NOTES ON E. PIMA THIN SECT.

DDH 140 @ 226' Log. Lat. porphy.

angular grains of qtz and feld. with interstial sericitized silt?. a few completed sericitized grains of feld? have shapes vaguely suggestive of euhedral xtals. One qtz grain shows a possible embayment of resorption type. Several fragments of qtzite and one of highly sericitized porphyry were seen. the rock is possibly a pyroclastic.

DDH 140 @ 246 Log Lat porhyry Sericitized phenoc of feldspar in a matrix of equigranular, cubic sericitized feld, with interstitial sericite. some qtz in veins. Felsite porphry.

DDH 140 @ 255. Log Lat porphy. Same as above. feld more highly sericitized.

DDH 140 @ 434. Log Qtz with streaking Argillite. Thin section shows angular qtz and feld grains of silt size in a matrix of Very fine (mud?) matrix of sericite & clay. Distinct alignment of larger frag on bedding. (matrix shows Bleeding of Grr Sus & alteration) Qtz and carbonate veining.

DDH 137 @ 29.1 Andesite (Magnetic)

laths of altered feld (sericite, and possibly ?? carbonate) in groundmass of clay and sericite w/ grams of carbonate and minor qtz. Large round or elliptical blebs of carbonate and a few smaller grains of qtz throut. Carbonate alson in veins. Magnetite (opaque) in grains with irregular boundaries in groundmass, well disseminated.

DDH 137 @ 300. Highly sericitized feld, in sericitic matrix. Introduced qtz plentiful. Felsite porphyry.

DDH 137 @ 1469 - Breccia. Original rock a silicified monzonite or diorite.

DDH 137 - 1492 Equigranular Microcline, Andesine (Ab 68) and minor orthoclase, all with partial euhedral outline, and large blebs of qtz. Also smaller qtz blebs. Some plagioclase (the more euhedral) is zoned and highly altered to clay and sericite. Rock is a silicified monzonite.

to: Dr. Bob

DDH
152 @ 310 - Qtz - feld - carbonate rock. An equigranular mossaic of low positive relief optically +: (albite?) feld. forms the bulk of rock. Intergrown "graphically" is qtz, sometimes in the same optic orientation over small areas. Also qtz veins. One 2 mm ± "grain" of qtz - feld intergrowth shows 2 extinx of qtz ~~alon~~ bounding along a more or less straight line, possibly being silicification of an original feld twin. Carbonate floods the rock in veins and irregular patches and in the groundmass. A few rounded zircons noted. Originally possibly a calcareous argillite.

also rhombic min: desc. below Local in qtz areas.

DDH 152 @ 357 Parallel banded qtz - carbonate veins in a matrix of equigranular low negative relief feldspar (orth?). Originally an argillite? below

DDH 152 @ 360 - Silicified rock, Qtz and Carbonate flooding rock, the Qtz guided by xtal faces. of a rhombic, vy fine grained mineral of moderate negative relief, birefringe vy weak, in the grey's. Possibly carnegieite ($Na_2O\ Al_2O_3\ 2SiO_2$) a variety of feldspar, index 1.52. Apatite abundant, and rounded zircon fairly common.

feld may be present. also vy fine grained fibrous mineral. Some epidote.

" Pink dense siliceous core "

DDH 144 @ 405 Vy fine grained mixture of feld? and sericite and clay. Some qtz also. Numerous larger fragments of qtz are also present, some appearing detrital, but also some showing "rhombic" shape of high-temp volcanic qtz, and one or two showing possible resorption embayments. This is then, on basis of feldspathic groundmass and possible igneous qtz, classified as rhyolitic tuff. (also one possible sericitized phenocryst of feldspar).
a veinlet of muscovite cuts the section
Some detrital? zircon. Carbonate veining

"Pink cat"

DDH 144 @ 411 - Argillite or siltstone. ~.005 mm qtz. some detrital zircon. Carbonate veinlets.

DDH ~~146~~ 146 @ 247 (Redbeds) Siltstone. angular silt (qtz) w/ opaques. (Ferromag?)

DDH 146 @ 247 - Same as above
slightly larger qtz frag.

DDH 158 @ 708

~~Rhyolite~~ qtz porphyry. large (1/2 - 1 1/2 mm) grains of quartz which are angular with abundant and intricate resorption embayments. An occasional "rhombic" section of qtz noted. Remnants of feldspar? are completely alt. to clay sericite and carbonate. (Phenocrysts of qtz and feld? = 50%) These are set in a swirly groundmass of devitrified glass, now very fine-grained sericite-carbonate. Some qtz veining.

