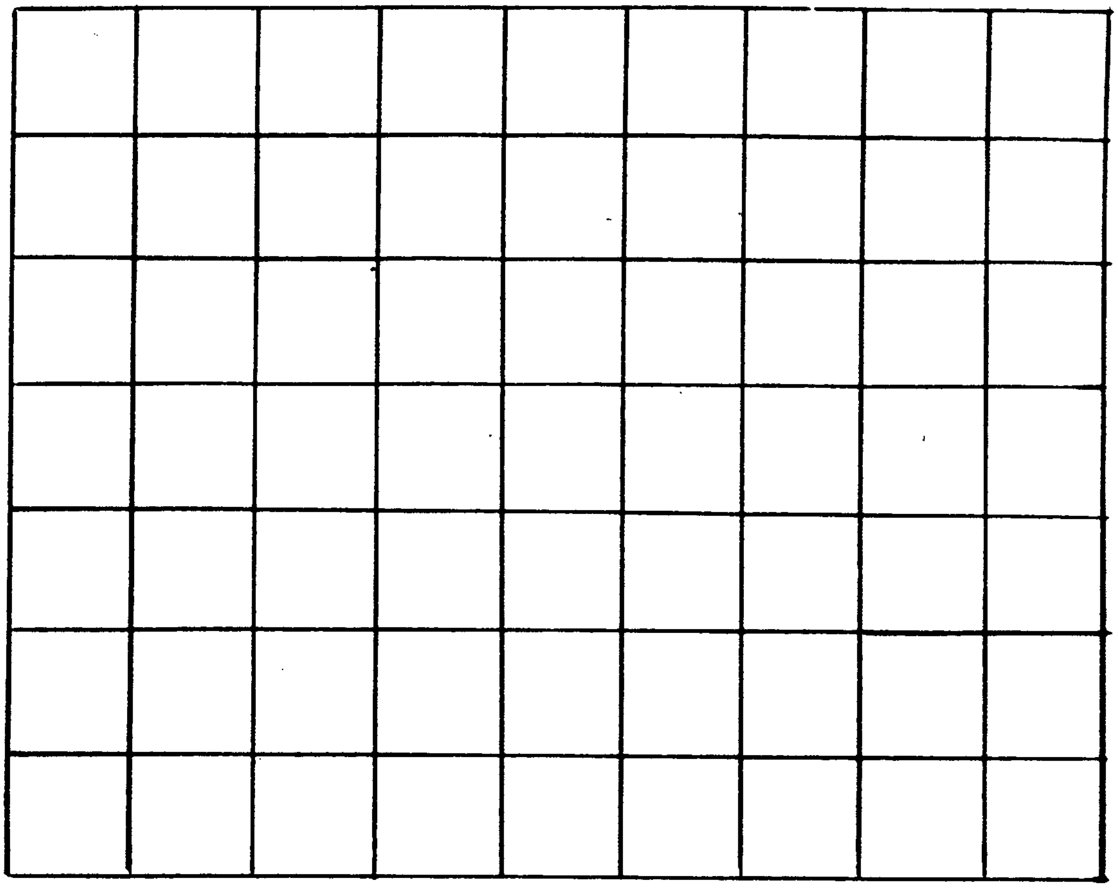
Seven sections contain a total of 10 particles of native gold or electrum. The largest of these, measuring about 17 x 17 μm, is illustrated in Figure 22. On average, the grains measure about 6 x 4 μm. Only two grains are dark enough to be considered native gold, the others likely have a higher content of silver which gives them a pale yellow colour. The typical occurrence of electrum/native gold is illustrated in Figure 21 where it occurs with chalcopyrite ± galena along narrow grain boundaries in massive or semi-massive pyrite.

Gangue Minerals. Of the 11 samples examined in pol-thin section, six were classified in the field as type 4A4, sulphide-bearing, ribbon banded, graphitic quartzites. In pol-thin section, however, the black streaky schist plane material does not consist of crystalline graphite and should properly be called carbonaceous. The sheared quartzite consists mainly of granular quartz with warped layers of muscovite and occasional granular carbonate. Figure 23 illustrates a deformation zone or kink band of muscovite with heavily strained and granulated quartz.

Sections cut from the G-type or baritic samples all have barite as the major gangue component. It is usually coarse grained and blocky and is accompanied by carbonate and quartz. Ten other samples of G-type were checked positively for barite content by x-ray powder diffraction. From pol-thin section examination and x-ray diffraction analysis, no talc was identified in the samples. Traces only of chlorite were noted in one sample (87V-09 at 211.2).

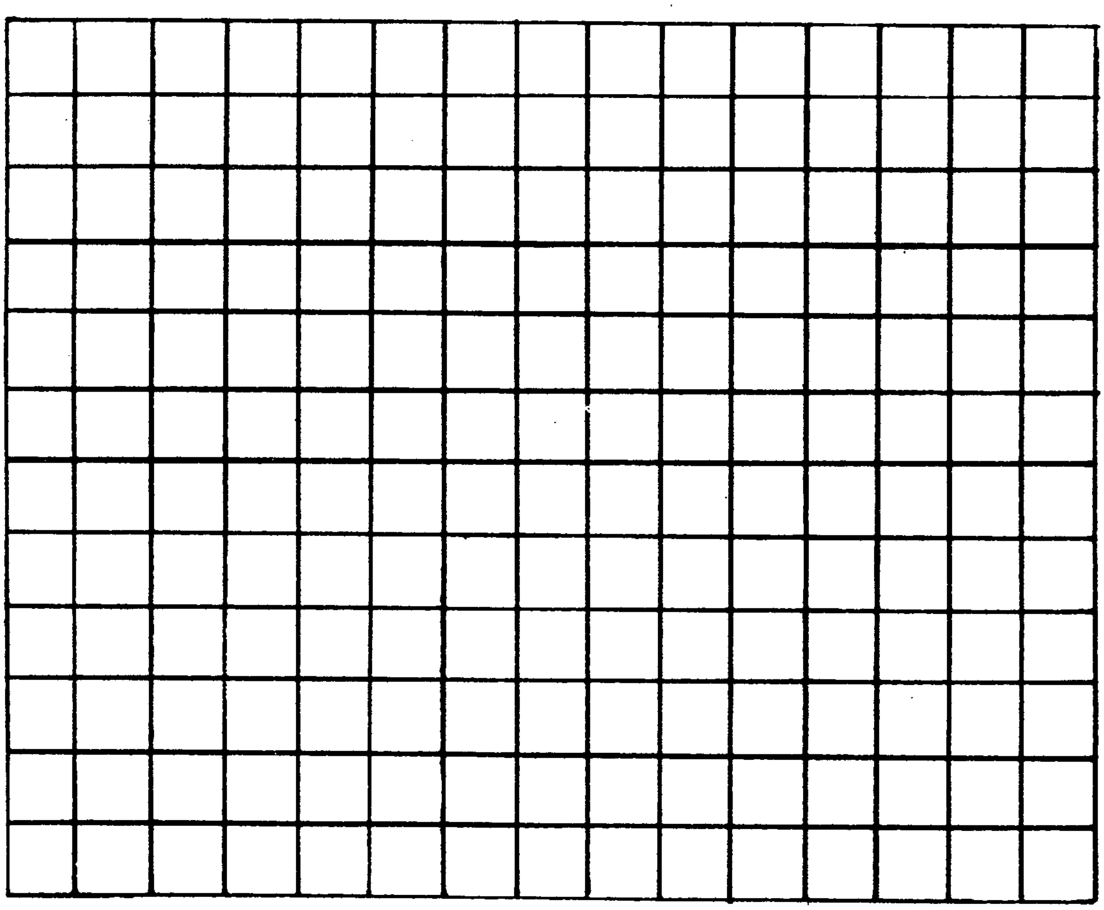
<u>"Weathered" or "Oxidized" samples</u>. Twelve samples were annotated as 'weathered', 'oxidized' or 'sandy'. In each case the polished section appearance was similar, with porous areas throughout the gangue as illustrated in Figure 24. It is apparent that one of the gangue constituents has been weathered, leaving solution pores throughout the ores. Examination of one of the partly weathered grains by x-ray diffraction revealed that it consists of barite.

No evidence of surface weathering of any of the ore minerals occurs in any of these samples so that metallurgical treatment should not be affected by secondary coatings such as covellite.



200 MESH

TEMPLATE FOR PHOTOMICROGRAPHS AT X200 MAGNIFICATION



325 MESH

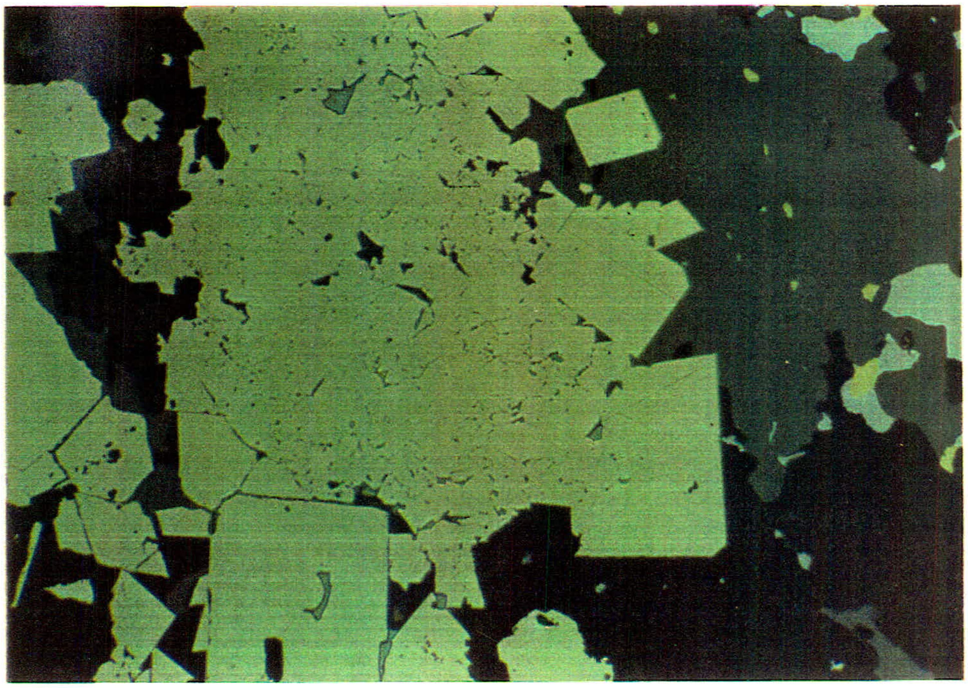


Figure 1 PS 1556
Sample 87V-09 at 99.0
Mag. X 220
Example of two varieties of pyrite, a medium grained euhedral to subhedral variety and an aggregate of densely packed anhedral grains. Within the latter, extremely fine intergranular particles of galena and chalcopyrite are present. Coarse sphalerite encloses blebs of galena, chalcopyrite and gangue.

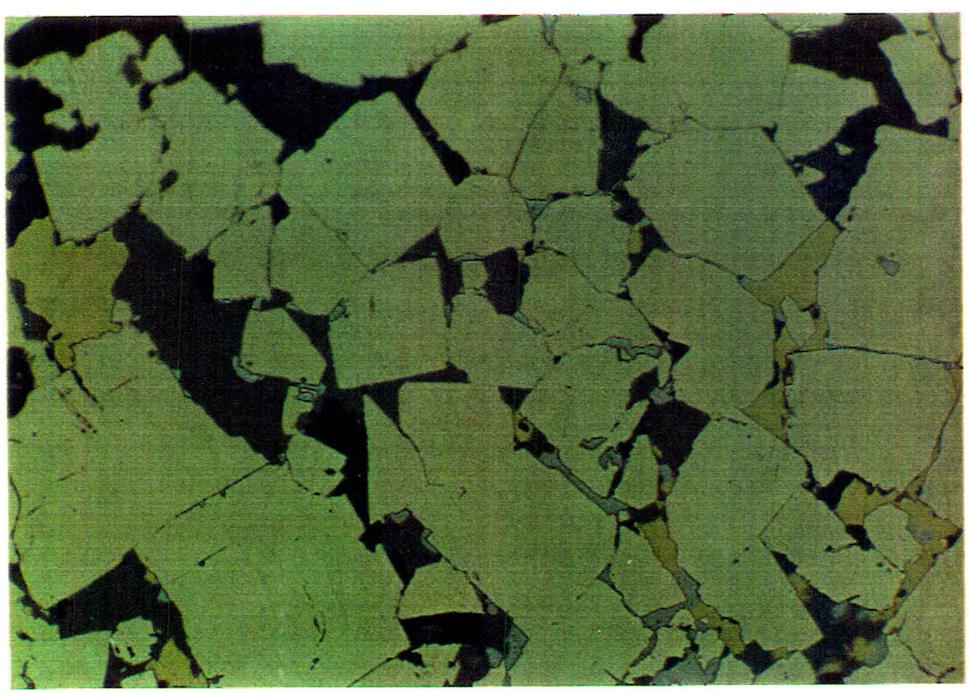


Figure 2 PS 1548
Sample 87V-25 at 180.4
Mag. X 220
Typical example of close-packed granular subhedral to anhedral pyrite. Interstitial base metal sulphides are generally fine grained.

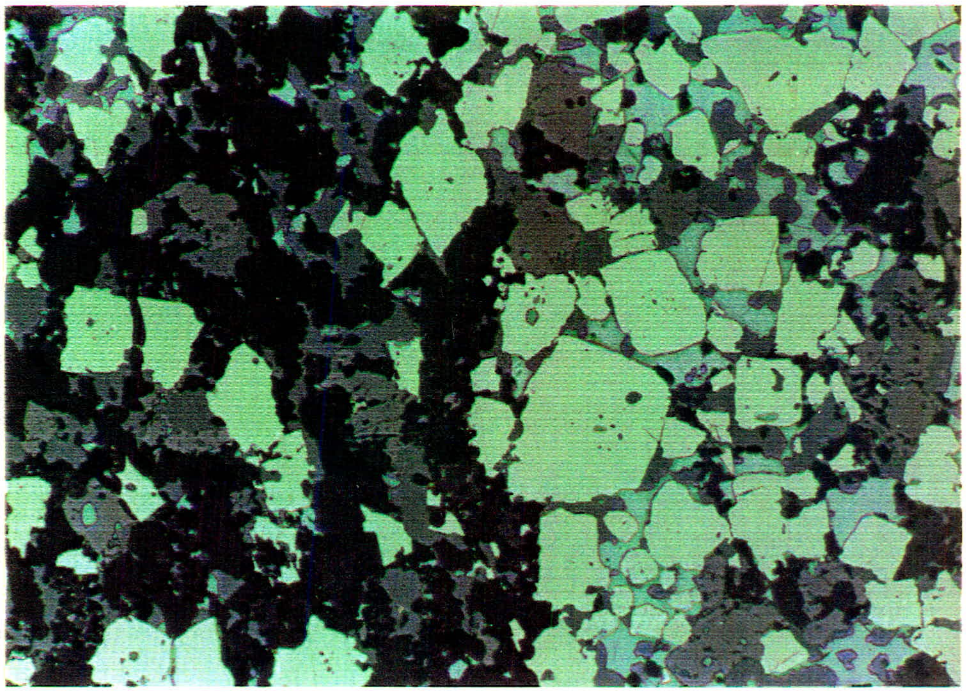


Figure 3 PS 1547
Sample 87V-10 at 170.0
Mag. X 55
Low magnification photomicrograph shows the contact between two types of mineralization. On the left, granular disseminated pyrite and magnetite are both highly corroded by galena and sphalerite. On the right, the gangue component is minor and the matrix to granular pyrite and magnetite consists mainly of galena with lesser sphalerite.

