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Banks I: Tel
103G/8

Harris
EXPLORATION SERVICES

MINERALOGY AND GEOCHEMISTRY

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Job #86-15
April 25th, 1986

Report for: Murray McClaren,
TRM Engineering Ltd.,
701 -744 West Hastings St.,
Vancouver. V6C 1A5

A petrographic study of samples from the Tel, Bob and Discovery deposits, Yellow Giant Property, Banks Island, B.C.

Introduction

The study suite consisted of various surface samples and pieces of drill core, intended to illustrate the various ore types distinguishable at the Tel deposit. A few miscellaneous samples from the other Yellow Giant properties were also included.

The samples, together with the style of petrographic preparation adopted, are listed in the following table:

Location or field description	Preparation type	Slide No.
DDH 85-007; 8" from beginning of 25675 E	Polished T.S.	86-057X
" ; 6" from beginning of 25669 E	"	58X
" ; beginning of 25672 E	"	59X
" ; 170 m	Thin section	60X
DDH 85-012; just before 23248 E	Polished T.S.	61X
" ; at beginning of 23250 E	"	62X
" ; at 23296 E	"	63X
DDH 85-019; 6" from beginning of 25704 F	Thin section	64X
DDH 86-002; from high grade assay interval 26280	Polished T.S.	67X
" ; "	"	68X
Surface samples		
Main Pit	Slab only	53X
"	"	54X
"	"	55X
Main Pit, A Zone; sulfides	Polished T.S.	65X
" ; altered marble	Thin section	66X
" ; porous pyrite	Polished T.S.	73X
" ; partially oxidized ore	"	74X
B Zone; typical mineralized rock	"	69X
" ; "	"	70X
C Zone; typical mineralized rock	"	71X
" ; "	"	72X

All of the above samples come from the Tel Deposit.

Bob Deposit

Mn-stained(?) carbonates	Thin section	75X
Typical mineralization (coarse grained)	Polished T.S.	76X
" " (fine grained)	"	77X

Discovery Deposit

Surface sample	Slab only	56X
DDH YGDY 86-001 39.93m (Assay sample 26100)	Polished T.S.	78X
DDH YGDY 86-006 64.31m (Assay sample 26650 F)	"	79X

The samples were examined by transmitted and reflected light. Results are contained in the attached individual descriptions. Characteristic features are illustrated in a set of photomicrographs (enclosed)

A brief discussion of geochemical characteristics of the Tel ore based on ICP multi element analyses is included as an Appendix to this report.

Summary

This is a rather varied suite, including host rocks as well as more or less strongly mineralized material which presumably represents veining or replacement.

A few comparisons and generalizations may be in order.

Features of the surface samples from the Tel A, B and C Zones suggest systematic differences between the zones (although these cannot be considered as firmly established on the basis of one or two samples from each zone).

The two mineralized samples from the A Zone (065X and 074X) show sphalerite, with varying proportions of pyrite and arsenopyrite as the major sulfides. The first sample has a quartz/carbonate gangue; the second has only quartz. Relatively abundant gold up to 100 microns in size is seen in both samples, in diverse textural associations, included within or on the contacts of the various sulfide and gangue minerals. Both samples contain traces of graphite; this occurs in both gangue and sulfide phases.

Sample 066X from the A Zone in the main pit is a simple calcitic marble with very minor disseminated micas and calc silicates. Traces of opaques include graphite.

The two samples from the B Zone (069X and 070X) are mineralogically similar to those from the A Zone. They consist dominantly of well segregated clumps of pyrite and sphalerite, with accessory arsenopyrite, in a texturally heterogenous siliceous gangue. Carbonate is essentially absent, and no graphite was seen. Gold occurs in both samples, as grains up to 100 microns in 069X but finer-grained in 070X. It shows no consistent textural relationships, occurring totally enclosed in sulfides and quartz as well as on sulfide/sulfide and sulfide/silicate contacts.

The A Zone and B Zone samples both show more or less banded, crustified textures suggestive of vein origin.

The two samples from the C Zone (071X and 072X) are only weakly mineralized,

arsenopyrite being essentially the only sulfide. It occurs as disseminated clumps and strings of euhedral grains, apparently following grain boundaries and microstructures in the hosting gangue. In 071X the gangue is largely quartz with minor carbonate, whilst in 072X these proportions are reversed. No gold was observed.

The drill hole samples illustrate a variety of specialized features and their relationship one to another is unknown.

The two samples from the bonanza (35 oz/ton) section in DDH-11 (067X and 068X) are distinctly different. The first is strongly mineralized with sphalerite and pyrite. These form well-segregated clusters in a quartz gangue with accessory carbonate which appears to be a 'late', veining constituent. Gold occurs in the usual diverse modes including some relatively coarse grained (100 microns) networks in sphalerite ranging down to minute inclusions in sulfides and gangue.

Sample 068X is of similar type to the C Zone samples, 071X and 072X. It consists of disseminated strings of tiny arsenopyrite euhedra in a complexly intergrown matrix of quartz and calcite. No gold was seen.

The samples from DDH 85-7 (057X - 060X) are a varied group.

Sample 057X is essentially massive pyrite; cut by veinlets of sphalerite and quartz/carbonate. Traces of Au were observed.

Sample 058X is a very unusual one, unlike any other in the suite. It consists of iron sulfides in pockety intergrowth with quartzose gangue. The sulfides consist, in major part, of an extremely fine-grained melnikovite (gel pyrite) with intimately and diffusely intergrown iron oxides. Crystalline pyrite forms patches, rims and cellular structures within the altered melnikovite.

Sample 059X is a calcite aggregate (marble?) showing a replacement contact with a strongly mineralized facies. The latter is a polymetallic assemblage of pyrite, arsenopyrite, sphalerite and galena (the only sample in which the latter was seen in significant amount) with associated quartz. Traces of graphite occur in the unaltered marble as well as incorporated in the mineralized zone.

Sample 060X is an unmineralized marble showing bands and wisps of a fine-grained silica/sericite (alteration?). This material locally shows incipient Fe staining.

The samples from DDH 85-12 (061X - 063X) all show varying degrees and styles of development of the limonite/chert assemblage characterized as jasperoid.

Sample 061X is a breccia of vein quartz fragments cemented by cherty silica more or less heavily impregnated with limonite. A minor accessory is possibly alunite.

Sample 062X is a similar type of rock in which limonite is more compact and concentrated; it forms shattered masses cemented by cherty quartz. It contains pockets of an unidentified material which appears to be a secondary sulfate and/or arsenate, rich in lead.

Both these samples contain scattered traces of pyrite of uncertain relation to the limonite, and both have scattered grains of gold in the ferruginous cherty melange.

Sample 063X is a calcitic marble showing adjacent replacement patches of two distinct types. One is of the silica/limonite jasperoid, and the other is of fresh sulfides (pyrite and arsenopyrite) with interstitial quartz. Sphalerite, as a fine-grained impregnation of cherty quartz, forms a gradational selvedge along the contact of sulfides and marble. The slide yields no information as to the relationship of the jasperoid and sulfides.

The sample 064X from DDH-19 is a non-mineralized calcitic marble with a central banded alteration zone of quartz and calc silicates (seemingly a mixture of diopside and tremolite).

The samples from the Bob Deposit (075X - 077X) are a mixed group.

The first is a slightly siliceous marble showing a zone of pervasive ferruginous staining. The second is a coarse-grained, strongly sulfidic rock consisting of strongly fractured massive pyrite with segregations and veinlets of chalcopyrite. The gangue is heterogenous-textured quartz with pockets and veinlets of carbonate. The third sample is similar but finer-grained and with less chalcopyrite. It also lacks carbonate. No gold was observed in these samples.