DDH 152 - 701 Log grey-brown Bx definitely pyroclastic with perlitic matrix.

This rock is a texturally confused aggregate of qtz and feldspar with replacement carbonate.

The bulk of the rock is a groundmass of quartz ranging from .05 to .2 mm in angular to sub-rounded shapes, many of which appear clastic, but some of which are too angular to be so considered. Abundant in this matrix are (1/2 mm ave) perfect euhedral Phenocrysts of Plagioclase, altered in varying degrees to sericite. In the matrix are a few angular frags. of Plag (small) with bent lamellae. Throughout the matrix are swirling, brown patches of devitrified glass. A very few qtz matrix grains show embayments of resorption type. Carbonate floods the rock in tiny

(over)

veinlets replacing along cleavage and grain boundaries, in large blebs, and as feld alteration. Two frags of qtzite were noted. The rock is probably a Dacitic Tuff-breccia.

152 @ 579 - (Feld xtals in a intercept of cgl or Bx. - Log) Trachyte por OK Maybe welded tuff
This rock consists of (.2-.5 mm) perfect euhedral phenocrysts of orthoclase (30%) in a groundmass of glass (clear under transmitted light and opaque under X-nicols in contrast to the highly sericitic clay type of 152-701). Feldspar slightly alt by wisps of sericite along cleavage, and in some there is much clay alt. Carbonate occurs in patches. The rock is a Trachyte porphyry.

129 - 883 a ½ of section is Argillite with qtz grains of .1-.3 mm in a finer-grained matrix. Qtz veins with surrounding silicification (Matrix shows slight strat. Other half is Arg. Qtz vein // bedding).

116 - 551' - Tuff of
Angular and resorbed qtz and Kaolinized feld (euhedral - orth?) in a groundmass of devitrified glass with abundant shards. This is a rhyolite (?) tuff.

116 - 541 Tuffs ok

Vy small scattered qtz grains in a (devitrified) groundmass of glass with small shards. Carbonate makes up possibly 30% of rock in hair-like veinlets. This is a rhyolite(?) tuff, and is essentialy (except for grain size and feld content) identical to 116 - 551'.

ok

151 - 731/525. Rhyolite? tuff - This is identical to 116 @ 541', except that sericite and carbonate floods nearly the entire rock in a peculiar mottled fashion.
(does not compare to 116 @ 541)

151 - 694 - Prob. water laid debris
This rock is very similar to 152 @ 701. and comments there apply equally well here. The frags are more numerous and consists of qtzt, and Rhyolite? tuff of the type noted in 116 - 541 and 151 525. Crossing on end of the thin section is an embayed frag of latite?. This has well developed flow structure.

525
151 - ~~731.~~

Sandy argillite with scattered small patches of tremolite, and carbonate and disseminated in tiny particles throughout.

Meta-porphyry series

86-547 Dacite? Porphyry.

in contact w/ qtzt.

86-570 This may be a highly silicified phase of the meta-porphyry.

Notes on Petr. question

1. If a condition of Fe metasomatism exists, and effects pure limestone, andradite will form (also SiO_2 metasomatism or detrital qtz is required). If this same Fe introduction effected aluminous limestone, would grossularite tend to form even though there was abundant Fe, and allow the iron to go to some other mineral, say, a sulfide. In other words, does the presence of grossularite prove that Fe metasomatism was negligible; or would andradite always form in the presence of iron?

2. The felsite porphyries have all been identified from the Kino fm. I believe, from the appearance of gradational contacts in the core as well as their spatial distribution, that they may be volcanic flows. ~~Is~~ this possible as interpreted by microscopic characteristics.

184-318 T.S. Felsite porphyry
Not pyroclastic

18A- 408 Felsite porphyry
Not pyroclastic
Compares rather favorably
to 128 Fp & 75 Fp

88-450 Arg - not greywake.
contains biotite (metamorphic)

144 - 424' - fragments of
siltstone and volcanic
Sed. and pyrocl. aspect
119 - 434. Similar above
org biotite present as ferromag.
These can probably be termed
greywake although no Ferromags
were seen under micke.

127@263
Qtz - feld (orth.) alteration.

146 @ 285

283 – Arg w/ local qtz-feld replacements plus local recryst. forming feld Matrix (very fine) almost all orthoclase.

292 – Sedimentary band (sandy arg) with high orthoclase content with a feldspathic rock lips above making the rest of the section (Arg)

300 – Considerable feld recrystallization w/ fine feld matrix. Some igneous aspects in areas of no recrystallization.

303 – Same as 300 with intense reff. and coarse and med. and fine gr. texture
will cut new section to get garnet band

315 – like 283.