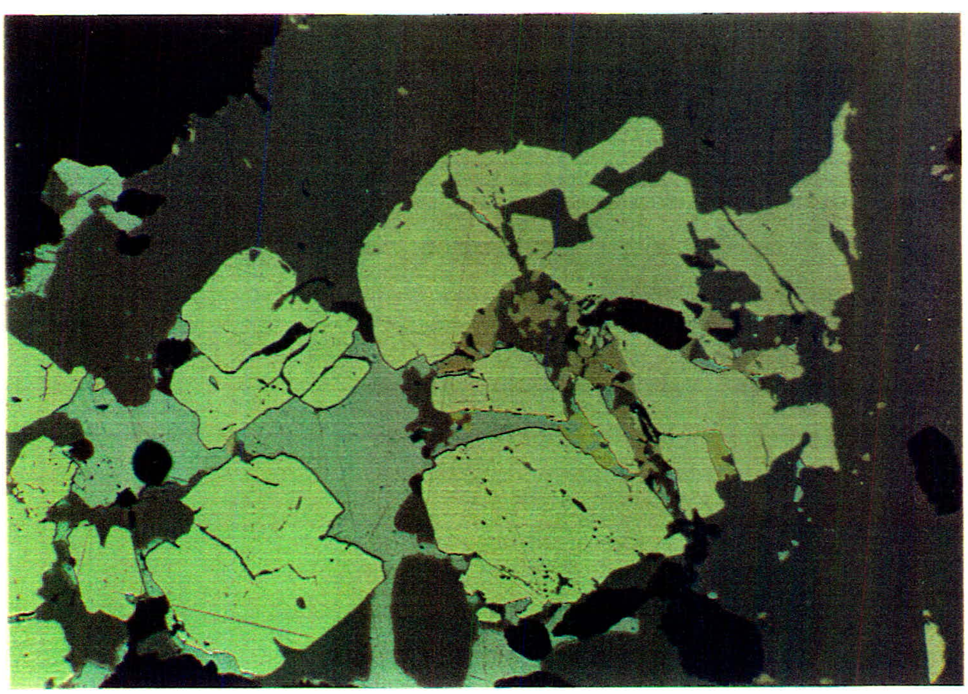


Figure 4 PS 1580
Sample 87V-01 at 118.4
Mag. X 220
Massive coarse sphalerite encloses corroded grains of pyrite. Interstitial to the pyrite is medium to fine grained galena and fine grained pyrrhotite and chalcopyrite.

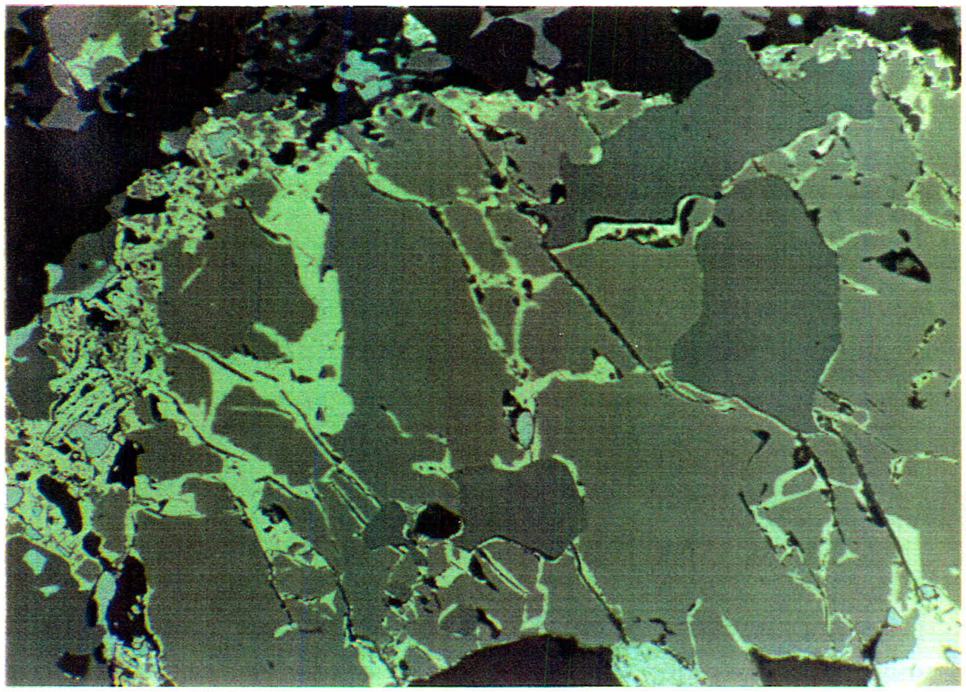


Figure 5 PS 1588
Sample 87V-10 at 193.3
Mag. X 220

Coarse magnetite displays a texture noted only rarely. Replacement blebs of sphalerite and galena are quite common, but the later penetration by secondary pyrite is quite unusual. Marcasite after pyrrhotite is also present within the magnetite.

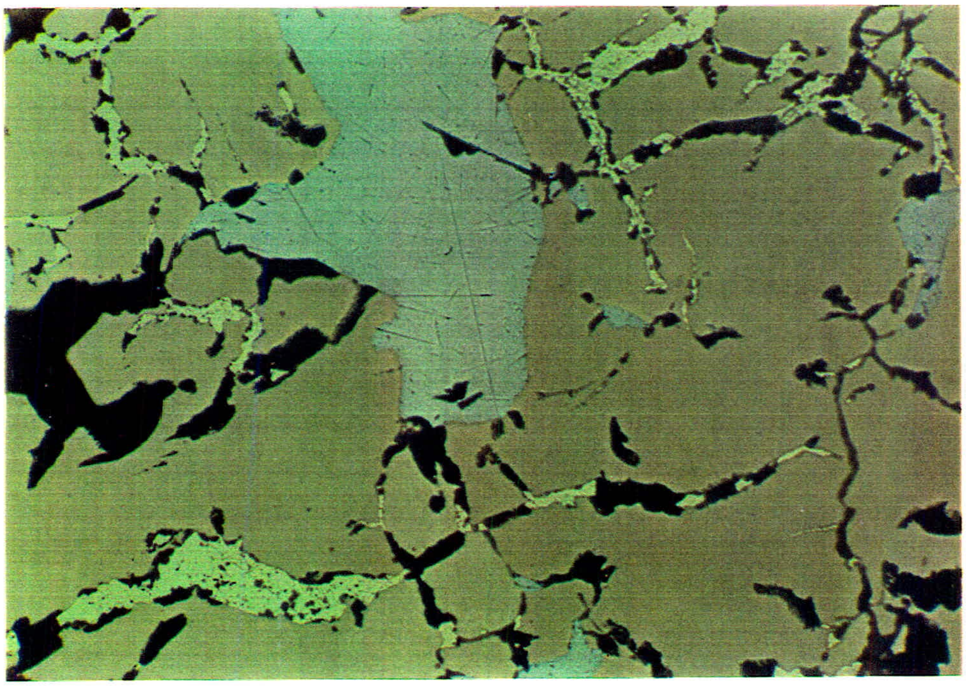


Figure 6 PS 1595
Sample 87V-01 at 174.2
Mag. X 220

Massive pyrrhotite is transected by narrow streaks of marcasite and secondary pyrite. Galena also shows late penetrative relationships into the pyrrhotite.

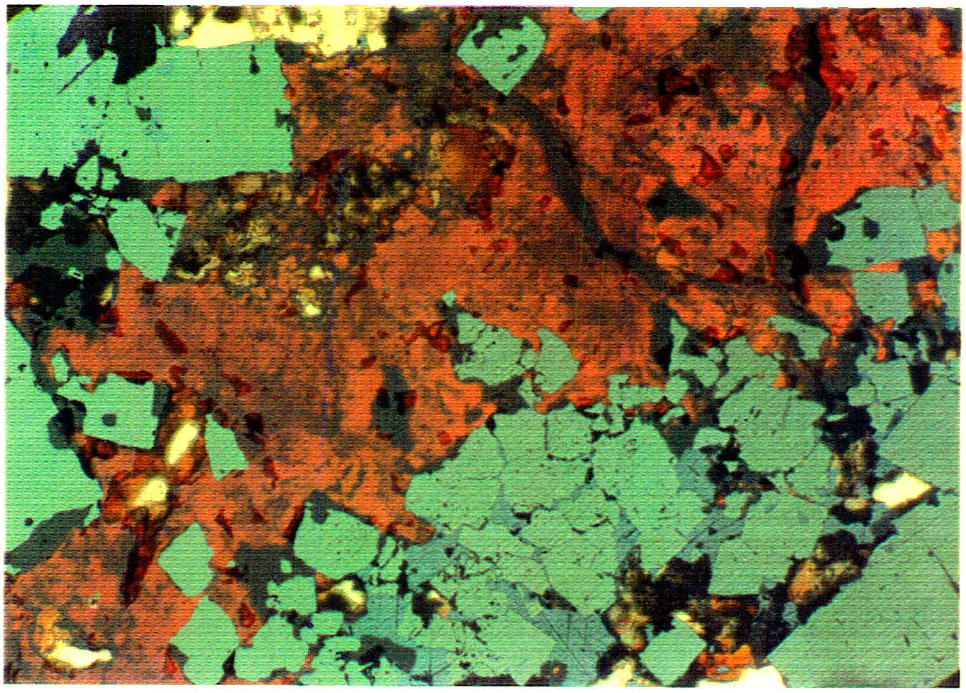


Figure 7 PTS 548
Sample 87V-22 at 53.8
Mag. X 220
This photomicrograph is taken in simultaneous incident and transmitted plane light to illustrate the translucent brown colour of the coarse sphalerite. Galena cements and replaces grains of subhedral to anhedral pyrite.

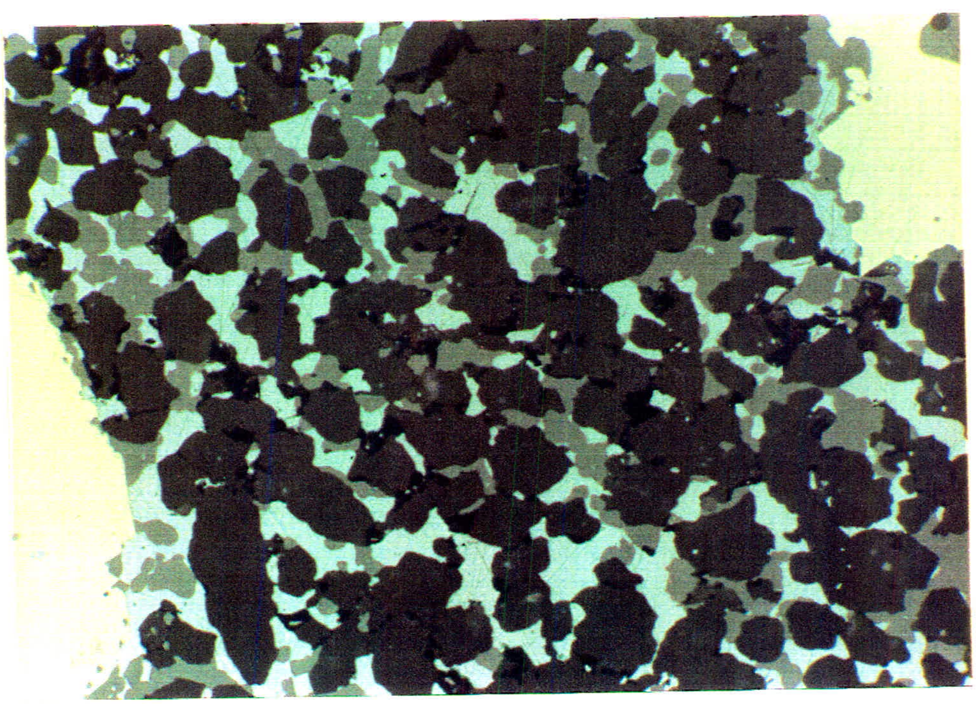
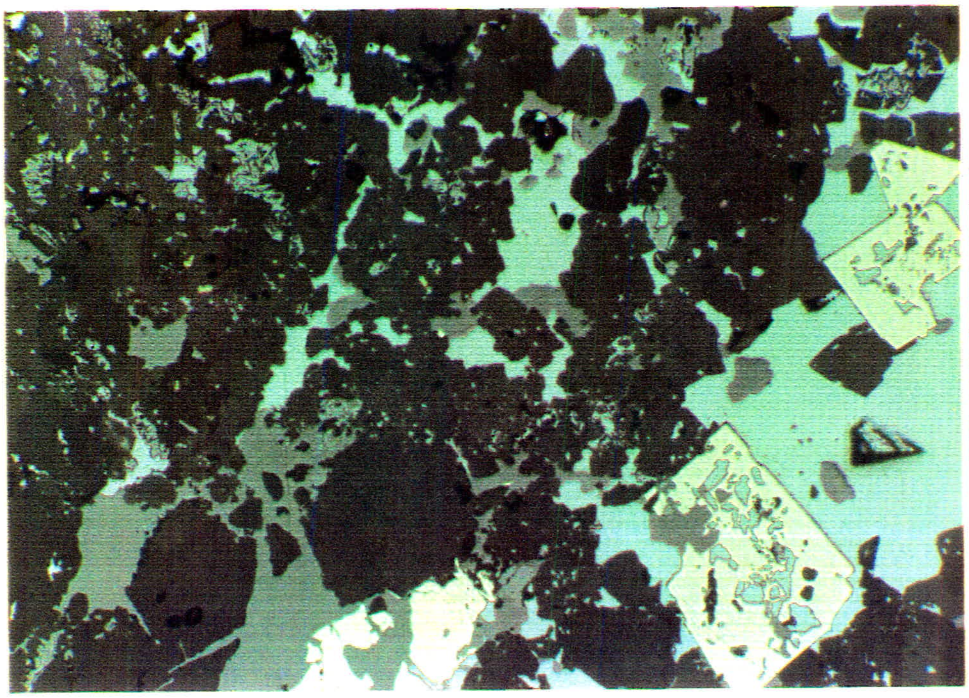
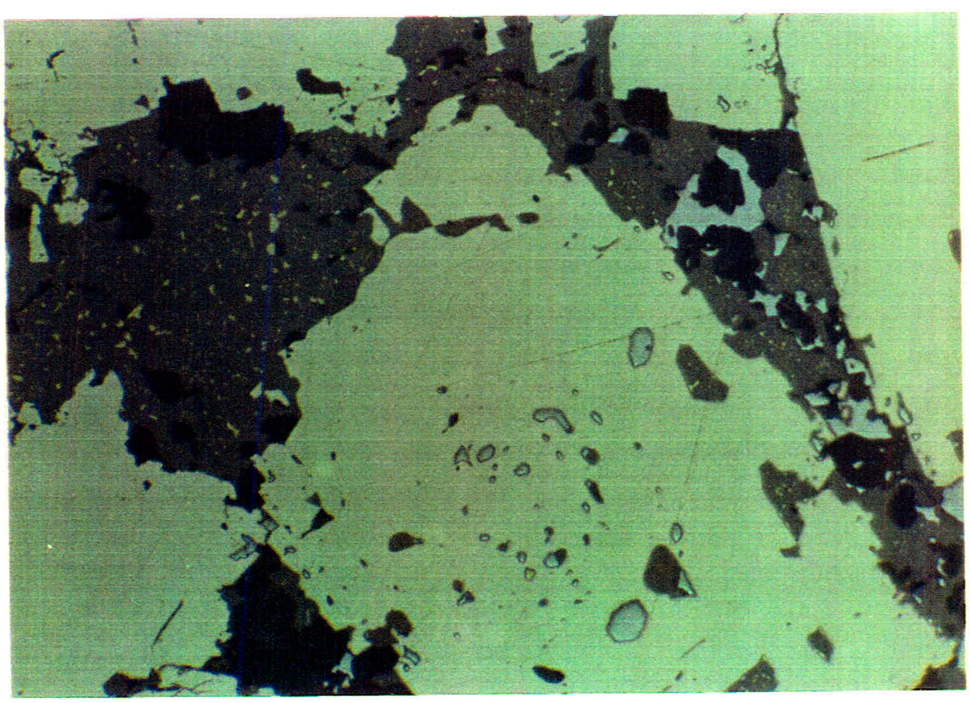