The samples from the Discovery (078X and 079X) illustrate the mode of occurrence of pyrrhotite at that deposit. The first is essentially massive, compact pyrrhotite partially altered to secondary pyrite marginal to carbonate-filled microfractures. The second is an intricate (replacement-type) permeation of strongly skarnified marble by pyrrhotite.

J.F. Harris Ph.D.

Chemex Labs Ltd.

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Semi quantitative multi element ICP analysis

Nitric-Aqua-Regia digestion of 0.5 gm of material followed by ICP analysis. Since this digestion is incomplete for many minerals, values reported for Al, Sb, Ba, Be, Ca, Cr, Ga, La, Mg, K, Na, Sr, Tl, Ti, W and V can only be considered as semi-quantitative.

CERTIFICATE OF ANALYSIS

TO : HARRIS EXPLORATION SERVICES

534 ELLIS ST.
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UPLICATE

CERT. # : A8611193-001-A
INVOICE # : I8611193
DATE : 25-APR-86
P.O. # : NONE
YELLOW GIANT

COMMENTS :

Sample description	Al %	Ag ppm	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	K %	La ppm
25579	0.04	0.2	70	210	<0.5	4	27.81	0.5	2	<1	7	0.32	40	<0.01	<10
67953	0.05	0.2	40	60	<0.5	4	29.87	4.0	2	<1	7	0.16	50	<0.01	<10
67954	0.08	0.8	1330	60	<0.5	<2	4.81	>99.9	4	14	232	6.70	10	<0.01	<10
67955	0.06	0.2	220	40	<0.5	<2	20.05	>99.9	2	<1	53	1.37	30	<0.01	<10
67980	0.49	0.2	820	90	<0.5	<2	18.44	<0.5	5	<1	22	1.00	30	0.09	<10
25946	0.67	0.2	10	40	<0.5	<2	2.55	3.0	4	1	39	1.26	10	0.29	10
23349	0.19	5.0	80	20	<0.5	<2	9.63	33.5	2	12	98	0.92	20	<0.01	<10
23203	0.38	10.6	940	60	<0.5	<2	4.31	47.5	5	13	149	3.93	10	0.06	<10
23204	1.11	22.0	1750	50	<0.5	<2	2.18	>99.9	10	9	507	10.03	<10	0.32	<10
23235	0.09	7.8	1440	130	<0.5	<2	1.66	>99.9	6	48	1184	26.28	<10	<0.01	<10
25705	0.12	>200.0	>9999	20	<0.5	<2	11.05	<0.5	7	<1	1375	9.06	20	0.01	<10
25773	0.42	0.6	>9999	10	<0.5	<2	11.29	<0.5	14	3	31	12.58	20	0.04	<10
25863	0.69	0.2	60	250	<0.5	<2	20.82	2.0	4	<1	20	0.89	40	0.18	<10
25986	0.18	5.8	2840	180	<0.5	2	6.62	>99.9	3	20	162	6.18	10	<0.01	<10
26071	0.75	0.2	20	140	<0.5	<2	12.46	<0.5	4	<1	8	1.40	20	0.04	<10
23347	0.52	2.0	210	70	<0.5	2	25.40	52.5	5	<1	70	1.21	50	0.19	<10

Sample description	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm		
25579	0.25	3554	<1	<0.01	4	80	16	10	272	<0.01	<10	<10	10	10	50	--	--
67953	0.48	882	1	<0.01	3	50	14	10	424	<0.01	<10	<10	5	<10	130	--	--
67954	0.15	637	3	<0.01	5	80	58	20	44	<0.01	<10	<10	24	<10	>9999	--	--
67955	0.17	1601	1	<0.01	4	400	14	10	78	<0.01	<10	<10	23	<10	2740	--	--
67980	0.96	1364	<1	0.01	9	160	16	<10	230	0.02	<10	<10	6	<10	130	--	--
25946	0.26	470	2	0.06	2	400	20	<10	165	0.04	<10	<10	9	<10	160	--	--
23349	0.27	1199	1	<0.01	7	<10	1140	<10	248	<0.01	<10	<10	142	<10	900	--	--
23203	0.69	452	<1	0.01	7	100	156	<10	44	<0.01	<10	<10	16	<10	2960	--	--
23204	1.00	738	<1	0.06	13	420	386	<10	19	<0.01	<10	<10	32	<10	6710	--	--
23235	0.17	611	5	0.03	2	680	<2	<10	43	<0.01	<10	<10	191	<10	8760	--	--
25705	1.33	>9999	8	<0.01	7	330	>9999	220	168	<0.01	<10	<10	8	<10	6420	--	--
25773	1.30	>9999	<1	<0.01	20	130	58	60	235	<0.01	<10	<10	7	<10	20	--	--
25863	0.96	348	<1	0.04	10	180	52	<10	455	0.02	<10	<10	9	<10	100	--	--
25986	0.39	1377	2	0.01	4	270	144	10	63	<0.01	<10	<10	41	<10	6100	--	--
26071	1.07	1635	<1	0.02	8	80	6	<10	118	<0.01	<10	<10	10	<10	20	--	--
23347	0.76	759	<1	<0.01	10	260	1062	10	464	<0.01	<10	<10	35	<10	1240	--	--

APPENDIX

COMMENTS ON MULTI-ELEMENT ANALYSES OF TEL SAMPLES.

Introduction

As requested, Chemex Labs were instructed to run semi-quantitative ICP analyses on a series of Tel assay samples held on file. Results are attached.

A list of the samples, with Au assays and field descriptions by M. McClaren, is as follows:

Hole Number	Sample Number	Gold Assay (oz/ton)	Field Remarks
YGTL-85-006	67953	0.002	Fractured Marble: soft brown, fracture filling
	67954	0.396	Pyrite - Quartz - breccia
	67955	0.032	Brecciated Marble: Mylonite
	67980	0.004	Pyrite - Qtz - Sphal - Aspy
YGTL-85-007	25579	<0.002	Qtz - Ankerite
YGTL-85-010	23235 F	0.416	Jasperoid
	23203	0.208	Qtz pyrite
	23204	0.536	Qtz pyrite
YGTL-85-011	25986	0.208	Qtz - Limonite zone
YGTL-85-014	25863	<0.002	Soft brown gouge
YGTL-85-019	25773	0.120	Aspy - Hornfels
YGTL-85-019	25705	0.162	Galena - Aspy
YGTL-85-022	25946	<0.002	Brown gouge
YGTL-85-025	26071	<0.002	Qtz stockwork
YGTL-85-013	23347	0.018	Very altered silty marble
YGTL-85-013	23349	0.012	Silicified

Interpretation

a) Gangue compositions: The samples show Ca contents ranging from 1.7 - 29.9%. The high Ca samples are presumably mineralized marbles or carbonate vein material. Mg contents are all low, indicating predominantly calcitic material with little or no dolomite. The low Ca samples are presumably mainly quartzose in character (since Al, K and Na contents are consistently low).

Sulfide and/or Au mineralization appears to be developed in both Ca-rich and Ca-poor (Si-rich) associations.

The field designation of 25579 as ankerite is not supported (low Mg, Fe);

the 'soft brown gouge' of 25863 is apparently mainly calcite, but the brown gouge of 25946 is not (since it is low in Ca, Mg, Fe and Al, it is prsumably siliceous); the 'quartz stockwork' of 26071 is also quite calcitic.

b) Sulfide compositions: Without analyses for S, there is no reliable measure of the level of sulfides in each sample. Presumably the Fe content gives a rough indication - on the assumption that it is present largely as pyrite. However, in a few cases (jasperoid) the Fe may be in oxide form (e.g. in 23235 and 25986). Excluding these two samples, Fe contents range from 0.3 - 12.6% with the majority around 1 - 2%. Samples 25773, 23204 and 25705 are indicated as containing around 20% sulfides; samples 25986 and 67954 around 10%, and the remainder 5% or less.