320 – Sandy Arg

379 – Sandy Arg

406 – Orth - garnet epidote

184 –

Correlation of qtzts of P.f in West area 3150N

111	117	108
Pgf		
325'		
Upper Qtzt	Pgf	Pgf
605	550	450
Hf	Hf	Hf
667	608	530
Lower Qtzt	Lower Qtzt	Lower Qtzt
700	650	548
Tf	Tf	Tf

Correlation of Kf

4950 N —

54	119	144
Tf	Tf	
240'		
Mb		Bx zone
330'		250
Hf or Tf		Cgl of Kf
410'		310
Grey Kf	Grey K	Grey Kf
470	375	338
Dark Red Kf	"	"

109 – show relations not clear

Pgf - Pif cut

32	164	28
543 Tt (Arg)	Arg	Arg 270 Tt (Arg)
455	375	310
Tt	Tt Some Fe in lower parts	Tt, red
570	462	453
Mb	Mb	Mb

Thin Sections:
Calc Arg of Pima fm

	Petog.	Log
151 @ 525	Sandy Calc Arg } JEK	Calc Arg
149 @ 742	Arg.	"
770	Hf	"
788	Calc Arg	"
41 @ 581	Arg	"
62 @ 418	Arg	"
41 @ 585		"

Feldspar rock in Pima fm

134 @ 265	Feld replac.	Mass feld
275	Qtz-feld replac.	" "
152 @ 310	qtz-carbonate feld rock (JK)	Feldspathic rock
152 @ 357	Banded, qtz-carbonate and feld rock (JK)	Qtz vein
152 @ 360	qtz-carbonate-feld rock (JK)	Feldspathic rock

Breccia zone w/ Fragments of Kino fm?

152 @ 579	Cgl or Bx w/ feld.	(JK) Felsite por.
152 @ 701	Perlitic BX	(JK) Pyroclastic? Nearly identical to 151 @ 694
41 @ 644	Cgl	Arg

COMPOSITE ASSAYS

suggested — Never used as such.

Mo & Cu

DDH 44 - 249.0 - 301.2'

77 - 235.0 - 381.4

86 - 237.7 - 313.5

95 - 312.9 - 395.2 (Log Ark. Prob Qfm)

98 - 455.7 - 539.9

Tactites formed from Marble unit

DDH 65 @	304	Garnet Tt - S.B. poss both
21	359	Marble (in tactite unit)
51	376	Garnet Tt Prob Gross
63	498	" " Prob Gross
76	408	Diop. Garnet Tt
76	499	" Trem Grnt Tt

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88 @ 700 -

DDH 113

@ 302 - Arg. with a few calcite veins and qtz veins. Sericite in matrix. Calcite cuts qtz veins.

—— see next page for 113 @ 300

89 @ 300 - Fine gr. feldrock. Prob. rext. siltstone.
Calcite veins, some epidote, tremolite along the veins.

@ 291 - feld-qtz w/ CO_3 in vein and dissem. Assoc sulf. Some Grnt & diop. along CO_3.

@ 288 - band of Grnt & band of qtz-feld. Grnt & diop. enh. against qtz-feld.

@ 314 - Diop Hf - grading toward hedenbergite. Sulfide w/ CO_3 and post sulfide CO_3.

@ 348 - Diop & garnet. Vy fine grained, qtz.-sulfide veinlet.

D 42 @ 604 - Fn-gr qtz-feld and Silicate - diop or towards hedenbergite. Calc Arg.

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32 @ 367 - Garnet, little feld and qtz along w/ sulfides. Practically no diop.

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89 @ 292 Rext. qtz with calcite, and a band of garnet w/ minor qtz. Garnet band has ragged edge with qtz - calcite band.

89 @ 300 - See other side

113 @ 300 - Qtz mossaic, fn-gr, surrounding Bx ? garnet. Some coaser gr qtz veins with grad. boundary to finer grained qtz mossaic.

89 @ 327

D 111 @ 611 - Feld, qtz, calcite, garnet, and sulfides. Qtz-sulf.-feld veinlets, carbonate between. Some minor garnet.

@ 614 - Matrix very fn-gr diop poss with minor actin.
blue green veinlets is act-trem.
Diop possibly toward hedenbergite but too fine to tell. Another veinlet has calcite w/sulfides

@ 626 - Diop Hf with some to much hedenbergite. Veinlet with sulfides is tremolite-Actinolite

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36 @ 571 - Most of the section act-trem. Residual white areas of handspecimen is unidentifiable microscop (too fine gr)
@ 582 - Fibrous trem-act most of section. Residual areas are very fine calcite + amphibole (fibrous)

36 @ 587 - Diop & hedenbergite cut by act-trem veins, and also showing in diop areas.