Figure 8 PS 1569
Sample 87V-17 at 27.0
Mag. X 220
Excellent example of network sulphides (galena, sphalerite) forming the matrix to granular gangue. Both grains of pyrite show typical corroded edges in contact with the base metal sulphides.



<u>Figure 9 PS 1543</u>
<u>Sample 87V-27 at 25.4</u>
<u>Mag. X 220</u>
Example of highly replaced subhedral pyrite grains by sphalerite and galena. The photomicrograph also illustrates extremely fine grained base metal sulphides, especially galena, in gangue.



<u>Figure 10 PS 1531</u>
<u>Sample 87V-22 at 43.6</u>
<u>Mag. X 220</u>
Example of unusually high chalcopyrite exsolution blebs in sphalerite. The coarse, highly corroded pyrite contains abundant small inclusions of galena and sphalerite/chalcopyrite.

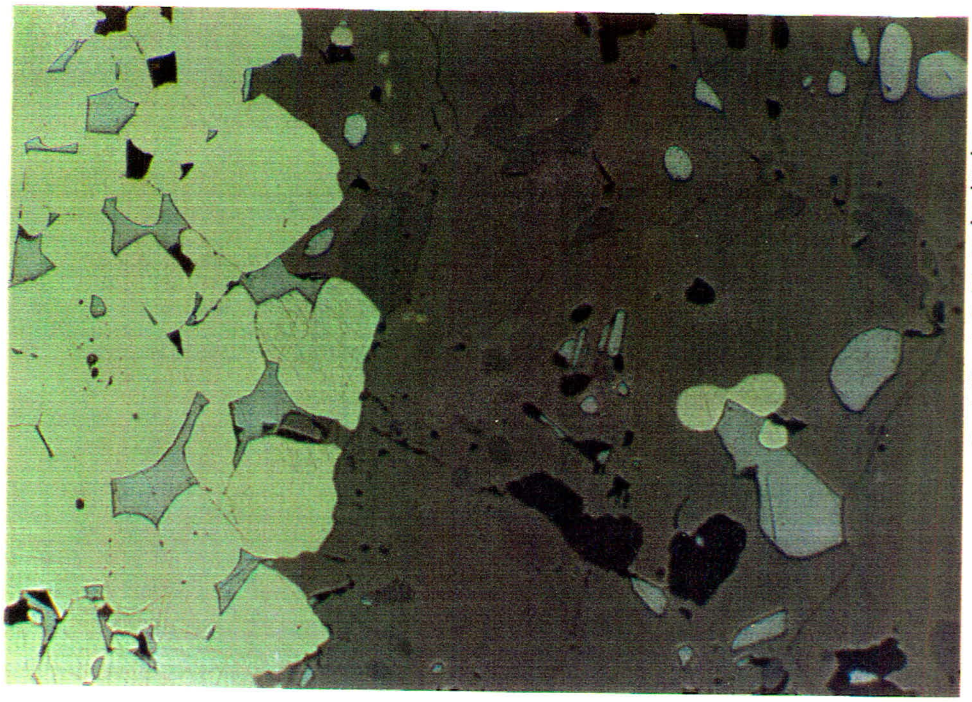


Figure 11 PS 1551
Sample 87V-05 at 89.8
Mag. X 220
Massive granular magnetite is partly replaced by blebs of sphalerite and galena. It is typically intergranular to the pyrite which in this area is fine to medium grained subhedral granular with interstitial galena.

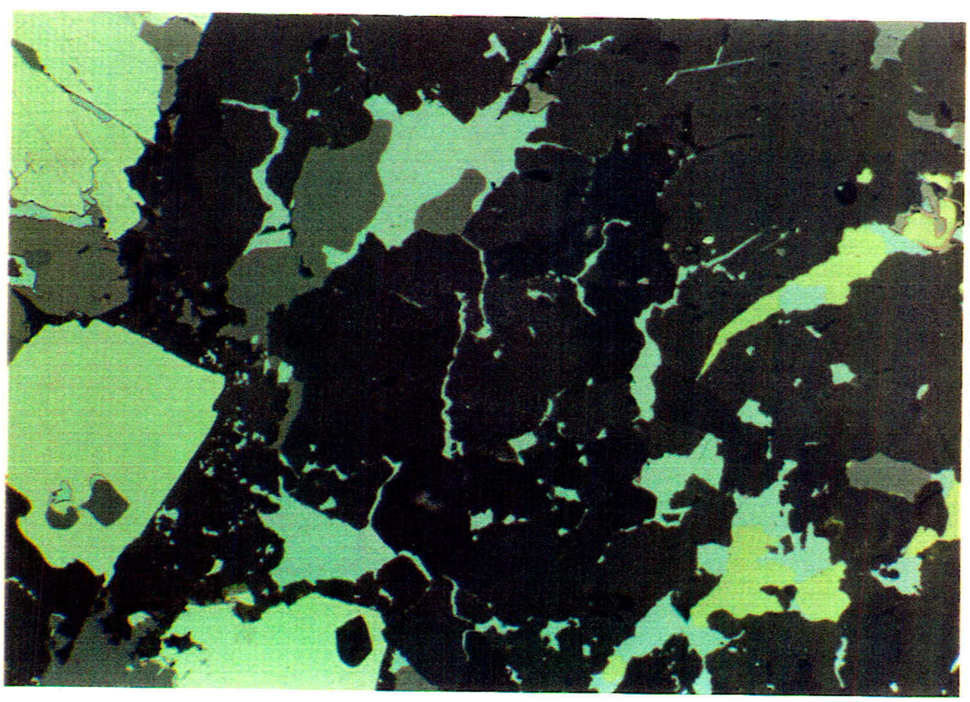


Figure 12 PS 1547
Sample 87V-10 at 170.0
Mag. X 220
Extremely fine streaks of galena have permeated along grain boundaries in gangue. Other disseminated patches consist of galena ± sphalerite ± chalcopyrite. Blocky pyrite is corroded in contact with the base metal sulphides.

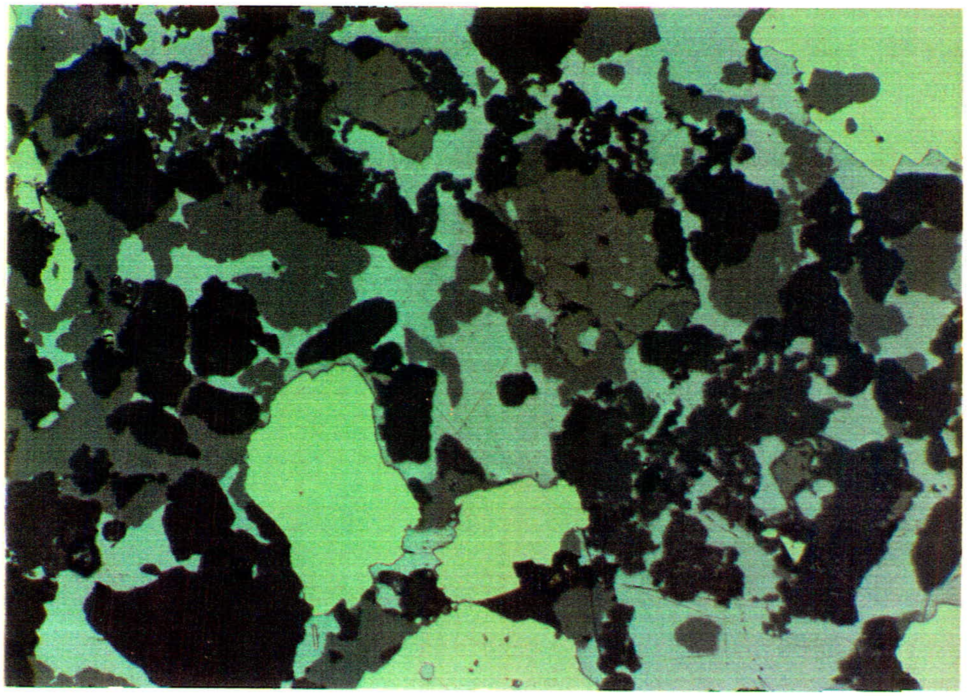


Figure 13 PS 1583
Sample 87V-02 at 77.5
Mag. X 220
Rounded fragments of gangue, corroded grains of pyrite and irregular grains of magnetite are enclosed in a massive galena/sphalerite matrix.

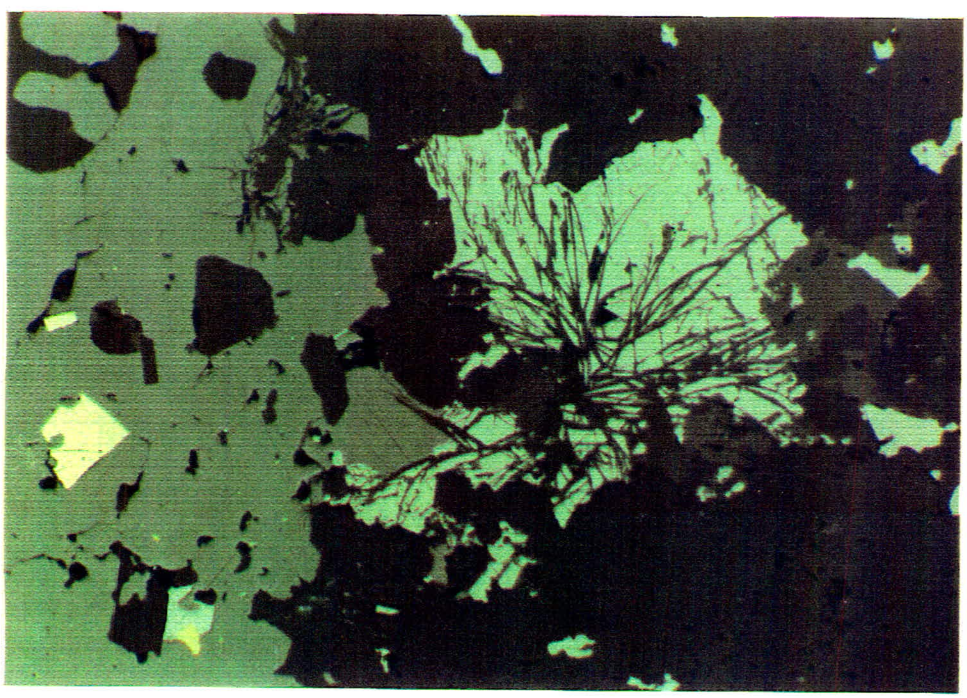


Figure 14 PS 1580
Sample 87V-01 at 118.4
Mag. X 220
Only a few samples contain this type of galena - fibrous gangue intergrowth. Sphalerite is quite massive, containing scattered grains of gangue and other sulphides.

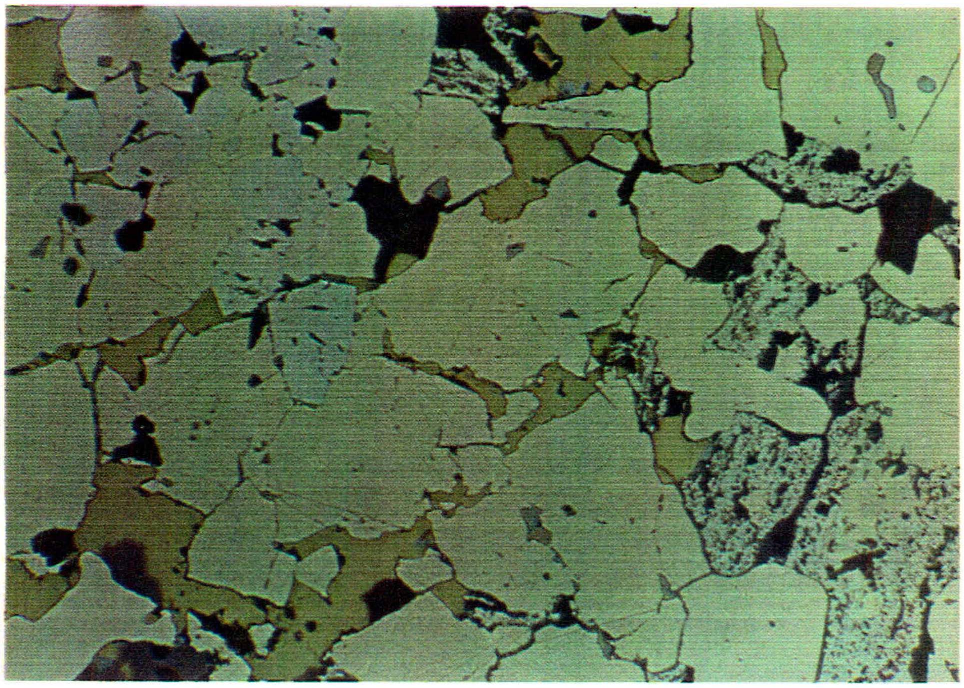


Figure 15 PS 1563
Sample 87V-25 at 244.9
Mag. X 220

Small subhedral arsenopyrite grains occur with corroded pyrite. Chalcopyrite and marcasite (after pyrrhotite) are the main intergranular sulphides.