Of the more sulfide-rich samples, 25705 and 25773 have high As, presumably in the form of arsenopyrite. The As levels in the other samples suggest only minor contents of arsenopyrite.

Cu contents are generally low, confirming the mineralogical observations that chalcopyrite in the Tel mineralization is essentially confined to a minor exsolved phase in sphalerite.

Zn analyses exceed 1% in only one sample (67954). In the other higher sulfide samples the indicated contents of sphalerite are in the range 1 - 1.5% except for 25773 which is very low.

Pb contents are generally low (again confirming the mineralogical observations). The single exception is 25705, which was known from the field description to contain galena.

Other sulfofile elements such as Bi, Co, Mo, Ni and Sb are low throughout (except for a comparative enrichment in Sb in the Pb-rich 25705)

One element not so far discussed is Cd. Values in a number of cases are notably high. Normally this element shows a close correlation with Zn (by virtue of its occurrence almost entirely in sold solution in sphalerite) and this is true of the Tel material.

Unfortunately the Cd values in many cases are above the maximum detection limit of the method, so cannot be used in calculating ratios. Using the three samples showing Cd contents of around 30 - 50 ppm, the average Cd/Zn ratio calculates as 0.032, i.e. 3.2 ppm Cd for every 100 ppm Zn. This is a higher relative Cd content than is shown by most sphalerites, though not outside the recorded range.

One discrepancy is 25705 which is one of the relatively Zn-rich samples but shows no Cd.

This is so contrary to the trend that one almost suspects an analytical or reporting error. Alternatively this sample may be genetically distinct from the others.

Ag levels are generally low. Of the 7 samples which show 2 ppm or more, there is a fair correlation with indicated total sulfide content. However, the strongly mineralized samples 67954 and, especially, 25773 (high in Fe and As) are low in Ag.

The only strongly argentiferous sample is 25705, which is the galena-bearing rock previously noted as being unique in the suite.

c) Other elements: Miscellaneous elements such as Be, Cr, Ga, La, P, Ti, Tl, U, V and W show low values without significant variation. Analyses by this technique are, in any event, only partial for most of these elements. For the same reason the variations (from 1- - 250 ppm) shown in Ba are of doubtful significance.

Mn, as is commonly the case, shows highly variable contents. The higher values tend to occur in the more calcareous samples and Mn may well be present in minor quantities in the calcite. Mn shows no apparent correlation with contents of Fe or total sulfides. It is strongly enriched in the two samples from DDH-19.

d) Correlations with Au grade: The suite includes a wide range of Au contents (from 0.002 - 0.536 oz/ton). Generally speaking the ore grade samples (>0.1 oz/ton) are those indicated as the more strongly sulfidic, and are those containing relatively high values in Fe and As and often Zn, Cd and Ag. 25773 is distinctive in containing low Ag, Zn and Cd, and 67954 in having low Ag.

It is noteworthy that the two samples described as jasperoid or limonitic (23235 and 25986) both contain good Au values, as well as elevated As, Ag, Zn and Cd, similar to the sulfidic examples.

e) Conclusions

1. The chemical data confirm the characteristic mineralogy of quartz and calcite, with pyrite, arsenopyrite and sphalerite as the dominant sulfides. Cu and Pb are typically low.

2. Ore grade Au values correlate closely with the more strongly mineralized sections.

3. Sample 25773, though Au-bearing, appears distinctive in lacking associated Zn (and Cd and Ag).

4. Sample 25705 is also distinctive in containing high Pb (Ag, Sb) and in having no Cd (despite a substantial Zn content).

5. Both these samples (25773 and 25705) come from DDH 85-19 and may represent a distinctive facies or zone. They are also notably enriched in Mn compared with the other samples.

6. The jasperoid samples show a very similar trace geochemical profile to the sulfidic ones.

7. The mineralization shows no enrichment in exotic elements.

8. Data obtained in another study (on Tel sulfide concentrate and on bonanza ore) suggests no particular enrichment in Te or Hg.

PHOTOMICROGRAPHS

Illumination conditions: RL = reflected light
PPTL = plane polarized transmitted light
CPTL = cross polarized transmitted light

Tel Deposit, drill core samples

Slide No.	Neg. No.	
86-057X	63-7	RL Scale 1 cm = 42 microns Gold in mincrofractures in massive pyrite. Grey mineral in some fractures is sphalerite.
	63-8	RL Scale 1 cm = 42 microns Gold (circled) as blebs in compact pyrite. Dark grey (bottom left) is sphalerite, with exsolution chalcopyrite (yellow).
86-058X	6309	RL Scale 1 cm = 0.17mm Crystalline pyrite (cream colour, top left) in field of intimately associated melnikovite (buff) and limonite (grey). Note diffuse gradations from dominantly melnikovite to dominantly limonite.
	633-10	RL Scale 1 cm = 0.08mm Similar field to 63-9 but higher magnification. Note colloform textures. Compact limonite (grey) locally forms inter-crustified layers (chevron forms, centre).
	63-11	RL Scale 1 cm = 0.17mm Crystalline pyrite rimming euhedral quartz crystals (dark, left) and forming boxwork ribs in melnikovite. Greyish mottled appearance of melnikovite caused by dense disseminations of micron-sized limonite.
86-059X	63-12	RL Scale 1 cm = 0.17mm Typical texture. Cream colour (centre) is pyrite; slightly whiter (centre right, lower left) is arsenopyrite; bluish grey, often with elongate black pits, is galena; medium grey with yellow speckles is sphalerite with exsolved chalcopyrite. Darkest grey is gangue e.g. euhedral quartz (left) and fine-grained carbonate (intergrown with galena and sphalerite).
86-060X	64-1	CPTL Scale 1 cm = 0.17mm Brown alteration zone in marble.
	64-2	CPTL Scale 1 cm = 0.17mm 'White' (sub-opaque) alteration zone in marble.
86-061X	64-3	CPTL Scale 1 cm = 0.17mm Jasperoid. Bluish grey flecked, mottled is cherty silica; dark brown to black is limonite; fibrous whites and orange is (?) alunite.
	64-4	PPTL Scale 1 cm = 0.17mm Jasperoid. Breccia fragments of vein quartz rimmed and cemented by limonite and chert. Much of the limonite is as pellets or tiny fragments in the chert cement. Late chert veinlets (white) cut the other phases.
	64-5	CPTL Scale 1 cm = 0.17mm Same field as 64-4

Slide No.	Neg. No.	
86-061X	63-13	RL Scale 1 cm = 85 microns Gold grain in limonitic chert. Large medium grey areas are quartz fragments. Speckled dark areas are non-polishing limonite in cherty silica. Brighter grey patches are areas of crystalline limonite.
86-062X	64-6	CPTL Scale 1 cm = 0.17mm Shattered limonite (dark) cemented by cherty quartz (white-blue, speckled).
	64-8	PPTL Scale 1 cm = 0.17mm Showing heterogenous texture in jasperoid. Central part shows pale green fine-grained Mineral X speckled and veined by quartz (white), intergrown with euhedral grains of Mineral Y (dark speckled grey, sub-opaque).
86-063X	63-36	CPTL Scale 1 cm = 0.17mm Crustified jasperoid alteration (cherty silica and limonite) in replacement contact (right) with marble.
86-064X	63-35	CPTL Scale 1 cm = 0.17mm Calc silicates (brown, blues, purple) developed in calcite marble (greys, e.g. bottom right) at contact with zone of finely granular quartz (blue-greys, dark: top left).
86-067X	63-33	RL Scale 1 cm = 85 microns Gold (brightest) in gangue (dark grey) and on contacts of gangue and sphalerite (medium grey, pitted). Scattered whitish grains are arsenopyrite. Note replacement of small arsenopyrite grain by gold (upper centre).
	63-34	RL Scale 1 cm = 85 microns Impregnations of sphalerite (matrix) by gold. Small pyrite grains associated with the gold.
86-068X	63-32	RL Scale 1 cm = 0.17mm Fine-grained arsenopyrite associated with contacts of carbonate (darkest grey, speckled) and quartz (smooth, slightly lighter grey: note local euhedral forms).