36 @ 601 - Diop Hf. very fine grained

37 @ 682 - Diop, some hedenbergite, cut by Act vein.

24 - 567 1/2 Gyp & tremolite

24 - 569 Diop residual areas cut by fibrous act-trem, all cut by gypsum veinlets.

151 - 226 D, op Hf.
Minor garnet. qtz, calcite, feld.
Sulf associated with calcite and felds, together or separate.
Py euhed against Cp y replace CO_3.
Garnet euhedral against CO_3.

@263 ~~Massive~~ garnet, zoned, anisotropic, mixed diopside-hedenbergite in considerable quantity. Garnets bx and surrounded by diop.

@269 Garnet, zoned euhedral, especially against qtz. Patches and areas of diopside throughout.

@ 279 Massive garnet (95%) sprinkled with diop-hedenbergite.

@ 286 Garnet with diop.
similar to 263. Diop thus possibly later.

X-120- contact area of porphyry & ark!

532, c - Sedimentary possibly pyrocl.

@ 536 - Monzonite. Sericitized: Very few qtz pheno, No rext fel. Not correlate Mp.

89 @ 327 - Further study

X 120 - 253
Argillite. - might be some pyrocl. but this very indefinite.

109-303 Garnet. calcite abundant. qtz patches. possibly contemp.

Notes on Sirvas' thesis

1. I question the validity of useing the low, medium, and high "grades" of metamorphism as applied to regionaly metamorphosed rocks ~~as~~ aso a basis of classification at East Pima. The element of shearing stress, which is a critical factor in the formation of the mineral assemblages of the regional metamorphic facies, is absent at East Pima. It is true, however, that there is relatively little useful data concerning static metamorphism, particularly where metasomatism is important.

2. Agrees w/ Dubois on hydrothermal gypsum, the evidence cited being that they are in veins or in other forms of crystallization other than sedimentary. It could of course, simply have been reworked and redeposited but not introduced.

3. The classification of clastic rocks, following Pettijohn and other recent writers, gives an excellent base for visualization of general sedimentary environment. Our present classification, used by DuBois, is more practical for logging purposes.

4. p. 27. Our presently termed Felsite porphyry is regarded as extrusive, but no reasons cited. For several reasons, I agree with this.

5. The presently termed meta-porphyry is regarded as igneous, this being in agreement with DuBois. The reasoning is much the same.

6. The 3 grades of pumice are related spatially to meta porphyry intrusion. This is important if in fact it is so. Servos' individual sections descriptions should be consulted and plotted on a graph or map to see if this can be shown.

7. The green alteration bands surrounding sulfide veinlets were [illegible] identified as actinolite, an alteration [illegible] in the original [illegible]. I noted these same bands at the [illegible] mine (identified as actinolite). This must be a characteristic alteration.

EA 69547
Joslin

EA 52611

MISSION AREA, PIMA DISTRICT, PIMA COUNTY, ARIZONA

Key to semiquantitative spectrographic analyses shown on report dated 4/12/61

Figures, given in parts per million, may be converted to percent by shifting the decimal point four places to the left

Sample Number	Description		
MN-110	D.H. 88	A1	Argillite - Papago fm.
111	"	A2	"
112	"	A3	"
113	"	A4	"
114	D.H.163	A5	"
115	"	A6	"
116	"	A7	"
117	"	A8	"
118	"	Q1	Quartzite-Pima fm.
119	"	Q2	"
120	D. H.88	H1	(Some garnite & bornite) Hornfels, principally diopside - hedenbergite plus calcite Pima fm.
121	"	H2	"
122	D.H.151	H3	"
123	D.H.230	H4	(Some sphalerite) "
124	D.H.151	T1	Tactite - Pima fm. (Principally garnet plus some diopside)
125	D.H.151	T2	"
126	"	T3	"
127	D.H.163	T4	"
128	"	T5	"
129	D.H.134	F1	Metasomatic feldspar rock - Pima fm.
130	D.H.112	M1	Marble - Pima fm.(w/veins qtz. cpy. sph.)
131	"	M2	" " (trace sulphides only)
132	D.H.152	Z1	Massive Pb-Zn, in Pima fm, Hf & marble above thrust fault.
133	D.H.102	B1	Strong bornite in tactite, Pima fm.
134	"	B2	"
135	D.H.130	K1	Kino fm. - Argillite and hard cgl.
136	D.H.130	K2	"
137	"	K3	"
138	D.H .101	P1	Quartz monzonite porphyry
139	D.H. 101	P2	"
140	"	P3	"
141	C-1		Tactite & hornfels - composite
142	J-3		Mixed material - tactite, porphyry, gypsiferous material and argillite - composite
143	J-4		Quartzite-composite
144	G-2		Argillite-composite
145	DDH04		EV - 1 East vein Strong sulphide in Bx.