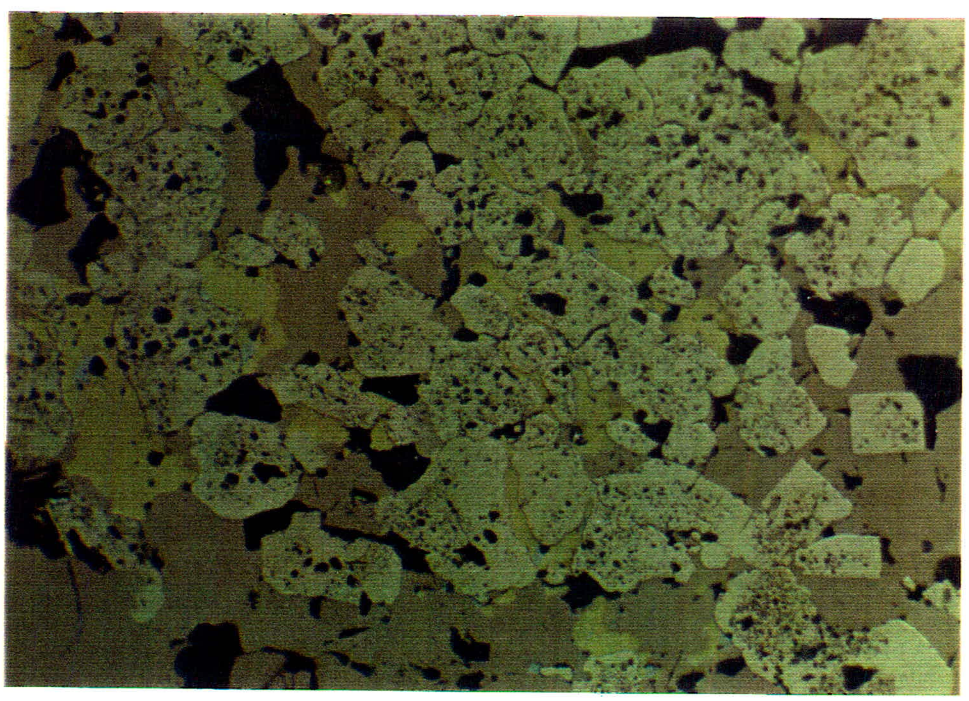


Figure 16 PS 1587
Sample 87V-09 at 258.1
Mag. X 220

The granular pyrite in this section is particularly porous and filled with gangue inclusions. It is set in a matrix of pyrrhotite and chalcopyrite.

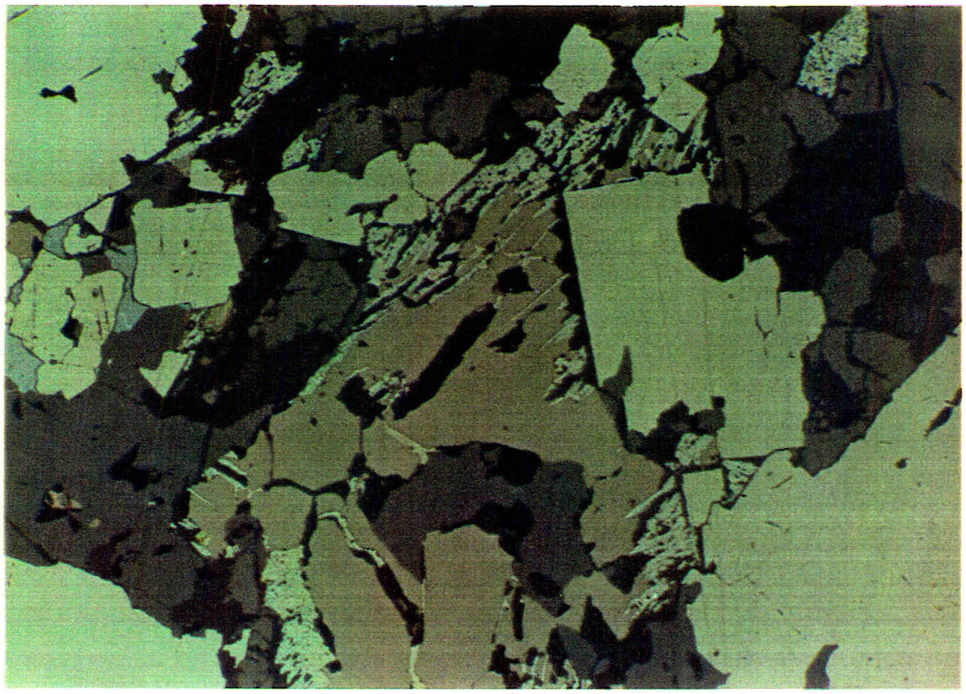


Figure 17 PS 1532
Sample 87V-06 at 168
Mag. X 220
Subhedral to corroded pyrite, blocky intergranular magnetite, marcasite development in patches and streaks throughout the pyrrhotite, and later penetration by sphalerite and galena are all illustrated.

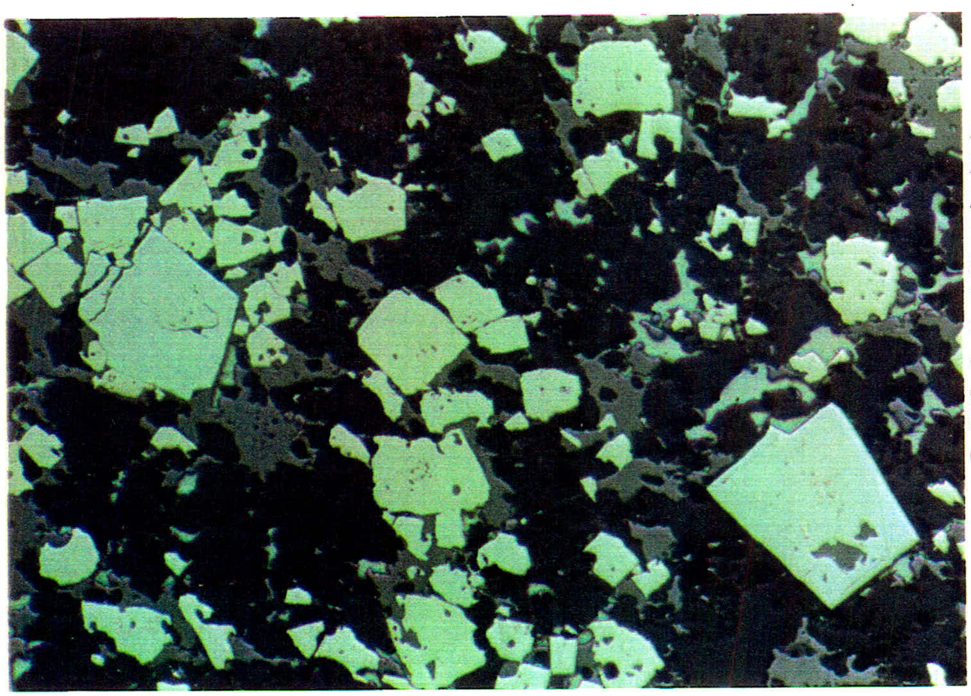
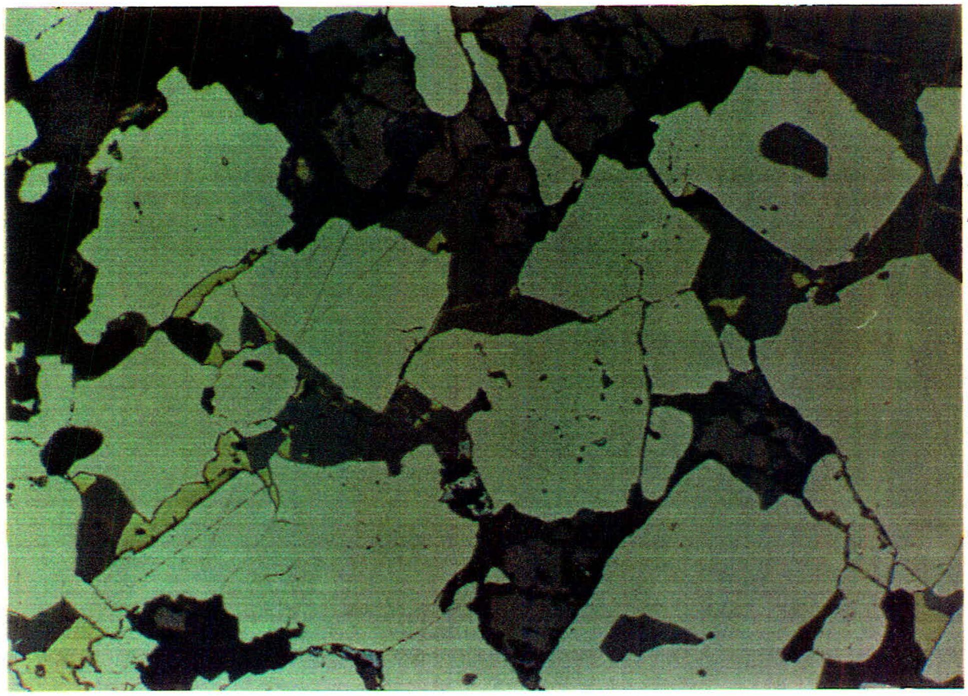
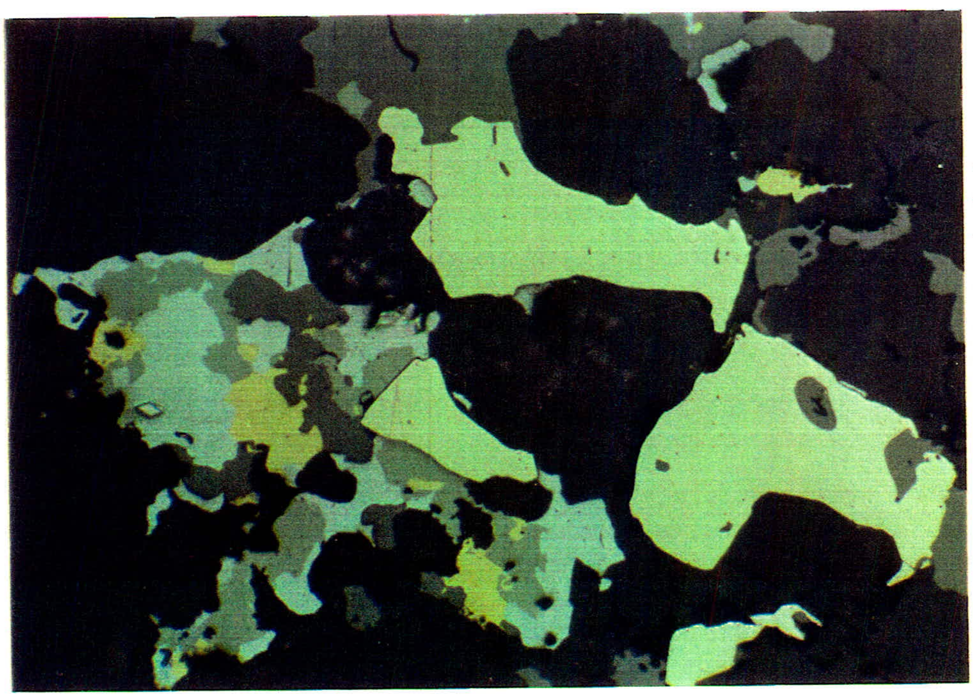


Figure 18 PS 1568
Sample 87V-05 at 94.4
Mag. X 55
Low magnification photomicrograph taken to show the coarse subhedral arsenopyrite crystals which occur with smaller grains of generally corroded pyrite. Both occur in a typical network of sphalerite and galena.



<u>Figure 19 PS 1563</u>
<u>Sample 87V-25 at 244.9</u>
<u>Mag. X 220</u>
Coarse blocky pyrite is generally corroded and blocky grains of intergranular magnetite appear to be partly replaced by gangue. Sphalerite is the major intergranular sulphide with chalcopyrite and rare galena forming along narrow zones between pyrite grains.



<u>Figure 20 PS 1582</u>
<u>Sample 87V-11 at 195.0</u>
<u>Mag. X 220</u>
Corroded grains of pyrite occur with intergranular patches of sphalerite, galena, chalcopyrite and tetrahedrite. The latter shows mutual boundary relationships with the other base metal sulphides.

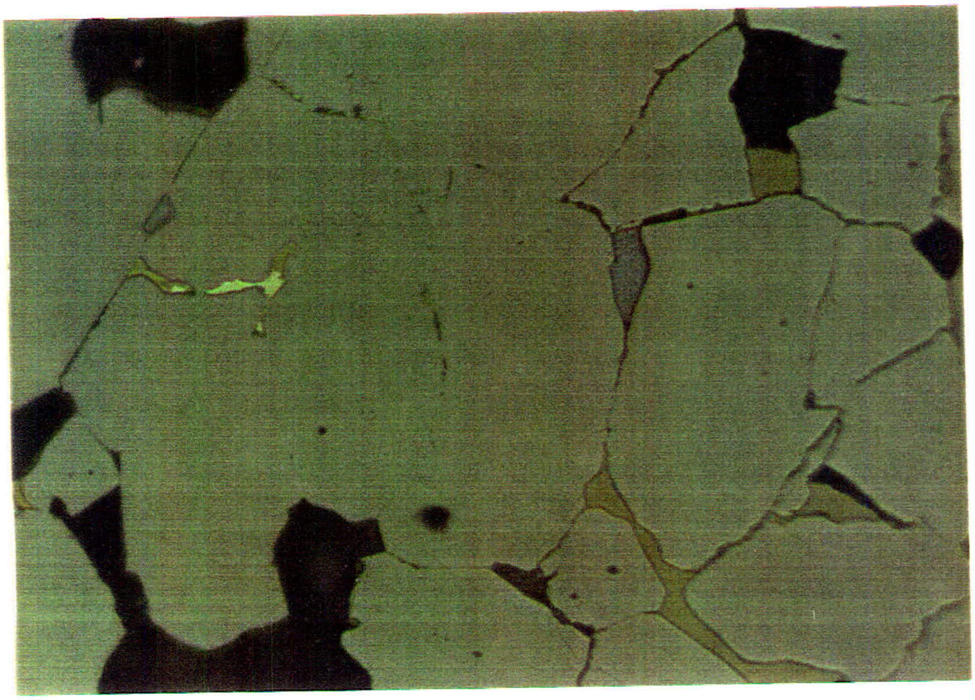


Figure 21 PS 1562
Sample 87V-09 at 99.0
Mag. X 550
Narrow intergranular streaks and patches of sulphides within densely packed pyrite grains consist of chalcopyrite, galena and electrum. The latter is associated with chalcopyrite in very fine (2-3 μm wide) streaks.