<u>Tel, surface samples</u>

86-065X	63-15	PPTL Scale 1 cm = 0.17mm Granular/interstitial intergrowth of sphalerite (brown) and arsenopyrite (black) with quartz (white) and carbonate (grey speckled).
	63-16	CPTL Scale 1 cm = 0.17mm Same field as 63-15
	63-19	RL Scale 1 cm = 42 microns Pyrite grain with inclusions of gold. Also gold grain in gangue on pyrite contact (bottom). Adjacent grain (greyer, less creamy) is arsenopyrite.
	63-20	RL Scale 1 cm = 42 microns Gold in and on contact of arsenopyrite. Dark brownish grey laths and irregular grains (e.g. in arsenopyrite, left; and associated with gold, lower centre and upper right) are graphite.

Slide No.	Neg. No.	
86-069X	63-31	RL Scale 1 cm = 85 microns Showing gold (bottom left) totally enclosed in quartz gangue (dark). Main constituent is pyrite.
86-070X	63-29	RL Scale 1 cm = 85 microns Gold (bright yellow, lower left centre) associated with arsenopyrite (light creamy grey) in field of sphalerite (dark grey) with abundant exsolution blebs and marginal segregations of chalcopyrite (brownish yellow).
86-072X	63-28	RL Scale 1 cm = 0.17mm Arsenopyrite disseminated in carbonate gangue. Note partial control by grain boundaries.
86-073X	63-27	RL Scale 1 cm = 0.17mm Fine-grained pyrite forming cellular boxwork. Dark areas are voids.
86-074X	63-1	RL Scale 1 cm = 42 microns Electrum (brightest creamy white, right centre) in sphalerite on contact with quartz (darkest grey). Brownish grey flakes in sphalerite and quartz are graphite.
	63-3	RL Scale 1 cm = 42 microns Gold in pyrite and sphalerite near contact of the two minerals. Note chalcopyrite as exsolution blebs in sphalerite and filling fractures in pyrite.

Bob Deposit

86-075X	63-26	CPTL Scale 1 cm = 0.17mm Gradational contact of limonitized zone (right) with marble (left) Blue-grey and white grains (top) are quartz.
86-076X	63-24	RL Scale 1 cm = 0.17mm Shows typical texture. Large cream coloured grains are pyrite. Whiter material is arsenopyrite. Yellow is chalcopyrite. Dark grey matrix or cement is quartz (smooth) and carbonate (speckled). Medium grey phase at chalcopyrite/pyrite contact (right), and as veinlets and inclusions in pyrite, is sphalerite.
86-077X	63-6	RL Scale 1 cm = 0.17mm Typical texture. Brecciated clusters of pyrite grains in quartz matrix. Note chalcopyrite as interstitial pockets and occasional small inclusions in pyrite.

Discovery Deposit

86-078X	63-22	RL Scale 1 cm = 0.17mm Secondary pyrite (cream colour, centre) as envelope around carbonate veinlet (dark linear zone). Matrix (beige with black polishing pits) is pyrrhotite. Rare inclusions of chalcopyrite (yellow) in the pyrrhotite.
86-079X	63-21	CPTL Scale 1 cm = 0.17mm Calcite marble (greys) with calc silicates (diopside/tremolite; blues, greens, pinks, orange). Note incipient fine-grained calc silicate development in the calcite, as well as the coarse prismatic masses. Black areas are pyrite (opaque). Note probable replacement contact with the hosting skarn.

Sample DDH 85-7, 8" from 25675 E (Slide 86-057X)

Estimated mode

Pyrite	95
Sphalerite	2
Chalcopyrite	trace
Arsenopyrite	trace
Gold	trace
Limonite	trace
Graphite	trace
Quartz	2
Carbonate	1
Sericite	trace

The slide consists almost entirely of massive, anhedral pyrite.

Angular interstitial pockets and hairline fractures and grain boundary networks are filled by the gangue minerals and sphalerite.

Non-sulfides consist of granular, partly euhedral quartz with intergrown irregular patches of carbonate and/or felted sericite. The sphalerite (which contains abundant, minute exsolution inclusions of chalcopyrite) is patchily intergrown with the quartz/carbonate and appears contemporaneous with it. Small irregular inclusions of sphalerite and chalcopyrite also occur sparsely disseminated throughout the massive pyrite.

Both sphalerite and the gangue minerals show a veining relationship to the pyrite. Some quartz veinlets show thin selvedges of carbonate along the walls. This locally diverges into cross-cutting fracture fillings in the quartz, indicating that the carbonate is the youngest component.

Thin films of limonite follow some of the threadlike quartz carbonate and sphalerite veinlets; limonite also locally forms diffuse impregnations of sericite-rich gangue.

Graphite forms sparsely scattered individual small flakes associated with the gangue/sphalerite pockets and sometimes enclosed within compact pyrite.

Gold was observed as minute threads one or two microns in thickness, filling micro-fractures in pyrite, and as irregular blebs up to 25 microns in size within compact pyrite.

Sample DDH 85-7, 6" from 25669 E (Slide 86-058X)

Estimated mode

Massive pyrite	30
Fine-grained colloform pyrite)	30
Limonite)	
Quartz	38
Sericite	2
Graphite	trace

This slide exhibits striking and unusual textural/mineralogical features.

It consists of irregular patchy/pockety intergrowths of quartzose gangue and an Fe sulfide/oxide assemblage.

The quartz is a normal granular/sparry (partly interlocking, euhedral) aggregate containing relatively abundant accessory sericite as ragged clusters and wisps. Rare traces of graphite are sometimes associated with the micaceous areas.

The sulfide/oxide assemblage consists of three phases: optically normal pyrite, as rather fine-grained crustified aggregates and compact masses; cryptocrystalline brownish pyrite (melnikovite) showing colloform textures and blotchy non-polishable patches; and translucent, colloform/crustified limonite.

The two latter phases show intimate intergrowth, with limonite filling shrinkage cracks and cuspate voids in the colloform melnikovite, as well as occurring diffusely admixed on the micron scale to varying degrees throughout the melnikovite. The intergrown melnikovite and limonite constitute the dark areas macroscopically visible in the slide.

The crystalline pyrite forms irregular patches, rims and boxwork-like ribs through the melnikovite/limonite matrix.

The latter appears to fill angular vuggy pockets within the quartz mass, with crystalline pyrite typically encrusting the walls of such pockets.

The relationship of the limonite to the melnikovite is not typical of secondary oxidation; rather, the limonite appears primary (though youngest in the paragenesis). It may represent the transition to oxidizing conditions which elsewhere has produced the enigmatic jasperoid.

Sample DDH 85-7, 25672 E (Slide 86-059X)

Estimated mode

Carbonate	52
Quartz	8
Sericite	trace
Graphite	trace
Arsenopyrite	12
Pyrite	10
Sphalerite	9
Galena	8
Chalcopyrite	1
Secondary Cu minerals	trace
Electrum	trace

This slide shows the contact between mineralized and gangue material.

The gangue is dominantly carbonate (moderately reactive to dilute acid and so, apparently, mainly calcite, possibly with some intermixed dolomite). In the unmineralized area this is a rather even anhedral mosaic of grain size 0.5 - 2.0mm. Quartz occurs as sparsely scattered pockets and ill-defined (replacement-type?) veinlets.

In the mineralized area the gangue is matrix to abundantly disseminated grains and coalescent clusters of sulfides. Here the carbonate aggregate is noticeably finer grained than in the unmineralized area and contains considerably more quartz, as evenly distributed small pockets and/or euhedral-subhedral crystals. Traces of sericite and graphite also occur in this association.