Sample Number	Description		
MN-146	DDD142,	325.9 - 335.9	Pima fm.
147	"	335.9 - 343.7	"
148	"	351.5	"
149	"	358.5	"
150	"	368.5	"
151	"	378.6	"
152	"	387.3	"
153	"	395.3	"
154	"	403.2	"
155	"	413.3	"
156	"	423.3	"
157	"	433.3	"
158	"	443.3	"
159	"	444.5	"
160	"	444.5- 454.5	"
161	"	454.5-460.2	"
162	"	465.2	"
163	"	478.6	"
164	"	488.7	"
165	"	498.7	"
166	"	507.6	"
167	"	513.3	"
168	"	523.5	"
169	"	533.6	"
170	"	543.6	"
171	"	553.5	"
172	"	561.9	"
173	"	570.8	"
174	"	580.8	"
175	"	591.0	"
176	"	601.2	"
177	"	611.4	"
178	"	621.6	"
179	"	631.8	"
180	"	637.4	"
181	"	646.2	"
182	"	655.9	"
183	"	664.3	"
184	"	674.4	"
185	"	674.4 - 682.5	"
186	"	682.5 - 692.7	"
187	"	702.9	"
188	"	713.0	"
189	"	723.3	"
190	"	734.1	"
191	"	741.2	"
192	"	746.7	"
193	"	756.8	"
194	"	766.8	"
195	"	777.0	"
196	"	787.2	"

Sample Number	Description		
MN-197	DDD142,	797.2	Pima fm.
198	"	807.2	"
199	"	815.5	"
200	"	824.2	"
201	"	834.3	"
202	"	844.4	"
203	"	852.4	"
204	"	863.6	"
205	"	866.7	"
206	"	866.7 - 873.6	"

MN

Argellite - Papago formation

✓ 88	110	.78	348.5 - 358.2	A-1	
✓	111	.62	- 367.4	A-2	
✓	112	.62	- 375.6	A-3	
✓	113	.89	- 385.1	A-4	
✓ 163	114	.96	365.7 - 370.9	A-5	
✓	115	.71	376.1	A-6	
✓	116	.45	382.2	A-7	
✓	117	.44	391.0	A-8	

Quartzite - Pima fm

✓ 163	118	.83	434.5 - 450.3	Q-1	
✓	119	.13	- 460.4	Q-2	

Hornfels (principally diopside - hedenbergite plus calcite)
Pima fm.

✓ 88	120	1.12	669.7 - 678.3	H-1	(Some garnet & bornite)
✓	121	1.21	- 687.9	H2	(")
✓ 151	122	6.25	370.9 - 378.0	H-3	
✓ 230	123	1.40	382.5 - 392.6	H-4	(Some sph)

Tactite - Pima fm (Principally garnet plus some diopside)

✓ 151	124	1.06	263.1 - 271.4	T-1
✓	125	.24	271.4 - 279.7	T-2
✓	126	.77	286.0 - 296.1	T-3
✓ 163	127	1.06	489.9 - 499.8	T-4
✓	128	.41	- 509.9	T-5

MN Metasomatic feldspar rock (Pima fm)

✓ 134 129 2.91 266.6 - 276.6 F-1

Marble (Pima fm)

✓ 112 130 1.00 343.5 - 353.7 M-1 (w/ veins g/z - cpy - sph)

✓ 131 .05 353.7 - 363.7 M-2 Trace sulphide only

Massive Pb-Zn, in Pima fm - Hf & Mb above thrust fault

✓ 152 132 1.12 485.9 - 494.2 Z-1

Strong Bornite in tactite, Pima form.

✓ 102 133 1.44 543.3 - 551.8 B-1

✓ 134 2.68 - 565.8 B-2

MN-146 thru 206 [DDH 142 - Pima fm 73 samples 225.7 - 873.6]

Kino fm - Argillite and hard cgl.

✓ 130 135 <.10 460.9 - 468.0 K-1

✓ 136 - 474.5 K-2

✓ 137 481.7 K-3

Qtz monzonite porphyry

✓ 101 138 .41 318.6 - 326.3 P-1

✓ 139 .56 - 337.3 P-2

✓ 140 .34 - 346.4 P-3

East vein - strong sulphide in Bx.