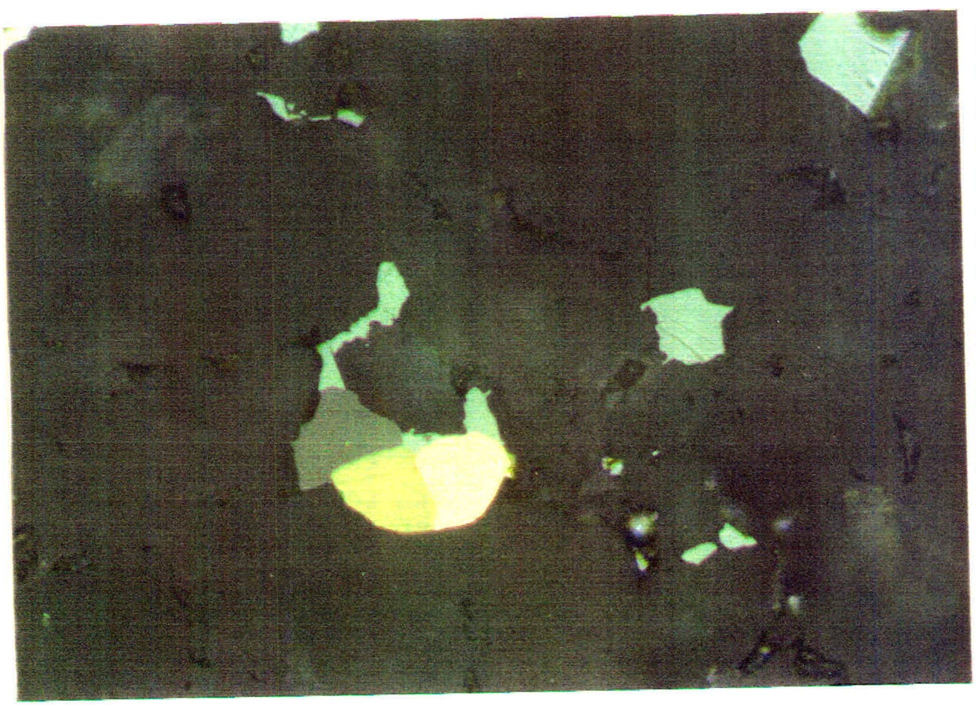
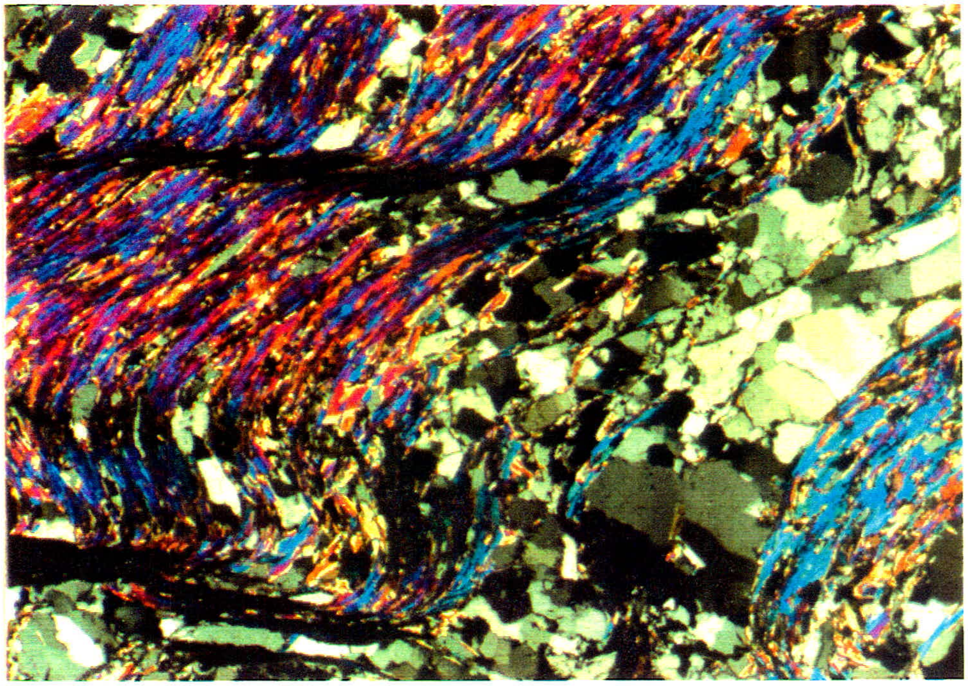
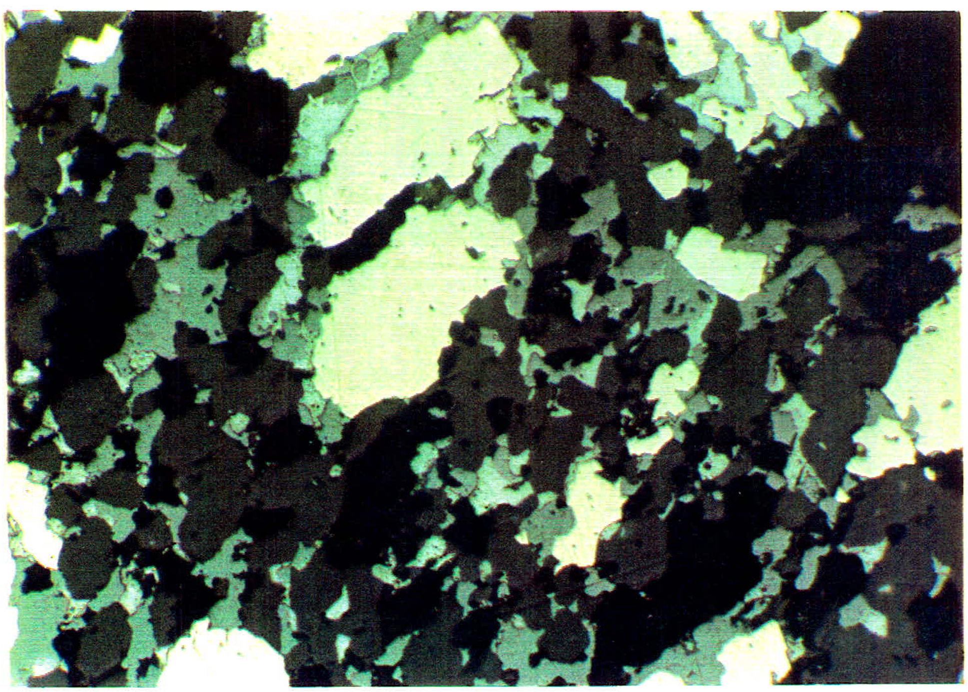


Figure 22 PS 1565
Sample 87V-25 at 129.4
Mag.X 550
A composite bleb in gangue consists of sphalerite, chalcopyrite, galena and electrum. This is the largest grain of electrum noted in the sample suite. It measures approximately 17 μm diameter. Other disseminated sulphide grains in the photomicrograph consist of galena.



<u>Figure 23 PTS 545</u>
<u>Sample 87V-10 at 82.5</u>
<u>Mag. X 55</u>
Warped muscovite and heavily strained and granulated quartz is indicative of deformation in the argillaceous host rock.



<u>Figure 24 PS 1530</u>
<u>Sample 87V-19 at 24.1</u>
<u>Mag. X 220</u>
Black patches throughout the photomicrograph represent holes in the section. From its x-ray diffraction pattern, the gangue consists of barite only so these are likely solution pores in the weathered sample. Corroded pyrite and network sphalerite/galena occur in typical textures.

Table No. 1 - Estimates of Average Opaque Mineral Proportions in Various Ore Types

Ore Type	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Total
A	7	10 1/2	4 1/2	1 1/2	5	1 1/2	1	31
C	16	2	2	2	8	1	4	35
E_1	48	2	1	1 1/2	3 1/2	-	3	59
E_2	37 1/2	13	7	1 1/2	4	1	4 1/2	68 1/2
Œ	27	13 1/2	6 1/2	1/2	3	-	4 1/2	55
G	15	12	7	1	2	-	6	43
Total 82 Samples	28	8 1/2	4 1/2	1 1/2	4	1/2	4	51

<u>Table 2 - Estimated Ore Mineral Liberation Characteristics at 200 mesh</u>

Ore Type (# of Samples)	Sphalerite						Galena						Chalcopyrite					
	Free	associated with:					Free	associated with:					Free	associated with:				
		Py	Ga	Gal	Cp	Po Mag		Py	Ga	Sph	Cp	Po Mag		Py	Ga	Sph	Gal	Po Mag
A (12)	55	4	30	7	-	3	39	4	31	22	1	3	64	4	25	1	6	-
C (8)	46	10	32	3	-	8	45	14	32	2	1	6	45	27	22	2	1	3
E_1 (22)	30	42	19	4	2	2	18	47	25	6	3	1	18	54	23	3	1	1
E_2 (13)	46	22	21	9	1	1	26	34	23	16	-	1	24	50	14	9	2	1
GE (13)	45	5	25	21	-	4	25	8	31	33	-	3	31	10	40	11	1	7
Gr (14)	54	4	20	20	-	2	29	5	33	30	-	3	27	2	40	25	4	2
Total (82)	44	18	23	10 1/2	1/2	3	28	22	28	18	1	2 1/2	32	27 1/2	27	8 1/2	2 1/2	2

Table 3 - Ore Type 'A' - Estimated Mineral Proportions in PS or PTS

Sample	Field Class	PS or PTS #	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Tet	Au Elect	Qtz	Musc	Barite	Carb.	Chl
87V-01 at 118.4*	4D48	1580	14	15	5	1	5	2	3	-	-	-	-	-	-	-
87V-01 at 174.2*	4D348	1595	6	10	10	3	18	Tr	13	-	-	-	-	-	-	-
87V-05 at 136.7	4A4	PTS544	12	10	4	-	Tr	-	-	-	-	60	12	-	2	-
87V-07 at 31.5	4A4	PTS540	10	10	3	2	12	3	-	-	-	36	9	-	15	-
87V-09 at 99.0	4A4	1556	6	8	4	1	Tr	1	-	-	-	-	-	-	-	-
87V-10 at 82.5	4A4	PTS545	4	11	3	-	Tr	2	-	-	-	60	20	-	-	-
87V-11 at 85.0	4A4	PTS547	20	9	4	1	-	6	-	-	-	50	10	-	-	-
87V-11 at 140.5	4D44	1605	1	18	8	Tr	11	2	-	Tr	-	-	-	-	-	-
87V-20 at 76.7	4A4	1560	10	8	3	4	Tr	-	-	-	-	-	-	-	-	-
87V-27 at 101.5	4A4	PTS543	5	8	1	3	15	-	-	-	-	43	20	-	5	-
87V-27 at 109.5	4A4	1554	5	10	3	1	-	1	-	-	-	-	-	-	-	-
87V-27 at 211.5	4A4	PTS539	10	10	6	1	-	2	-	-	-	68	4	-	1	-
Average (12)			7	10 1/2	4 1/2	1 1/2	5	1 1/2								

* not strictly A type since the samples do not have carbonaceous schist layers. They are likely true 'D' type samples according to field classification.

Table 3A - Ore Type 'A' Estimated Ore Mineral Liberation Characteristics at 200 mesh

	Sphalerite						Galena						Chalcopyrite					
		associated with:						associated with:						associated with:				
Sample	Free	Py	Ga	Gal	Cp	Po Mag	Free	Py	Ga	Sph	Cp	Po Mag	Free	Py	Ga	Sph	Gal	Po Mag
87V-01 at 118.4	65	5	10	10	-	10	25	5	40	20	-	10	-	-	-	-	-	
87V-01 at 174.2	70	5	10	10	-	5	65	5	10	15	-	5	65	5	20	-	10	-
87V-05 at 136.7	75	5	20	-	-	-	70	5	25	-	-	-	-	-	-	-	-	-
87V-07 at 31.5	40	5	50	5	-	-	20	5	25	50	-	-	75	5	10	5	5	-
87V-09 at 99.0	45	5	45	5	-	-	35	5	50	10	-	-	-	-	-	-	-	-
87V-10 at 82.5	60	5	30	5	-	-	30	5	55	10	-	-	-	-	-	-	-	-
87V-11 at 85.0	55	5	35	5	-	-	50	5	35	10	-	-	-	-	-	-	-	-
87V-11 at 140.5	35	-	20	25	-	20	30	-	25	25	-	20	-	-	-	-	-	-
87V-20 at 76.7	60	5	35	-	-	-	40	5	50	-	5	-	50	5	40	-	5	-
87V-27 at 101.5	50	-	40	5	-	5	20	-	10	55	20	5	65	-	30	-	5	-
87V-27 at 109.5	50	5	30	15	-	-	20	-	20	60	-	-	-	-	-	-	-	-
87V-27 at 211.5	60	5	30	5	-	-	50	5	25	20	-	-	-	-	-	-	-	-
Average	55	4	30	7	-	3	39	4	31	22	1	3	64	4	25	1	6	-

Table No. 4 - Ore Type 'C' - Estimated Mineral Proportions in P.S.