The sulfides consist dominantly of euhedral to subhedral grains of arsenopyrite and pyrite, 0.2 - 1.0mm in size, as abundantly disseminated individuals and, to some extent, intergrown clumps.

Sphalerite (packed with tiny exsolution blebs of chalcopyrite) and galena are prominent accessories. They occur interstitially to the Fe-As sulfides, forming irregular patches in the gangue and, to a lesser degree, rimming, penetrating grain boundaries, and marginally replacing the pyrite/arsenopyrite. The sphalerite and galena show a rather striking tendency for segregation, seldom if ever showing complex intergrowths with each other.

Chalcopyrite is a minor constituent of this interstitial polymetallic sulfide phase, as small pockets often with fine rims and intergrowths of sphalerite and/or galena. It is often rimmed by secondary Cu minerals (chalcocite and digenite). The latter also form thread-like veinlets and grain boundary fillings in the sphalerite and micro-fractured pyrite.

The Pb-Zn-Cu sulfides (and, to some extent, the arsenopyrite) show complex, crenulate (replacement?) margins against the carbonate gangue, with zones of very fine-grained sulfides developed in carbonate cleavages, and as dusty permeations. Contacts against the quartz component of the gangue are sharper and the sulfides tend to mould around the scattered subhedral quartz crystals. The Pb-Zn-Cu sulfides locally form networks of micro-fracture fillings in the pyrite/arsenopyrite.

Rare, minute threads and flecks of electrum and/or native Ag were observed in pyrite and arsenopyrite.

The scattered graphite flakes occur both in the carbonate gangue and partially or wholly enclosed within sulfides.

Sample DDH 85-7 170 m (Slide 86-060X)

Estimated mode

Calcite	82
Phlogopite	1
Diopside (?)	1
Alteration assemblage	15
Opaques	1
Quartz	trace

This is a marble composed essentially of an evenly granular polygonal mosaic of calcite of grain size 0.2 - 1.0mm. Disseminated accessories are tiny flakes of a pale brown mica, granules of a colourless, high-relief calc-silicate (probably diopside or forsterite), and minute laths and specks of opaques (probably mainly graphite, with traces of pyrrhotite).

The rock exhibits sub-parallel bands of a distinctive textural/mineralogical aspect which appear to be a form of incipient alteration, or possibly relate to pre-metamorphic, layered, compositional variations in the original limestone. These zones contain a high concentration of a structureless, whitish sub-opaque material as clusters of sub-coalescent pellet-like masses, apparently randomly superimposed on the calcite grain fabric. Extremely fine-grained felted sericite and minor cherty silica is intimately intergrown with the sub-opaque component.

The brown zone at one end of the slide is indentical with the less obvious whitish zones except for a diffuse colouration (traces of limonite staining?).

SEM microanalysis of these zones suggests that the material of the whitish zones is dolomite with silica and minor Fe. That of the brown zone showed calcite with silica and traces of Fe. Associated material in both cases is composed of K, Al and Si (the felted sericite).

Sample DDH 85-12 just before 23248 E (Slide 86-061X)

Estimated mode

Quartz	75	
Limonite	24	
Mineral X	1	(Alunite?)
Pyrite	trace	
Gold	trace	

This is a limonitic siliceous breccia composed of matrix-supported, angular fragments of vein-type quartz ranging from 0.1 - 8.0mm in size. These are tightly cemented by a very fine-grained cherty to micro comb-textured quartz containing more or less limonite as irregular tiny granules, colloform masses, shard-like fragments and diffuse impregnations, grading to compact limonite.

The majority of the limonite is of the earthy or non-polishing variety, with only scattered irregular fragment-like or lamellar grains of more crystalline material.

Certain areas of the limonitic chert with relatively few quartz fragments contain fine-grained sheafs and meshwork intergrowths of a colourless, prismatic mineral which may possibly be alunite.

Minute specks of pyrite are occasionally seen as inclusions in the vein quartz fragments and, very rarely, within crystalline limonite. There is, however, no indication that the limonite has formed by in situ alteration of sulfides.

A rather surprising constituent is gold, as rare, scattered tiny grains, 10 - 100 microns in size, within the ferruginous, cherty cement.

Sample DDH 85-12 beginning of 23250 E (Slide 86-062X)

Estimated mode

Limonite	59
Quartz	25
Mineral X	15
Mineral Y	1
Pyrite	trace
Gold	trace

This is a heterogenous limonitic rock (jasperoid?) of similar aspect and general character to 061X.

A considerable proportion of the limonite in this sample is a compact form, with a diffuse sub-colloform/cellular internal structure, which takes a good polish. This occurs as minutely brecciated masses and elongate, shard-like fragments cemented by a network of veinlets of cherty and microcrystalline quartz. A few brecciated masses of coarse quartz are also present. A component of powdery, non-polishing limonite tends to rim the brecciated masses of compact limonite. In part this is cut by the cherty quartz veinlets and in part forms an intimate diffuse impregnation of the chert.

The slide contains some rather extensive pockets of a pale green, high birefringent fibrous or microcolloform aggregate mineral (Mineral X). This is indicated by SEM microanalysis as of complex composition (dominantly As Pb and Cu with traces of Zn and Ca); it could contain S (the peak of which is masked by Pb) and may be a complex secondary sulfate or an arsenate.

In a few places patches of mineral X contain prominent prismatic crystals of a colourless, sub-opaque, high relief mineral (Mineral Y). SEM analysis indicates a composition of Pb and As and the mineral appears to be of related type to mineral X - possibly a lead arsenate.

Pyrite occurs as scattered tiny grains, within limonite and within quartz. The pyrite grains are often rimmed by limonite.

The relationship of these traces of pyrite to the abundant limonite is unclear. The latter does not have the aspect of having formed by pseudomorphous or in situ alteration of sulfides.

The slide contains one large (300 micron) hackly grain of gold. This occurs in diffusely limonitic chert on the contact with a patch of mineral X.

Sample 85-12, 23296 E (Slide 86-063X)

Estimated mode

Marble	
Carbonate	90
Quartz	10
Chlorite	trace
Leucoxene (?)	trace
Graphite	trace
Limonitic zone	
Limonite	27
Pyrite	3
Quartz	50
Carbonate	20
Sulfidic zone	
Pyrite	55
Arsenopyrite	12
Sphalerite	8
Chalcopyrite	trace
Quartz	25
Carbonate	trace
Chlorite	trace

This slide comprises a heterogenous assemblage of several distinct sub-types in uncertain relationship.

Macroscopically it appears to consist of a central zone of altered marble flanked on one side by limonitic material and on the other by fresh pyrite with quartz. Both the latter phases appear to show gradational, replacement-type contacts with the marble in some cases with the development of selvedges which have the appearance of reaction zones.

The marble is a rather coarse-grained (0.5 - 2.0mm) anhedral aggregate of calcite, intimately pervaded by silica as small pockets, thread-like and diffuse veinlets, and fine-grained permeations of carbonate cleavages.

Other accessories (in trace amounts) are tiny flakes of graphite, small pockets of felted chlorite, and rounded, colloform blobs of a brownish sub-opaque material (leucoxene?, ferruginous clay?).

The limonitic area consists of quartz, carbonate and limonite. The quartz forms sub-parallel banded/crustified zones and veinlets of fine-grained cherty-textured material, and also areas of intimate intergrowth with carbonate in which quartz forms a cement to a meshwork of elongate prismatic carbonate grains. This is transitional to the altered marble previously described via a zone in which quartz forms a network, permeating the grain boundaries of the grnaular carbonate aggregate.

Limonite occurs throughout the silica and silica/carbonate as more or less concentrated bands, patches of close-packed colloform pellets, and areas of diffuse permeation and staining.