✓ 0-4 145 173.0 - 178.1 EV-1

Composite

			MN	
1.00	.013	C-1 ✓	141	Tactite & Hornfels
.84	.073	J-3 ✓	142	Mixed rock - tactite, porphyry, gypsiferous material and argillite.
.67	.021	~~JK~~-4 ✓	143	Quartzite
.82	.024	G-2 ✓	144	Argillite

Caliche cgl -

X - 204

Sample No.		Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
M/N 110-117	Papago fm. Argillite	9625	<200	1188	138	1562	238	<50	74	4625	194	464	126	18	<35	<10	<11	275	2	<10	<11	<12	1.1	<20	<50	<500
118-119	Pima fm Quartzite	1250	5100	150	<20	1250	175	<50	20	2850	75	40	40	45	10	<10	<10	200	<3	<10	<10	<10	<1	<20	<50	<500
120-123	Pima fm Hornfels	650	1175	88	<20	>8800	68	<50	45	9250	42	130	80	<28	15	<10	<10	162	35	<10	<12	<10	2.5	<65	<50	<500
124-128	Pima fm Tactite	420	<620	20	<20	>10000	58	<50	58	3200	54	136	56	<13	16	<10	<10	124	5.6	<10	40	20	2.6	<66	<50	<500
129	Pima fm Metasomatic feldspar rock	3000	200	3000	300	1500	500	70	50	>10000	100	200	30	<10	1000	<10	<10	300	30	<10	20	10	<1	100	<50	<500
130-131	Pima fm Marble	150	<5100	15	300	5500	<15	<50	15	2550	12	505	85	<12	570	<10	<10	12	5	<15	<10	<10	<1	<20	<50	<500
132	Pima fm Massive Pb-Zn	200	>10000	70	20	10000	20	<50	10	5000	20	>10000	20	40	20	<10	<10	15	100	70	<10	<10	1	<20	<50	<500
133-134	Pima fm Bornite in tactite	125	1350	25	75	10000	15	<50	15	>10000	10	225	35	<10	425	<10	<10	175	12	15	45	22	1.5	20	<50	<500
135-137	Kino fm Argillite and hard conglomerate	5666	<200	1666	100	1233	333	<50	73	300	63	30	80	<10	13	<10	13	28	<1	<10	<10	13	<1	<20	<50	<500
138-140	Qtz Monz Porp	4000	<200	1500	100	350	333	<50	40	1500	<5	53	13	<10	33	<10	<10	367	<1	<10	<10	<13	1	<30	<50	<500
141	Composite tac & HF	500	2000	150	20	>10000	200	<50	50	*	20	300	70	<10	50	<10	<10	*	15	<10	<10	10	1	30	<50	<500
142	Composite Porp Gyp Material Arg	7000	<200	500	100	5000	500	<50	50	*	10	10	20	10	20	<10	<10	*	2	<10	<10	<10	1	<20	<50	<500
143	Composite Quartzite	500	<200	240	<20	3000	100	<50	10	*	30	20	20	<10	20	<10	<10	*	2	<10	<10	<10	<1	<20	<50	<500
144	Composite Argillite	3000	200	1000	100	2000	200	<50	70	*	50	50	50	10	50	<10	<10	*	2	<10	<10	10	2	<20	<50	<500
145	East Vein	5000	1500	500	150	10000	300	<50	50	>10000	20	20	15	20	20	<10	<10	700	500	10	30	20	2	20	<50	<500
146-206	Pima fm	1543	1305	217	44	8241	92	<50	51	3754	41	66	61	14	14	<10	10.6	270	166	189	159	15	1.5	62	<50	<500