Sample	Field Class.	PS or PTS	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Tet	Au Elect
87V-05 at 201.5	4C08	1567	18	5	Tr	2	15	-	-	-	-
87V-07 at 45.3	4D0	1586	3	5	2	2	3	12	-	-	-
87V-09 at 258.1	4D8	1587	12	1	2	4	15	-	10	-	-
87V-09 at 297.2	4C0	1557	14	1	Tr	2	4	-	2	-	-
87V-14 at 56.8	4D4#8	1607	16	Tr	6	Tr	-	-	-	-	-
87V-14 at 68.1	4E8	1550	22	1	1	3	13	Tr	-	-	-
87V-17 at 62.4	4CD8	1572	18	2	3	3	7	Tr	17	-	-
87V-19 at 106.6	4C0	1576	25	1	Tr	4	9	Tr	-	-	-
Average (8)			16	2	2	2	8	1	4	-	-

Table 4A - Ore Type 'C' Estimated Ore Mineral Liberation Characteristics at 200 mesh

Sample	Sphalerite						Galena						Chalcopyrite					
		associated with:						associated with:						associated with:				
	Free	Py	Ga	Gal	Cp	Po Mag	Free	Py	Ga	Sph	Cp	Po Mag	Free	Py	Ga	Sph	Gal	Po Mag
87V-05 at 201.5	40	25	35	-	-	-	-	-	-	-	-	-	15	75	-	10	-	-
87V-07 at 45.3	65	-	30	5	-	-	60	-	25	5	-	10	75	-	20	5	-	-
87V-09 at 258.1	-	-	-	-	-	-	50	-	35	-	5	10	50	-	35	-	5	10
87V-09 at 297.2	-	-	-	-	-	-	-	-	-	-	-	-	65	5	30	-	-	-
87V-14 at 56.8	-	-	-	-	-	-	35	35	30	-	-	-	-	-	-	-	-	-
87V-14 at 68.1	-	-	-	-	-	-	-	-	-	-	-	-	60	5	30	-	-	5
87V-17 at 62.4	30	5	35	5	-	25	35	20	35	5	-	5	35	30	30	-	-	5
87V-19 at 106.6	-	-	-	-	-	-	-	-	-	-	-	-	15	75	10	-	-	-
Average	46	10	32	3	-	8	45	14	32	2	1	6	45	27	22	2	1	3

Table No. 5 - Ore Type 'E1' - Estimated Mineral Proportions in PS and PTS

Sample	Field Class	PS or PTS #	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Tet	Au Elect.	Qtz	Musc	Barite	Carb	Chl
87V-02 at 121.1	4E46	PTS546	70	Tr	Tr	Tr	-	-	-	-	-	15	-	10	5	-
87V-02 at 142.2	4C3	1558	50	Tr	Tr	2	3	-	-	-	-	-	-	-	-	-
87V-05 at 99.0	4E48	1534	64	4	1	1	6	6	3	Tr	-	-	-	-	-	-
87V-05 at 191.0	4D38	1592	30	4	1	3	3	2	4	-	-	-	-	-	-	-
87V-05 at 238.0	4E18	1545	30	1	-	2	9	-	8	-	-	-	-	-	-	-
87V-05 at 278.8	4D38	1593	33	1	1	3	4	Tr	8	-	-	-	-	-	-	
87V-06 at 155.0	4E0	1561	80	Tr	Tr	3	2	-	-	-	-	-	-	-	-	-
87V-06 at 206.0	4E4	1529	50	1	2	1	-	-	-	-	-	-	-	-	-	-
87V-06 at 258.6	4C0	1559	33	Tr	Tr	2	Tr	-	-	-	-	-	-	-	-	-
87V-07 at 91.6	4E01	1542	50	2	Tr	3	-	Tr	-	-	-	-	-	-	-	-
87V-09 at 194.0	4E08	1562	70	3	1	3	5	-	4	-	Tr	-	-	-	-	-
87V-10 at 189.9	4E01	1541	57	1	1	1	-	Tr	-	-	-	-	-	-	-	-
87V-10 at 221.5	4K4#	1596	33	Tr	6	1	-	-	-	-	-	-	-	-	-	-
87V-10 at 244.5	4E10	1546	35	1	Tr	4	-	-	-	-	-	-	-	-	-	-
87V-11 at 257.5	4D0	1608	35	4	4	1	6	-	10	-	Tr	-	-	-	-	-
87V-11 at 277.8	4C0789	1555	40	6	2	1	12	-	15	-	-	-	-	-	-	-
87V-14 at 33.5	4C0	1553	50	1	2	2	1	-	-	-	-	-	-	-	-	-
87V-17 at 53.5	4E18	1540	62	1	Tr	2	15	Tr	-	-	-	-	-	-	-	-
87V-19 at 69.7	4E4	1524	70	6	1	1	Tr	-	-	-	-	-	-	-	-	-
87V-19 at 76.5	4D34	1606	35	7	1	1	6	-	-	-	-	-	-	-	-	-
87V-22 at 82.5	4E45	1527	75	Tr	Tr	1	4	-	-	-	Tr	-	-	-	-	-
87V-25 at 117.5	4E48	1535	36	5	4	Tr	3	-	10	-	-	-	-	-	-	-
Average (22)			48	2	1	1 1/2	3 1/2	-	3	-	-	-	-	-	-	-

Table 5A - Ore Type"E1" Estimated Ore Mineral Liberation Characteristics at 200 mesh

Sample	Sphalerite						Galena						Chalcopyrite					
		associated with:						associated with:						associated with:				
	Free	Py	Ga	Gal	Cp	Po Mag	Free	Py	Ga	Sph	Cp	Po Mag	Free	Py	Ga	Sph	Gal	Po Mag
87V-02 at 121.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87V-02 at 142.2	-	-	-	-	-	-	-	-	-	-	-	-	5	95	-	-	-	-
87V-05 at 99.0	45	35	10	5	5	-	10	60	20	5	5	-	5	75	10	5	5	-
87V-05 at 191.0	30	25	40	-	5	-	-	-	-	-	-	-	30	10	45	15	-	-
87V-05 at 238.0	-	-	-	-	-	-	-	-	-	-	-	-	40	-	60	-	-	-
87V-05 at 278.8	-	-	-	-	-	-	-	-	-	-	-	-	50	15	35	-	-	-
87V-06 at 155.0	-	-	-	-	-	-	-	-	-	-	-	-	5	95	-	-	-	-
87V-06 at 206.0	-	-	-	-	-	-	5	80	15	-	-	-	-	-	-	-	-	-
87V-06 at 258.6	-	-	-	-	-	-	-	-	-	-	-	-	10	10	80	-	-	-
87V-07 at 91.6	5	85	5	-	5	-	-	-	-	-	-	-	5	85	5	5	-	-
87V-09 at 194.0	35	60	5	-	-	-	-	-	-	-	-	-	10	85	-	5	-	-
87V-10 at 189.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87V-10 at 221.5	-	-	-	-	-	-	35	20	45	-	-	-	-	-	-	-	-	-
87V-10 at 244.5	-	-	-	-	-	-	-	-	-	-	-	-	30	15	55	-	-	-
87V-11 at 257.5	30	30	30	-	-	10	25	30	40	-	-	5	20	65	10	-	-	5
87V-11 at 277.8	45	45	5	-	-	5	10	60	5	-	25	-	5	80	-	5	5	5
87V-14 at 33.5	25	60	10	-	5	-	35	10	55	-	-	-	15	80	-	5	-	-
87V-17 at 53.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87V-19 at 69.7	30	30	30	5	5	-	10	85	-	5	-	-	25	50	25	-	-	-
87V-19 at 76.5	30	50	15	5	-	-	20	60	15	5	-	-	-	-	-	-	-	-
87V-22 at 82.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87V-25 at 117.5	20	5	40	25	-	10	10	15	35	35	-	5	-	-	-	-	-	-
Average (22)	30	42	19	4	2	2	18	47	25	6	3	1	18	54	23	3	1	1

Table No. 6 - Ore Type 'E2' - Estimated Mineral Proportions from P.S.

Sample	Field Class.	PS or PTS	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Tet	Au Elect
87V-02 at 137.2	4D3#	1594	24	9	2	3	6	8	4	-	-
87V-05 at 181.6	4E41	1528	24	20	12	Tr	12	-	12	-	-
87V-06 at 123.8	4E4	1620	40	10	5	Tr	-	-	-	-	-
87V-06 at 168.0	4E48	1532	50	5	3	2	8	-	12	-	-
87V-10 at 285.6	4D483	1597	25	25	10	-	8	-	12	-	-
87V-12 at 214.6	4E48	1526	36	6	5	1	Tr	-	12	-	-
87V-12 at 291.5	4E4$	1544	50	5	2	4	2	3	1	-	-
87V-22 at 43.6	4E4	1531	54	16	10	4	4	-	-	-	-
87V-25 at 110.8	4E0	1552	52	10	10	Tr	6	Tr	4	-	-
87V-25 at 180.4	4E46#	1548	34	18	12	1	Tr	-	-	-	-
87V-25 at 244.9	4E0	1563	40	10	2	3	8	8	4	-	Tr
87V-27 at 254.4	4E4##	1543	35	20	10	3	-	Tr	-	-	-
87V-27 at 277.8	4E14	1525	23	15	8	1	2	1	-	-	-
Average (13)			37 1/2	13	7	1 1/2	4	1	4 1/2	-	-

Table 6A - Ore Type"E2" Estimated Ore Mineral Liberation Characteristics at 200 mesh

Sample	Sphalerite						Galena						Chalcopyrite					
		associated with:						associated with:						associated with:				
	Free	Py	Ga	Gal	Cp	Po Mag	Free	Py	Ga	Sph	Cp	Po Mag	Free	Py	Ga	Sph	Gal	Po Mag
87V-02 at 137.2	40	25	35	-	-	-	30	35	30	-	-	5	30	40	30	-	-	-
87V-05 at 181.6	85	5	5	-	-	5	80	5	5	5	-	5	-	-	-	-	-	-
87V-06 at 123.8	70	5	15	10	-	-	40	5	20	35	-	-	-	-	-	-	-	-
87V-06 at 168.0	30	40	15	5	-	10	5	80	15	-	-	-	-	-	-	-	-	-
87V-10 at 285.6	65	5	10	20	-	-	20	10	30	40	-	-	-	-	-	-	-	-
87V-12 at 214.6	35	15	40	10	-	-	15	60	20	5	-	-	5	75	15	-	-	5
87V-12 at 291.5	20	50	20	5	5	-	15	60	20	5	-	-	-	-	-	-	-	-
87V-22 at 43.6	30	45	5	10	10	-	15	45	10	25	5	-	15	40	10	25	10	-
87V-25 at 110.8	30	25	35	5	-	5	20	40	35	5	-	-	-	-	-	-	-	-
87V-25 at 180.4	40	5	45	10	-	-	20	5	35	40	-	-	-	-	-	-	-	-
87V-25 at 244.9	60	10	20	5	5	-	35	20	40	5	-	-	45	45	-	10	-	-
87V-27 at 254.4	25	40	20	15	-	-	15	40	30	15	-	-	-	-	-	-	-	-
87V-27 at 277.8	55	20	5	20	-	-	30	40	5	25	-	-	-	-	-	-	-	-
Average (13)	46	22	21	9	1	1	26	34	23	16	-	1	24	50	14	9	2	1

Table 7 - Ore Type 'GE' - Estimated Mineral Proportions in PS or PTS

Sample	Field Class	PS or PTS #	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Tet	Au Elect	Qtz	Musc	Barite	Carb.	Chl
87V-05 at 89.8	4EG4	1551	40	7	3	2	7	-	18	-	-	-	-	-	-	-
87V-06 at 149.2	4G48#	1581	33	10	4	Tr	Tr	-	3	-	-	-	-	-	-	-
87V-09 at 134.5	4G4#	1590	25	15	5	-	-	Tr	-	Tr	-	-	-	-	-	-
87V-09 at 148.9	4G4#$	PTS542	25	9	4	2	-	2	12	-	-	5	-	25	16	-
87V-10 at 170.0	4E814	1547	20	9	6	1	13	-	18	-	Tr	-	-	-	-	-
87V-12 at 99.7	4EG	1549	20	30	15	1	-	-	-	-	-	-	-	-	-	-
87V-12 at 273.3	4G48	1571	28	20	8	-	-	-	-	-	-	-	-	-	-	-
87V-19 at 24.1	4E48	1530	22	12	6	1	1	Tr	3	-	-	-	-	55	-	-
87V-20 at 62.5	4E48	1533	26	18	6	Tr	-	Tr	-	Tr	-	-	-	-	-	-
87V-22 at 32.0	4G4	1585	30	14	8	Tr	Tr	-	-	-	-	-	-	-	-	-
87V-22 at 53.8	4G4	PTS548	24	12	4	1	12	2	-	-	-	5	-	33	7	-
87V-25 at 129.4	4G4	1565	30	10	8	1	5	-	4	-	Tr	-	-	-	-	-
87V-27 at 231.7	4G4	1574	25	12	7	Tr	-	-	1	Tr	-	-	-	-	-	-
Average (13)			27	13 1/2	6 1/2	1/2	3	-	4 1/2	-	-	-	-	-	-	-

Table 7A - Ore Type"GE" Estimated Ore Mineral Liberation Characteristics at 200 mesh

Sample	Sphalerite						Galena						Chalcopyrite					
		associated with:						associated with:						associated with:				
	Free	Py	Ga	Gal	Cp	Po Mag	Free	Py	Ga	Sph	Cp	Po Mag	Free	Py	Ga	Sph	Gal	Po Mag
87V-05 at 89.8	45	5	15	10	-	25	25	20	20	15	-	20	40	25	15	5	-	15
87V-06 at 149.2	40	15	20	25	-	-	25	10	25	35	-	5	-	-	-	-	-	-
87V-09 at 134.5	65	-	25	10	-	-	25	-	35	40	-	-	-	-	-	-	-	-
87V-09 at 148.9	40	-	30	15	5	10	15	5	30	35	5	10	20	5	55	10	-	10
87V-10 at 170.0	65	5	10	5	5	10	45	15	20	15	-	5	45	15	15	25	-	-
87V-12 at 99.7	40	-	10	50	-	-	15	-	15	70	-	-	-	-	-	-	-	-
87V-12 at 273.3	60	5	20	15	-	-	35	5	30	30	-	-	-	-	-	-	-	-
87V-19 at 24.1	15	5	45	35	-	-	10	5	50	35	-	-	-	-	-	-	-	-
87V-20 at 62.5	15	5	45	35	-	-	5	5	50	40	-	-	-	-	-	-	-	-
87V-22 at 32.0	50	10	15	25	-	-	30	10	25	35	-	-	-	-	-	-	-	-
87V-22 at 53.8	45	5	40	5	-	5	25	10	45	15	-	5	10	-	75	5	5	5
87V-25 at 129.4	30	5	30	35	-	-	20	5	35	40	-	-	-	-	-	-	-	-
87V-27 at 231.7	70	-	20	10	-	-	40	10	30	20	-	-	-	-	-	-	-	-
Average	45	5	25	21	-	4	25	8	31	33	-	3	31	10	40	11	1	7