Some of the more compact limonite masses contain relatively abundant remnants(?) of pyrite, sometimes showing a finely granular texture, sometimes a ragged lamellar texture,and sometimes a cryptocrystalline/colloform texture (similar to the partially oxidized melnikovite in slide 86-058X).

The zone of unoxidized sulfides at the other end of the slide consists dominantly of pyrite with accessory arsenopyrite. This forms microbrecciated masses and clusters of individual euhedral/subhedral grains cemented by a matrix of finely granular quartz.

Traces of carbonate and chlorite occur in the quartz cement, as well as small patches of sphalerite.

Sphalerite is notably concentrated in an irregular selvedge zone at the contact with the marble. This consists of cherty silica intimately pervaded by micron sized granules of sphalerite. Sphalerite also forms some coarser patches and bands. Locally this cherty contact zone consists dominantly of fine-grained arsenopyrite.

Sample DDH 85-19 6" from 25704 F (Slide 86-064X)

Estimated mode

Calcite	65
Tremolite) Diopside)	20
Quartz	15
Sericite	trace
Graphite (?)	trace

This sample consists of a very pure, coarse-grained calcitic marble with a central, intensely altered zone of quartz and calc silicates.

The host marble consists of a simple polygonal aggregate of anhedral calcite, of grain size 0.2 - 2.0mm, in which the only impurities are sparsely scattered tiny flakes of sericite and graphite.

The central altered zone consists of banded alternations of quartz-rich and calc silicate-rich material.

The quartz is a rather evenly fine-grained polygonal mosaic (0.05 - 0.3mm), with minor interstitial flecks of carbonate and small granules of diopside/tremolite.

For the most part the calc-silicates are well segregated, as elongate bands and clumps of sub-prismatic grains up to several mm in size. They appear to consist of intergrown colourless pyroxene and amphibole, the latter sometimes forming rims to the former. They are typically strongly poikiloblastic and sieved with small granules of quartz. Calc-silicates also form prominent selvedges at the quartz/marble contacts, with irregular veniform patches developed in the marble itself near the contact.

The quartz/calc-silicate zone shows sharp but irregular contacts with the marble which appear to represent a replacement or alteration front.

Sample Tel Main Pit, A Zone (Slide 86-065X)

Estimated mode

Quartz	30
Carbonate	20
Chlorite/sericite	trace
Graphite	1
Sphalerite	25
Arsenopyrite	13
Pyrite	10
Chalcopyrite	1
Galena	trace
Gold	trace

This is a mineralized rock showing a crudely banded texture reflecting variations in the concentration of intergrown sulfides in gangue.

The gangue is a rather homogenous, randomly oriented intergrowth of quartz and carbonate as subhedral to euhedral grains 0.1 - 0.5mm. This contains traces of sericite and chlorite as tiny flecks and clumps, and relatively abundant small flakes of graphite. The latter occur in the gangue, on gangue/sulfide contacts and, less commonly, wholly or partially enclosed within sulfides.

The carbonate is less strongly reactive to dilute acid than that of some of the other samples. This may indicate a proportion of intergrown dolomite with the calcite, or may be simply a function of the intimate intergrowth with dominant quartz.

The commonest sulfide is sphalerite as angular pockets, commonly showing an interstitial or enclosing relationship to euhedral quartz grains.

Other major components are arsenopyrite, in similar mode to sphalerite and as clusters of partially euhedral grains (often embayed by adjacent gangue and or sphalerite) and pyrite, as coarse massive areas. Arsenopyrite also forms similar compact, monomineralic masses.

Chalcopyrite occurs as small exsolution blebs in sphalerite, and rare tiny pockets in pyrite. Traces of galena were seen as inclusions in arsenopyrite.

There is a limited degree of intergrowth between the three major sulfides but generally they are well-segregated.

The even texture and prevalence of euhedral forms in both gangue and sulfides bespeaks of essentially contemporaneous formation.

Gold is relatively abundant, occurring as irregular grains, clusters of grains and replacement-like patches in diverse textural situations e.g. within pyrite, arsenopyrite, sphalerite and in gangue at the contact of various sulfides. Flakes of graphite are occasionally seen intergrown with the gold, though there is no indication of a preferential association. The gold is relatively coarse (up to 100 microns) and is often a pale to very pale electrum, grading in some cases to native Ag (showing the typical irridescent tarnish).

Sample Tel, Main Pit, A Zone (Slide 86-066X)

Estimated mode

Carbonate	99
Tremolite	1
Quartz	trace
Chlorite	trace
Phlogopite	trace
Apatite	trace
Opaques	trace

This is an essentially monomineralic rock, composed of calcite as a non-foliated, polygonal aggregate of grain size 0.5 - 2.0mm.

Sparsely scattered, tiny, ragged prismatic to rounded grains of tremolite and phlogopite occur in grain boundary relationship to the calcite. Some of these accessories are partially altered to chlorite and a brownish stain.

Opaques are minute disseminated granules and laths - probably graphite.

Quartz occurs as a single, irregular, semi-continuous, comb-textured wisp (replacement veinlet?).

Sample DDH 86-2; assay 26280 (Slide 86-067X)

Estimated mode

Quartz	35
Carbonate	15
Sphalerite	30
Pyrite	18
Chalcopyrite	1
Arsenopyrite	1
Galena	trace
Gold	trace

This is a texturally heterogenous rock. The dominant gangue is quartz, of widely varying grain size (from 0.02mm to several mm). This forms a complexly interlocking fabric of euhedral grains with interstitial fine cherty material and zones of apparent fine granulation.

The sulfides, which form irregular clusters and semi-massive patches, are brecciated or 'pulled-apart' masses of sphalerite and pyrite. These two components are mainly well-segregated, though some areas of intergrowth are seen. Some pseudo-breccia (?) zones of close-packed, sand-like sulfides are also present.

The latter are typically cemented by carbonate. Carbonate throughout this sample has a 'late' aspect, forming veinlets and irregular replacement patches in quartz, and filling micro-fracture networks in pyrite and parallel gash-veinlets in sphalerite.

The traces of graphite seen in many other samples are apparently absent.

Chalcopyrite,as well as being rather sparsely disseminated as exsolution blebs in sphalerite,also forms small pockets and segregations in its own right. Arsenopyrite is a minor intergrown component with the pyrite and also locally forms areas of minutely fine-grained grain-boundary impregnations of quartz.

Gold is relatively abundant and (in part) coarse. It shows the usual diverse relationships, including coarse replacement networks (with grains up to 100 microns or more) in sphalerite, cementing and replacing minutely brecciated pyrite, as tiny blebs in arsenopyrite and gangue, etc. It is typically a rather pale coloured electrum.

Sample Sulfide-poor material from DDH 86-2; assay 26280. (Slide 86-068X)

Estimated mode

Carbonate	50
Quartz	45
Sericite	trace
Arsenopyrite	5
Pyrite	trace

This sample consists dominantly of a texturally heterogenous intergrowth of calcite and quartz.

Some areas are composed of coarse-grained, monomineralic calcite. Others are of calcite in which are developed ill-defined, veinlike zones of cherty or microbrecciated quartz, and isolated euhedral quartz crystals and crystal clumps. This material grades to a highly siliceous assemblage composed of interlocking, complexly intergrown, subhedral-euhedral quartz of highly variable grain size with carbonate occupying angular interstitial pockets. There is some evidence of minor marginal replacement of quartz by carbonate.

The quartz shows strong strain polarization. The fabric is totally non-oriented.

Sulfides consist almost entirely of arsenopyrite, as disseminated lines and clusters of euhedral grains 0.02 - 0.5mm. These tend to concentrate in carbonate peripheral to quartz clumps. They appear to be absent from the areas of coarse, quartz-free carbonate. Traces of sericite occur in association with the sulfides.