	No. of samples	Sample No	Drill Hole	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc	Y	Mo	Ag.	Bi	Sn	Ga	Be	W	Sb	As
Papago fm.		MN-110	88	10000	<200	1500	200	1500	200	<50	100	7000	200	<10	200	20	10	10	20	300	5	<10	20	20	2	20	<50	<500
Argillite		111	88	10000	<200	1500	200	1000	200	↓	100	5000	200	70	150	20	10	10	10	300	2	↓	10	15	<1	<20	↓	↓
		112	88	10000	<200	1500	200	1000	200		100	5000	200	70	150	10	<10	<10	<10	300	2		<10	10	↓	↓		
		113	88	10000	<200	1500	100	1500	200		70	5000	200	50	200	20	10	↓	↓	500	2		↓	10				
		114	163	10000	<200	500	100	2000	200		50	5000	200	70	70	20	50			200	2			<10				
		115	163	10000	<200	500	100	2000	200		50	5000	200	70	70	20	100			150	2			<10				
	(8)	116	163	10000	<200	1500	100	1500	200		20	3000	200	70	70	10	20			200	1			<10				
		117	163	7000	<200	1000	100	2000	500	<50	100	2000	150	100	100	20	70	<10	10	300	1			10	1			
		Avg.		9625	<200	1188	138	1562	238	<50	74	4625	194	<64	126	18	<35	<10	<11	275	2	<10	<11	<12	<1.1	<20	<50	<500
Pima fm. Quartzite	(2)	Avg	163	1250	5100	150	<20	1250	175	<50	20	2850	75	40	40	<15	10	<10	<10	200	<3	<10	<10	<10	<1	<20	<50	<500
Pima fm, hornfels	(4)	Avg.		650	1175	88	<20	>8800	68	<50	45	9250	42	130	80	<28	15	<10	<10	162	35	<10	<12	<10	2.5	<65	<50	<500
Pima fm, Tactite	(5)	Avg.		420	<620	20	<20	>10000	58	<50	58	3200	54	136	56	<13	16	<10	<10	124	5.6	<10	40	20	2.6	<66	<50	<500
Pima fm, Metasomatic feldspar rock	(1)			3000	200	3000	300	1500	500	70	50	>10000	100	200	30	<10	1000	<10	<10	300	30	<10	20	10	<1	100	<50	<500
Pima fm Marble	(2)	Avg		150	<5100	15	300	5500	<15	<50	15	2550	12	505	85	<12	510	<10	<10	12	5	<15	<10	<10	<1	<20	<50	<500
Pimafm Massive Pb-Zn	(1)			200	>10000	70	20	10000	20	<50	10	5000	20	>10000	20	<10	20	<10	<10	5	100	70	<10	<10	1	<20	<50	<500
Pima fm Bornite in tactite	(2)			125	1350	25	75	10000	15	<50	15	>10000	10	225	35	<10	425	<10	<10	175	12	15	45	22	1.5	20	<50	<500
Kino fm Argillite & Arkd Cgl.	(3)			5666	<200	1666	100	1233	333	<50	73	300	63	30	80	<10	13	<10	13	28	<1	<10	<10	13	<1	<20	<50	<500
Qtz Mon Porp.	(3)			4000	<200	1500	100	350	333	<50	40	150	<5	53	13	<10	33	<10	<10	367	<1	<10	<10	<13	1	<30	<50	<500
Composite Tac & Hf	(1)			500	2000	150	20	>10000	200	<50	50	*	20	300	70	<10	50	<10	<10	*	15	<10	<10	10	1	30	<50	<500
Composite Tac, Porp. Gyp Material & Agt	(1)			7000	<200	500	100	5000	500	<50	50	*	10	10	20	<10	20	<10	<10	*	2	<16	<10	<10	1	<20	<50	<500

		Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
Composite	Quartzite (193)	500	<200	200	<20	3000	100	<50	10	*	30	20	20	<10	20	<10	<10	*	2	<10	<10	<10	<1	<20	<50	<500
Composite	Argillite (144)	3000	200	1000	100	2000	200	<50	70	*	50	50	50	10	50	<10	<10	*	2	<10	<10	10	2	<20	<50	<500
145	EV-1 East vein	5000	1500	500	150	10000	300	<50	50	>10000	20	20	15	20	20	<10	<10	700	500	10	30	20	20	20	<50	<500
196-206	Pima fm 61	1543	1305	217	44	8241	92	<50	51	3754	41	66	61	14	14	<10	10.6	270	16.6	18.9	15.9	15	1.5	62	<50	<500

Spectrographic Analysis, given in parts per million

Element	Sample, Number 2	4	5	6
Ti	10000	500	300	1000
Zn	< 200	< 200	700	500
Ba	500	20	10	20
Sr	100	< 20	< 20	< 20
Mn	2000	>10000	>10000	>10000
Zr	200	70	70	100
La	< 50	< 50	< 50	< 50
V	50	70	70	100
Cu	5000	5000	1000	3000
Ni	200	30	50	70
Pb	< 10	10	500	150
Cr	70	50	50	100
Co	20	< 10	10	15
B	100	10	10	20
Sc	< 10	< 10	< 10	< 10
Y	< 10	10	10	10
Mo	150	20	50	200
Ag	2	10	2	7
Bi	< 10	< 10	< 10	< 10
Sn	< 10	20	20	20
Ga	< 10	20	20	20
Be	< 1	< 1	< 1	< 1
W	< 20	30	< 20	< 20
Sb	< 50	< 50	< 50	< 50
As	< 500	< 500	< 500	< 500