Table 8 - Ore Type 'G' - Estimated Mineral Proportions in PS or PTS

Sample	Field Class	PS or PTS #	Py	Sph	Gal	Cp	Po Marc	Aspy	Mag	Tet	Au Elect	Qtz	Musc	Barite	Carb.	Chl
87V-09 at 79.5	4G48	PTS549	20	14	6	-	5	-	Tr	-	-	40	-	12	3	-
87V-01 at 98.2	4G48	1570	13	12	6	Tr	Tr	Tr	8	-	-	-	-	-	-	-
87V-02 at 77.5	4G48	1583	20	12	8	-	-	-	2	-	-	-	-	-	-	-
87V-02 at 105.5	4G48	1589	12	12	9	1	-	-	3	-	-	-	-	-	-	-
87V-02 at 123.9	4G48#	1584	15	10	5	1	5	-	8	-	-	-	-	-	-	-
87V-05 at 94.4	4G4	1568	16	15	9	Tr	-	4	1	Tr	-	-	-	-	-	-
87V-05 at 162.9	4G487	1575	20	15	8	Tr	-	Tr	2	-	-	-	-	-	-	-
87V-07 at 39.4	4G4	1573	18	10	8	3	Tr	1	10	-	-	-	-	-	-	-
87V-09 at 211.2	4D4	PTS541	5	10	7	1	8	-	20	-	-	5	Tr	20	25	Tr
87V-10 at 193.3	4G4#8	1588	16	15	5	2	2	-	10	-	-	-	-	-	-	-
87V-11 at 164.5	4G4	1579	18	15	8	1	-	-	2	-	-	-	-	-	-	-
87V-11 at 195.0	4G4	1582	18	12	5	1	-	Tr	-	Tr	Tr	-	-	-	-	-
87V-17 at 27.0	4G4	1569	12	14	8	Tr	-	Tr	-	Tr	-	-	-	-	-	-
87V-27 at 263.9	4G48	1566	12	10	3	2	5	-	18	-	-	-	-	-	-	-
Average (14)			15	12	7	1	2	-	6	-	-	-	-	-	-	-

Table 8A - Ore Type"G" Estimated Ore Mineral Liberation Characteristics at 200 mesh

Sample	Sphalerite						Galena						Chalcopyrite					
		associated with:						associated with:						associated with:				
	Free	Py	Ga	Gal	Cp	Po Mag	Free	Py	Ga	Sph	Cp	Po Mag	Free	Py	Ga	Sph	Gal	Po Mag
87V-01 at 79.5	70	-	15	15	-	-	35	5	30	30	-	-	-	-	-	-	-	-
87V-01 at 98.2	55	5	20	15	-	5	45	5	30	15	-	5	-	-	-	-	-	-
87V-02 at 77.5	60	5	15	15	-	5	50	5	20	20	-	5	-	-	-	-	-	-
87V-02 at 105.5	10	5	45	40	-	-	10	5	40	45	-	-	-	-	-	-	-	-
87V-02 at 123.9	50	5	20	20	-	5	35	15	25	20	-	5	-	-	-	-	-	-
87V-05 at 94.4	75	5	10	10	-	-	60	5	20	15	-	-	-	-	-	-	-	-
87V-05 at 162.9	65	5	15	15	-	-	25	-	35	40	-	-	-	-	-	-	-	-
87V-07 at 39.4	30	5	30	30	-	5	25	5	40	30	-	-	40	-	45	5	10	-
87V-09 at 211.2	55	5	15	15	-	10	25	5	25	25	-	20	10	-	45	45	-	-
87V-10 at 193.3	60	5	15	20	-	-	25	5	30	40	-	-	20	5	30	40	-	5
87V-11 at 164.5	60	5	15	20	-	-	20	-	40	40	-	-	-	-	-	-	-	-
87V-11 at 195.0	60	5	15	15	5	-	30	5	30	30	5	-	25	5	30	30	10	-
87V-17 at 27.0	55	-	20	25	-	-	20	5	50	25	-	-	-	-	-	-	-	-
87V-27 at 263.9	35	-	30	30	-	5	5	-	50	35	-	10	40	-	50	5	-	5
Average	54	4	20	20	-	2	29	5	33	30	-	3	27	2	40	25	4	2

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Lakefield, Ontario
April 4, 1988