Sample Tel, Surface B Zone (Slide 86-069X)

Estimated mode

Quartz	40
Carbonate	trace
Sericite	trace
Pyrite	45
Sphalerite	14
Chalcopyrite	1
Arsenopyrite	trace
Gold	trace

This sample consists largely of sub-parallel, banded or crustified masses of pyrite in a siliceous gangue.

The gangue, unlike the A Zone samples, contains almost no carbonate. It is made up of heterogenous, interlocking, anhedral-subhedral aggregate of quartz of highly variable grain size, ranging from elongate grains of several mm down to abundant patches and elongate zones of microgranular material (0.02 - 0.2mm). Grain contacts are typically complex, with incipient granulation/recrystallization. A few zones of definite fracturing and micro-brecciation are observed.

The pyrite consists of subhedral grains, 0.1 - 1.0mm, coalescing to massive compact patches. These locally show microbrecciation and cementation by the matrix quartz.

Sphalerite is the other major sulfide. It is generally well-segregated, forming irregular masses and fine-grained impregnations in gangue adjacent to the pyrite aggregates. It has a high content of exsolution blebs of chalcopyrite.

Arsenopyrite is present in traces, as rare intergrown grains and intergranular veinlets in the pyrite masses.

Gold is relatively abundant and exhibits a variety of associations. It was seen as irregular tiny grains within compact pyrite, as small blebs in sphalerite, (sometimes associated with small pyrite inclusions), on pyrite/quartz and sphalerite/quartz contacts and as irregular grains totally within quartz. The coarsest gold (up to 100 microns) was in the latter setting.

The gold in this sample is notably deeper in colour (less Ag-rich ?) than the pale variety (electrum?) seen in many of the other samples of this suite.

Sample Tel, surface: B Zone (Slide 86-070X)

Estimated mode

Quartz	50
Sericite	trace
Sphalerite	25
Pyrite	18
Arsenopyrite	6
Chalcopyrite	1
Galena	trace
Gold	trace
Secondary Cu minerals	trace

This is a texturally similar rock to 069X but contains higher proportions of sphalerite and arsenopyrite.

The gangue is sparry quartz of heterogenous grain size. It includes coarse euhedral prisms to 6mm, areas of complexly interlocking anhedral aggregate, and patches, wisps and crustified interlayers of very fine-grained feathery textured material.

The sulfides occur as irregular clumps and patches showing a weakly banded (crustified?) distribution. As in 069X, they appear superimposed on the matrix fabric, transgressing grain boundaries and grain size variations.

Pyrite occurs as coarse anhedral masses and more or less close-packed clusters of individual subhedral grains, 0.1 - 0.5mm in size. The matrix quartz penetrates and cements along grain boundaries and local micro-brecciation networks.

Arsenopyrite forms mainly clusters of individual euhedra, rather finer grained than the pyrite (0.05 - 0.2mm). It also occurs intergrown with, moulded upon and interstitial to pyrite.

Sphalerite is generally well-segregated from the Fe-As sulfides but locally occurs intergrown with or moulding around them. It contains abundant exsolution blebs of chalcopyrite. Chalcopyrite also occurs as scattered small marginal segregations.

The pyrite contains scattered tiny inclusions and veinlets of sphalerite, chalcopyrite and galena.

Thin rims and veinlets of secondary Cu minerals (covellite and digenite) are developed in the sphalerite - presumably by virtue of its high dissolved Cu content. The discrete segregations of chalcopyrite, oddly enough, appear unaltered.

Gold was seen chiefly as tiny blebs and threads, 5 - 25 microns in size, within homogenous and microfractured pyrite. It was also observed, in a few cases, on pyrite/sphalerite contacts.

Sample Tel, surface: C Zone. (Slide 86-071X)

Estimated mode

Quartz	90
Carbonate	3
Arsenopyrite	7

This is a sulfide-poor sample consisting largely of sparry quartz gangue as coarse, interlocking subhedra (to 5mm in size) with a minor proportion of finer-grained interstitial material.

Carbonate occurs as scattered angular pockets and areas of intergrowth with finer quartz, it also forms small veinlets and cements clumps of fractured sulfides.

The sulfides are monomineralic arsenopyrite (as in 86-068X, which differs mainly in its much higher content of carbonate and more heterogenous texture). This occurs as rather evenly disseminated subhedral individuals (0.05 - 0.5mm) and compact coalescent clumps. Its distribution appears partially controlled by quartz grain boundaries.

The arsenopyrite is somewhat fractured but is mineralogically homogenous, lacking inclusions of other sulfides.

Sample Tel, surface: C Zone (Slide 86-072X)

Estimated mode

Carbonate	92
Quartz	4
Arsenopyrite	4
Pyrite	trace
Pyrrhotite	trace

This is a weakly mineralized rock consisting largely of coarse-grained anhedral calcite. Minor quartz occurs as scattered small euhedral individuals and irregular clumps, locally concentrating to patches of granular aggregate. The quartz seems sometimes to have developed along carbonate grain boundaries or to be associated with obscure fragmental structures.

Arsenopyrite is the principal sulfide. It occurs as curvate strings and networks of tiny, perfectly formed euhedra, 0.02 - 0.2mm in size, with local clumps of coarser grains to 1mm or more. Pyrite is a minor associate intimately intergrown in cementing mode to the arsenopyrite clusters, or as small selvedges moulded on them.

The distribution of the sulfide strings and clumps is clearly controlled by carbonate grain boundaries and the cryptic breccia structure previously referred to. It shows no consistent relation to the distribution of the accessory quartz.

Pyrrhotite occurs as minute lath-like grains disseminated as inclusions within some of the coarse calcite grains.

Sample Tel, Main Pit, A Zone: Delicate pyrite. (Slide 86-073X)

Estimated mode

Pyrite	99
Arsenopyrite	trace
Pyrrhotite	trace
Chalcopyrite	trace
Sphalerite	trace
Quartz	1
Sericite	trace

Microscopic examination of this sample confirms what is macroscopically evident, i.e. it is a porous, reticulate-cellular aggregate of finely crystalline pyrite.

The pyrite is predominantly a close-packed, polygonal mosaic of grains 0.02 - 0.2mm in size, exhibiting euhedral faces on the free surfaces (cell walls). Occasionaly much coarser grains are embedded within the microgranular aggregate; these typically contain minute inclusions of chalcopyrite and lesser sphalerite. Chalcopyrite also forms rare coarser segregations.

Other trace constituents are arsenopyrite, which forms scattered, relatively coarse, individual grains intergrown with the pyrite, and pyrrhotite as tiny inclusions in the microgranular pyrite.

The only other constituents are microgranular quartz with rare flecks of pale brown sericite and flakes of graphite. Small irregular patches of chalcopyrite occur intergrown with the quartz. This material occurs as a filling to a few of the vugs and may originally have been more extensive (lost by plucking during preparation). However, it would appear that many of the vugs were, in fact, open spaces.

The patches of dark (blue-black) material apparent in some of the hand-specimen pieces cannot be seen in the polished section. They may represent thin coatings of surface tarnish.

Sample Tel, Main Pit, A Zone: partially oxidized. (Slide 86-074X)

Estimated mode

Pyrite	43
Sphalerite	25
Arsenopyrite	5
Chalcopyrite	1
Pyrrhotite	trace
Gold	trace
Graphite	trace
Secondary Cu minerals	trace
Limonite	trace
Mineral X (Smithsonite?)	1
Quartz	25
Chlorite	trace

This is a strongly sulfidic sample, consisting of irregular masses and coalescent disseminations of pyrite and sphalerite in a quartzose gangue.

The latter consists of rather fine-grained, interlocking sparry-textured quartz with local cherty patches. Scattered flecks of sericite and radiate clusters of brownish chlorite occur in the quartz and on the contact of sulfides. Small individual flakes of graphite are relatively common; these occur mainly in the quartz, but also partially or completely enclosed within sulfides.

At one end of the slide the quartz contains cellular boxworks of a pale brown, high relief, high birefringent, spheroidal mineral. This has minute inclusions of sulfides and may be smithsonite (Zn carbonate).

Pyrite, which is the dominant sulfide, forms coarse anhedral masses as well as loose aggregates of individual small subhedral grains in gangue. In the latter form it is sometimes closely intergrown with sphalerite and arsenopyrite. The pyrite contains sparse tiny inclusions and veinlets of sphalerite, chalcopyrite and pyrrhotite.

Arsenopyrite is a relatively minor constituent overall, typically occurring as clusters of euhedral grains, 0.1 - 0.5mm in size, associated with sphalerite.

Sphalerite occurs as the usual irregular patches and coalescent networks in gangue. It contains abundant exsolution blebs of chalcopyrite. It is typically well-segregated from the pyrite, moulding around and locally marginally replacing it.

Gold (a rather pale, incipiently tarnished electrum) is widespread and shows the usual diverse associations. It was noted as grains 5 - 50 microns in size, enclosed within pyrite, sphalerite, quartz and, least commonly, arsenopyrite, and on grain contacts of these various minerals.

Trace amounts of secondary Cu minerals (digenite, covellite and malachite) coat pores and form thin rims and threadlike veinlets, especially in sphalerite. Some hairline veinlets of partially limonitized pyrrhotite or melnikovite are also seen.

Sample Bob Deposit: Fe-stained carbonate (Slide 86-075X)

Estimated mode

Carbonate	85
Quartz	8
Sericite	trace
Clay (?)	trace
Opaques	2
Limonite	5

This sample is a somewhat silicified marble showing localized ferruginous alteration.

It is composed dominantly of a rather even grained, interlocking aggregate of carbonate of grain size 0.1 - 0.5mm. A few patches of coarser sparry development (with curved crystal faces) and some breccia-like zones of much finer-grained material are also present.

Quartz occurs as scattered individual grains, semi-continuous, elongate, veinlike strings of euhedral grains, and irregular impregnations in some of the fine-grained, crush-zone carbonate.

Other constituents are rare flecks of sericite and scattered groups of small sub-rounded to irregular patches of brownish sub-opaque material (clays?).

Disseminated opaques are individual euhedra and small clumps of what appears to be mainly arsenopyrite. These show no consistent relation to the centres of silicification.

The dark reddish-brown zone at one end of the slide appears to be simply a strongly limonitized (stained and diffusely impregnated) carbonate. It is notable that disseminated sulfides survive apparently unaltered within this limonitic zone. Also incipient quartz veins continue unaltered across the alteration front. The contact of limonitized and normal carbonate is sharply gradational (with limonite visibly permeating the cleavages of the host carbonate).

The non-ferruginized carbonate is slightly slower to react to acid than the remnant carbonate in the ferruginized zone. The former may contain a minor component of dolomite whereas the latter is unquestionably calcitic.

Sample Bob Deposit, coarse-grained mineralization. (Slide 86-076X)

Estimated mode

Pyrite	62
Chalcopyrite	15
Pyrrhotite	1
Sphalerite	trace
Arsenopyrite	2
Quartz	14
Carbonate	5
Chlorite	1

The gangue in this sample is dominantly quartz, as a heterogenous anhedral aggregate with complex grain boundaries showing recrystallization/granulation, and with patches of very fine-grained cherty silica. Carbonate occurs as sparry pockets cementing and replacing (?) clumps of pyrite, as irregular veinlets in quartz and as diffuse impregnations of fine-grained cherty quartz. A pale brownish chlorite occurs as scattered wisps and sheafs.

The sulfides are principally pyrite, as subhedral grains, 0.1 - 2.0mm, coalescing to extensive, compact masses. It often show extreme microfracturing.

Aresenopyrite is a minor constituent intergrown with pyrite and interstitial to it.

Chalcopyrite forms well segregated, irregular, often coarse-grained masses. It moulds around pyrite grains, fills interstices and forms a network of hairline veinlets in fractured pyrite.

Traces of sphalerite occur as marginal exsolved segregations in chalcopyrite and, with chalcopyrite, as tiny inclusions in pyrite.

The coarse-grained chalcopyrite commonly contains elongate blades of a pinky-brown mineral which could be cubanite but may be simply pyrrhotite. Pyrrhotite is also seen, in an altered, lamellar form, as selvedges to chalcopyrite masses.

Somewhat surprisingly (considering the strongly mineralized and favourably fractured character of the sample) no gold was observed.

Sample Bob Deposit, fine-grained mineralization (Slide 86-077X)

Estimated mode

Pyrite	74
Chalcopyrite	3
Arsenopyrite	1
Sphalerite	trace
Quartz	22
Chlorite	trace

This sample is similar to 076X except for its lower content of chalcopyrite and lack of carbonate.

Texturally it differs somewhat in that the pyrite is finer-grained and seldom coalesces to compact masses. It typically forms loosely aggregated clusters, cemented interstitially by fine networks of matrix quartz.

The pyrite shows strong microbrecciation, but veining by chalcopyrite, though observed, is relatively rare. Chalcopyrite mainly occurs as a few segregated patches and as fine-grained pockets in gangue.

The quartz matrix shows the same complex interpenetrating fabric as 076X.

Sample Discovery deposit: pyrrhotite (Slide 86-078X)

Estimated mode

Pyrrhotite	89
Pyrite	5
Chalcopyrite	1
Quartz	2
Carbonate	3
Sericite	trace

This sample is essentially massive pyrrhotite, in the form of a compact aggregate of somewhat elongate grains, 0.05 - 0.2mm, showing local parallelism, a consistent strain-induced direction of lamellar twinning, and evidence of recrystallization and local deformation.

The pyrrhotite contains prominent elongate veinlike bodies and irregular patches of a very fine-grained, mottled pyrite. These are speckled with inclusions of carbonate and are often centred around hairline veinlets of carbonate; they also contain tiny ragged flecks (remnants?) of pyrrhotite. The pyrite development follows a coarse tri-directional network and is almost certainly a form of alteration, although a highly localized one (the pyrrhotite, overall, being strikingly fresh).

Chalcopyrite is the only other sulfide, as scattered small pockets within the massive pyrrhotite.

Granular quartz, with rather abundant flecks of sericite, is the other gangue component, as scattered irregular pockets and discontinuous veinlets.

Sample Discovery deposit: pyrrhotite   (Slide 86-079X)

Estimated mode

Pyrrhotite	60
Chalcopyrite	trace
Carbonate	26
Diopside) Tremolite)	12
Quartz	2
Chlorite	trace
Apatite	trace

The sample consists of irregular masses of compact pyrrhotite, alternating with a skarnified marble containing dispersed pyrrhotite.

The massive pyrrhotite is an aggregate of elongate grains of heterogenous grain size, showing strong lamellar twinning and fluidal deformation features. The only accessory is chalcopyrite as scattered tiny pockets and marginal segregations. The secondary pyrite of 078X is lacking.

The non-sulfide component is made up of calcite with a high content of calc silicates. These are often highly poikiloblastic or skeletal (clearly developing by alteration of carbonate via cleavages) and are of uncertain mineralogy. They probably include both diopside and tremolite. They form mainly rather small grains, 0.05 - 0.2mm, randomly clustered within the carbonate.

The latter shows strong deformation in the form of folding and localized shearing.

Other constituents are quartz, as scattered coarse subhedral grains, small veinlets and diffuse areas of cherty impregnation of carbonate; and small clumps of chlorite.

The contacts between the massive pyrrhotite and the gangue are transitional, complex and irregular; gangue forms inclusions in the sulfides, and sulfides form networks and irregular patches permeating the skarnified marble via grain boundaries, cleavages and shear zones.

There is no evidence that the calc-silicate development in the marble and the formation of the pyrrhotite are genetically connected.