FIGURE25 DISTRIBUTION OF VANGORDA SAMPLES   % Pyrite vs % BMS Plot

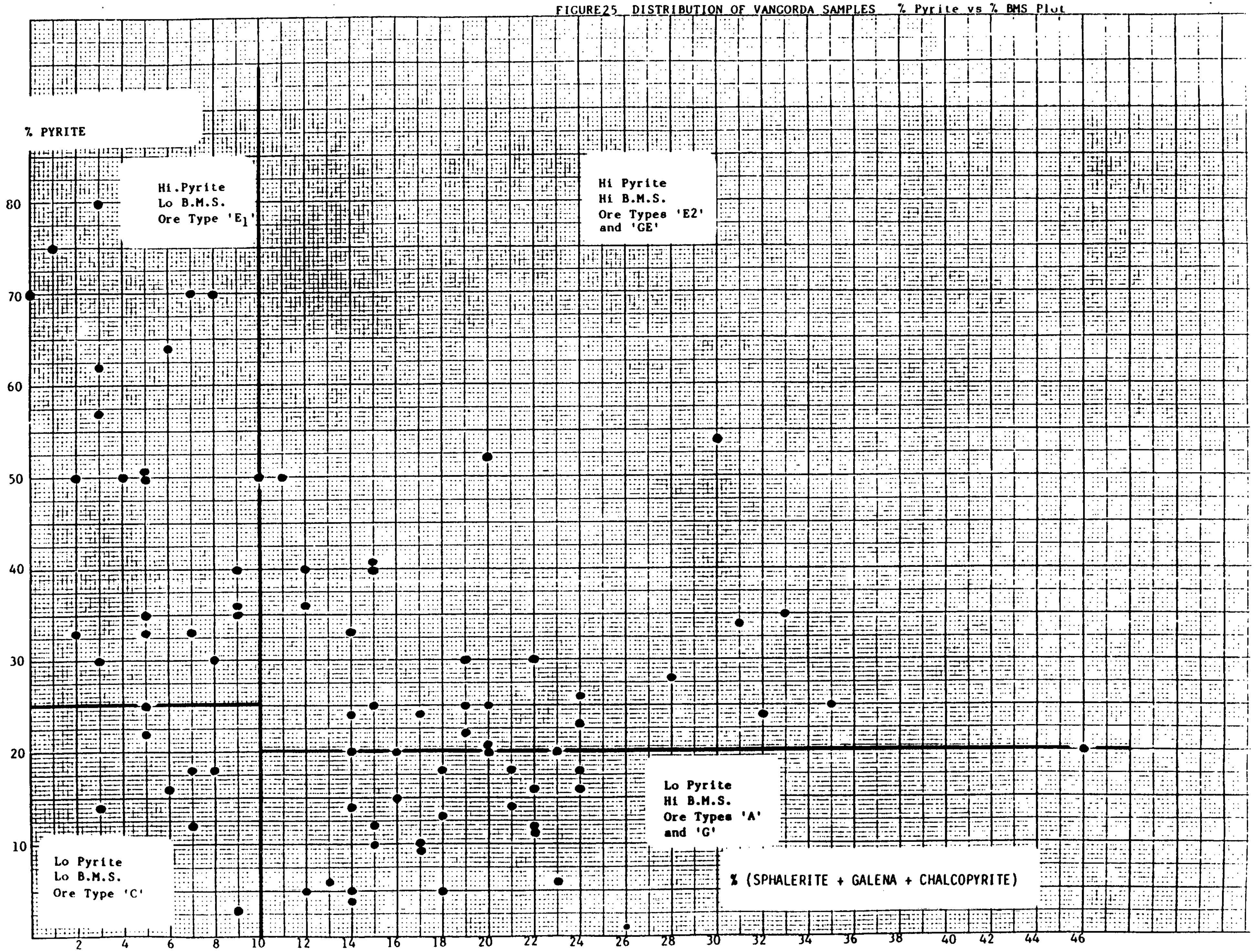


FIGURE 26 DISTRIBUTION OF PYRRHOTITE + MARCASITE (> 10%) in VANGORDA SAMPLES

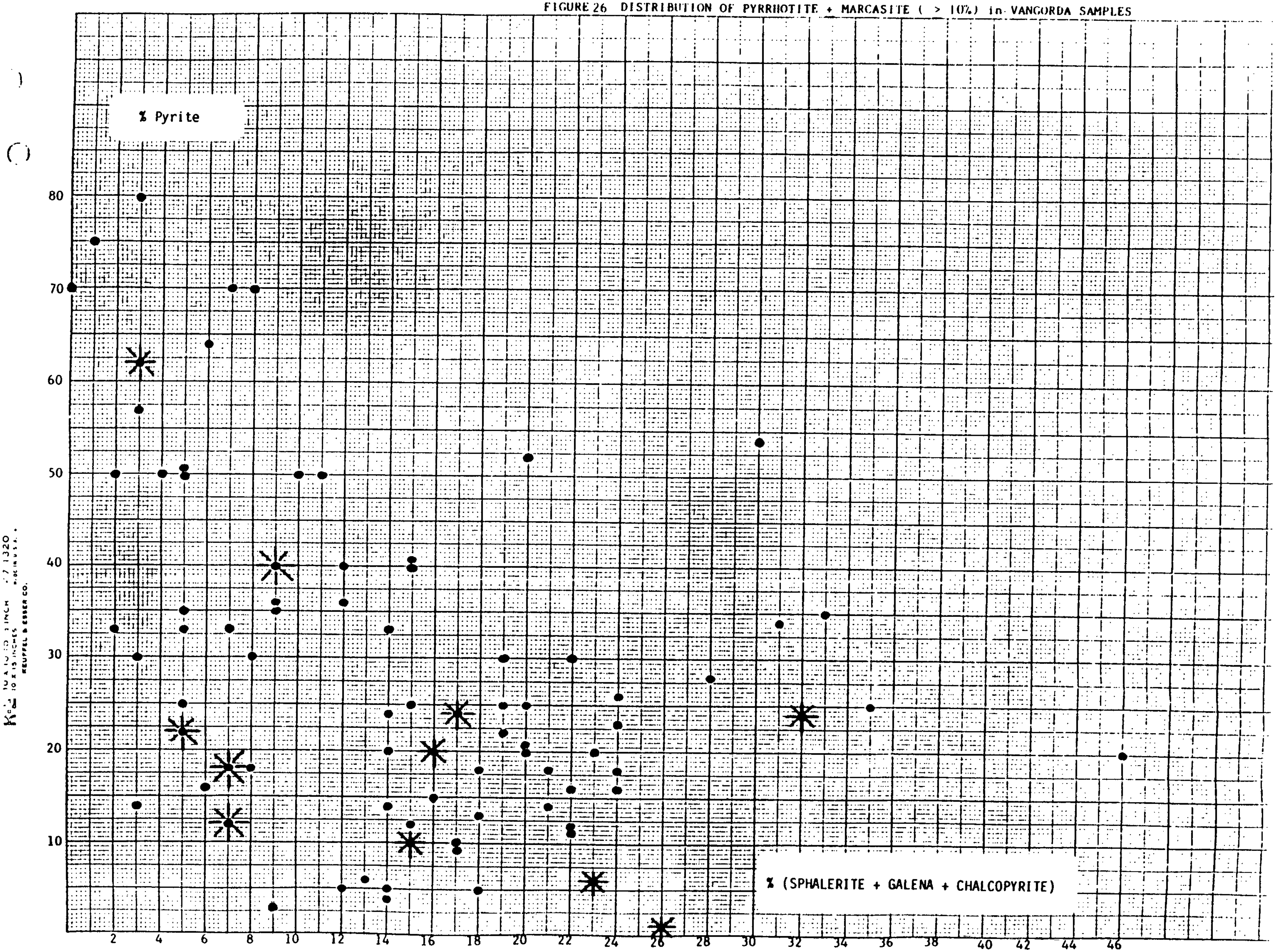


FIGURE 27 DISTRIBUTION OF MAGNETITE (> 10%) IN VANGORDA SAMPLES

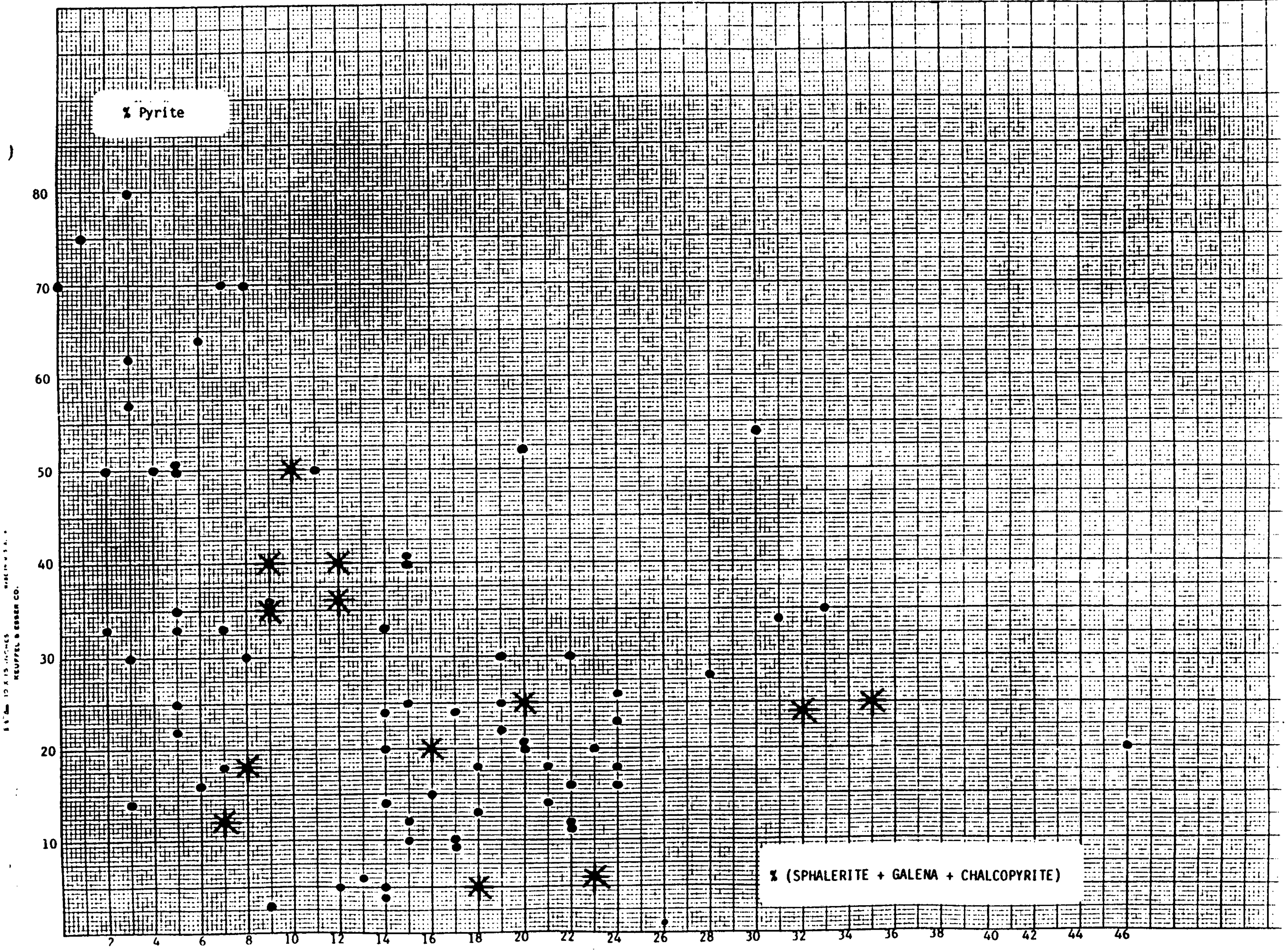


FIGURE 28 DISTRIBUTION OF CHALCOPYRITE (≥ 3%) IN VANGORDA SAMPLES

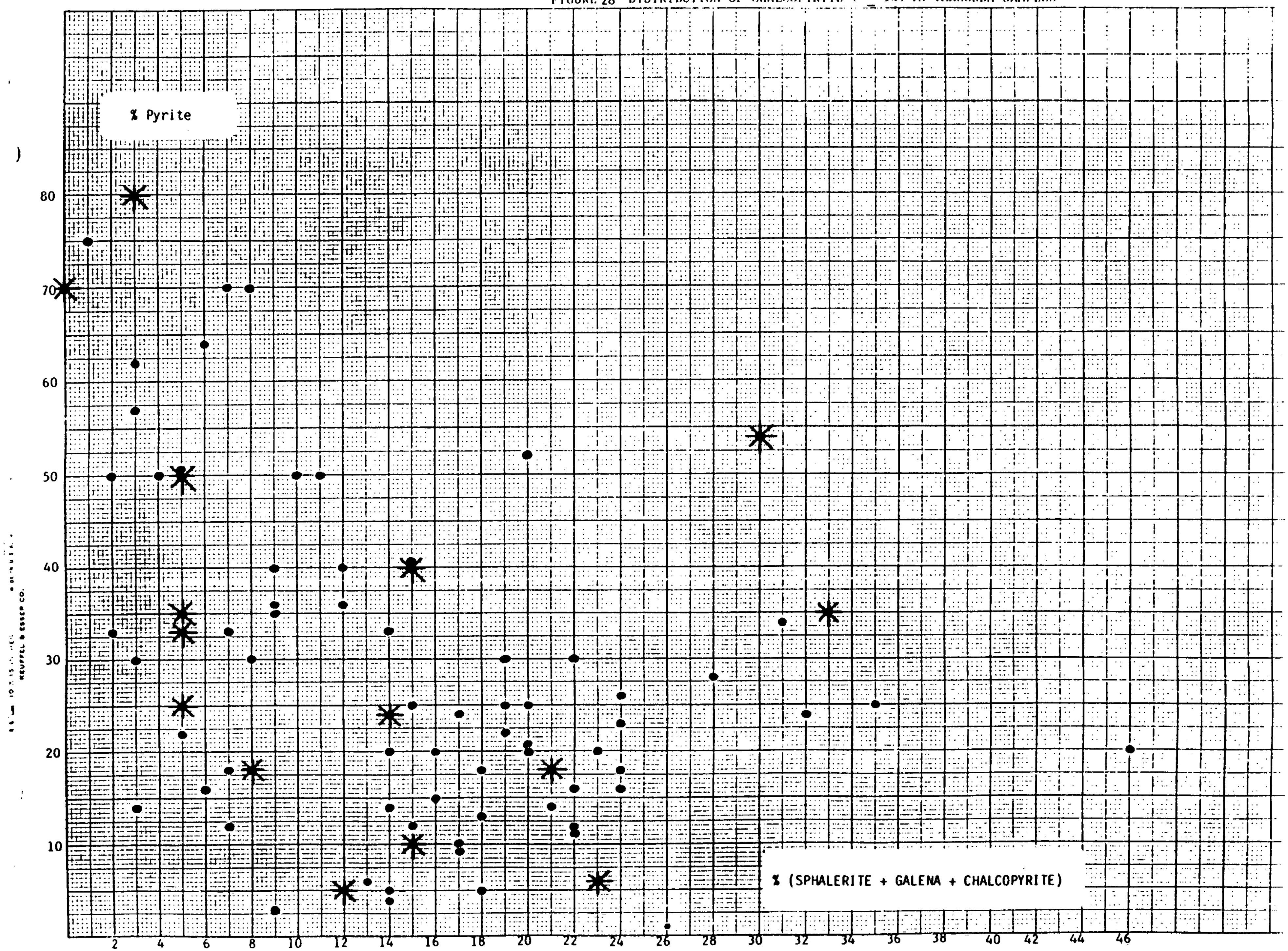


FIGURE 29 DISTRIBUTION OF ARSENOPYRITE (> 2%) IN VANGORDA SAMPLES

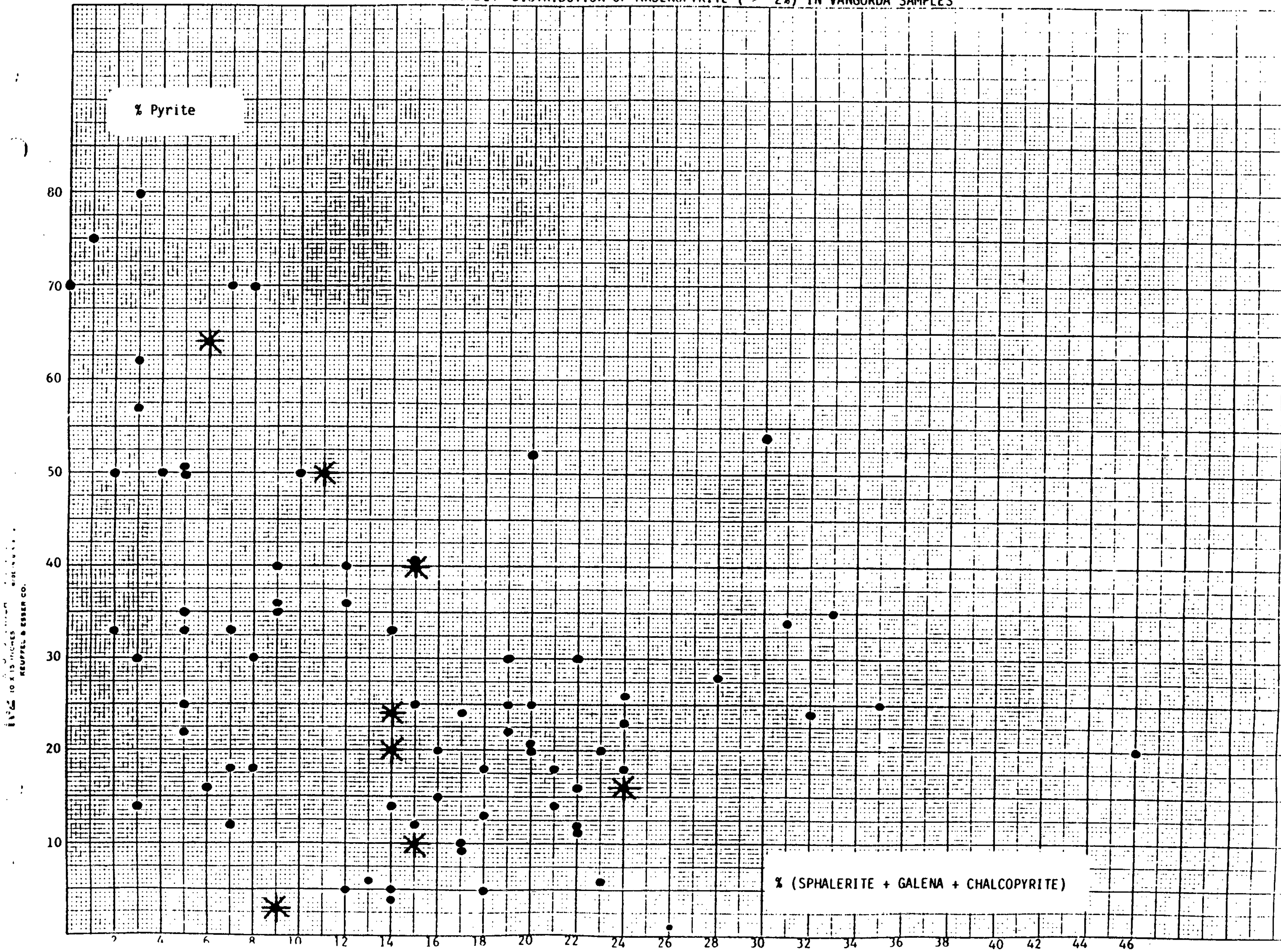
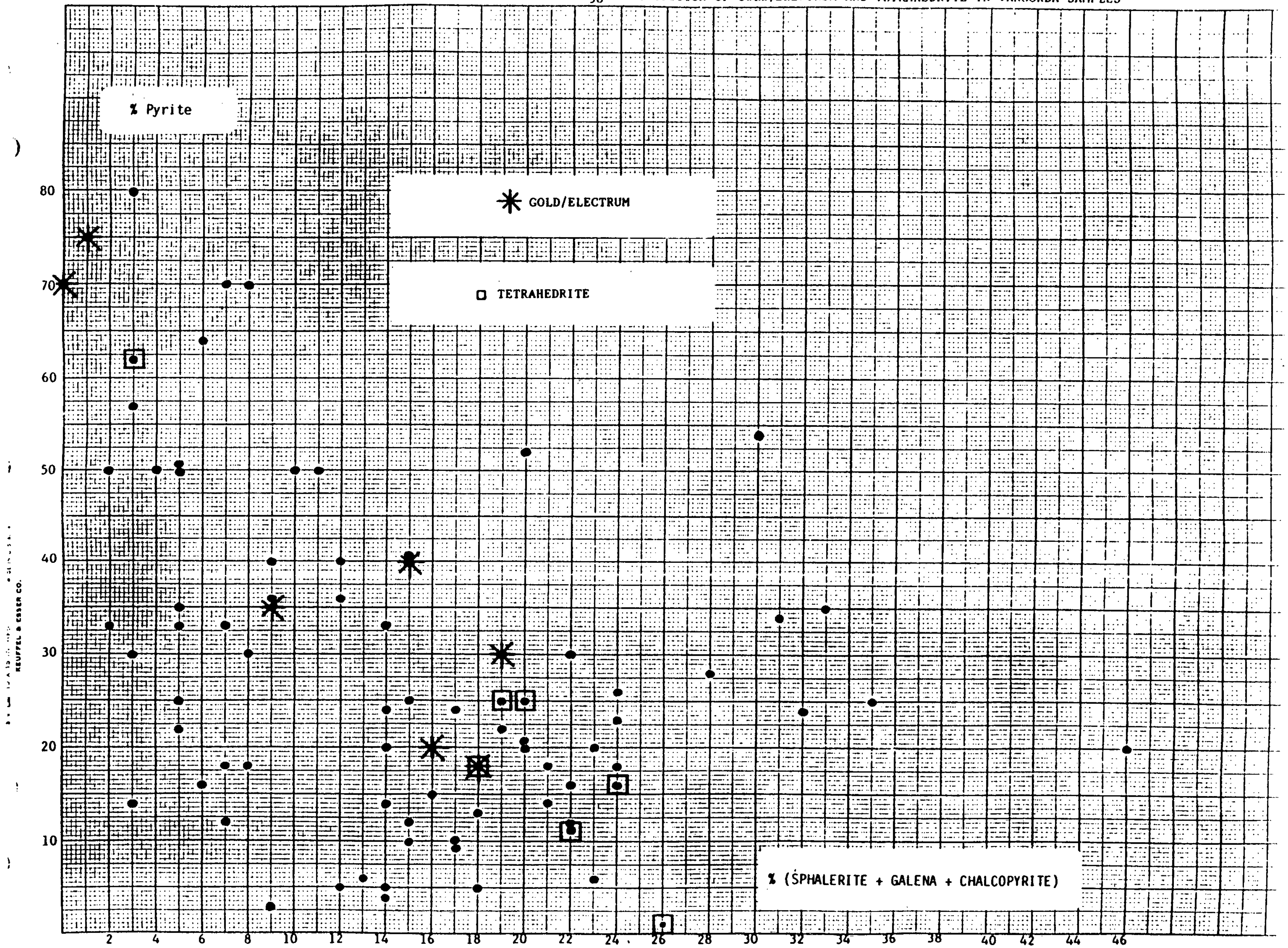


FIGURE 30 DISTRIBUTION OF GOLD/ELECTRUM AND TETRAHEDRITE IN VANGORDA SAMPLES



FIELD CLASSIFICATION CODES

Faro, Grum, Vangorda, DY Conformable Contact

Wate 2/4	922	2/4 -	A	Sulfide-bearing, ribbon-banded, graphitic quartzite	
	915		B	Pyrite-free quartzite (may conbtain base metal sulfides)	
	916		C	Base metal-poor, pyritic quartzite	
	942		D	Base metal-bearing, pyritic quartzite	
	918		E	Massive pyritic sulfides	
	923		F	Buckshot facies, massive sulfides	
	928		G	Baritic facies, massive sulfides/sulfates (>10%:$BaSO_4$)	
	924		H	Pyrrhotitic facies, massive sulfides	
	949		J	Non-pyritic, massive sulfides/oxides	
	921		K	Carbonate-bearing, massive pyritic sulfides	
	914		L	--->	2/4L Muscovite>qtz-chl-bio- (generally sulfide-

1	Siliceous	1	Siliceous			
2	Coarse, porphyroblastic pyrite-bearing	2	Pyrite-bearing			
3	Fine pyrite/marcasite-bearing	3	Talc/kaolinite-bearing	$	=	dolomite
4	Sphalerite and/or galena-bearing	4	ZnS and/or PbS-bearing	#	=	calcite
5	Carbonaceous	5	Carbonate-bearing	*	=	carbonate (not specified)
6	Barite-bearing	6	Chl-bio>qtz-musc ph			
7	Pyrrhotite-bearing	7	Pyrrhotite-bearing			
8	Magnetite-bearing	8	Magnetite-bearing			
9	Chalcopyrite-bearing	9	Chalcopyrite-bearing			
0	Normal					
*	Carbonate-bearing	0	Normal			