FILE ATTACHMENT

Key to Numbered samples of Neutron Analysis

1.	DH No. 163	274.5 - 286.2	Core
2.	DH No. 163	370.9 - 376.1	Core
3.	DH No. 164	344.9 - 355.0	Core
4.	DH No. 151	263.5 - 271.4	Core
5.	DH No. 151	271.4 - 279.7	Core
6.	DH No. 151	286.0 - 296.1	Core

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
REPORT NO. ____________

DATE 4[illegible]2-61
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SERIAL NO.	FIELD NO.	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc
	MN-194	200	<200	10	<20	>10000	10	<50	30	5000	15	<10	30	<10	<10	<10
	195	100	↓	30	↓	↓	10	↓	20	>10000	20	<10	20	15	<10	↓
	196	1000	↓	100	↓	↓	50	↓	20	>10000	20	<10	50	10	<10	↓
	197	70	↓	<10	↓	↓	<10	↓	10	3000	20	<10	10	20	10	↓
	198	70	↓	<10	↓	↓	<10	↓	10	2000	20	20	20	20	10	↓
	199	200	↓	20	↓	↓	20	↓	20	3000	15	200	50	<10	100	↓
	200	300	↓	20	↓	↓	50	↓	50	>10000	70	20	100	30	<10	↓
	201	300	10000	30	↓	↓	20	↓	20	5000	30	20	50	20	<10	↓
	202	500	<200	30	200	200	10	↓	50	100	10	30	50	<10	10	↓
	203	500	200	30	100	2000	10	↓	30	200	5	50	20	<10	<10	↓
	204	300	3000	20	50	3000	10	↓	20	2000	10	20	20	<10	<10	↓
	205	1500	2000	150	30	>10000	30	↓	20	7000	20	30	50	15	20	↓
	206	200	<200	<10	100	2000	<10	↓	30	200	5	30	30	<10	<10	↓
	MN-110	10000	<200	1500	200	1500	200	↓	100	7000	200	<10	200	20	10	10
	111	10000	<200	1500	200	1000	200	↓	100	5000	200	70	150	20	10	10
	112	10000	<200	1500	200	1000	200	↓	100	5000	200	70	150	10	<10	<10
	113	10000	200	1500	100	1500	200	↓	70	5000	200	50	200	20	10	↓
	114	10000	<200	500	100	2000	200	↓	50	5000	200	<10	70	20	50	↓
	115	10000	<200	500	100	2000	200	↓	50	5000	200	<10	70	20	100	↓
	116	10000	<200	1500	100	1500	200	↓	20	3000	200	<10	70	10	20	↓

NOTE:

ANALYST

NO. SAMPLES

NO. DETERMINATIONS

DATE COMPLETED

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
REPORT NO. ____________

DATE 4-[illegible]-61
REQUESTED BY Huff + Cooper

SERIAL NO.	FIELD NO.	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
	MN-194	<10	500	<1	<10	<10	15	1	50	<50	<500
	195		20	30			<10	1	<20		
	196		300	10			<10	1	<20		
	197		150	1			<10	1	<20		
	198		5	1			<10	1	<20		
	199		20	5		20	10	1	70		
	200		15	50		20	10	2	20		
	201		5	15		<10	<10	2	<20		
	202		<5	<1				<1			
	203		<5	2				<1			
	204		<5	5				<1			
	205		<5	15				1			
	206		<5	<1				<1			
	MN-110	20	300	5		20	20	2	20		
	111	10	300	2		10	15	<1	<20		
	112	<10	300	2		<10	10				
	113		500	2			10				
	114		200	2			<10				
	115		150	2			<10				
	116		200	1			<10				

NOTE:

ANALYST ____ NO. SAMPLES ____ NO. DETERMINATIONS ____ DATE COMPLETED ____

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
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DATE 4-[illegible]-61
REQUESTED BY Huffs & Cooper

SERIAL NO.	FIELD NO.	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc
	MN-117	7000	<200	1000	100	2000	500	<50	100	2000	150	50	100	20	70	<10
	118	1500	>10000	150	<20	2000	150	↓	20	5000	100	70	50	20	10	↓
	119	1000	<200	150	↓	500	200	↓	20	700	50	10	30	<10	10	↓
	120	700	2000	70	↓	10000	100	↓	30	10000	20	100	50	20	20	↓
	121	1500	1000	30	↓	5000	100	↓	50	10000	50	300	70	30	10	↓
	122	200	1000	150	20	>10000	20	↓	50	>10000	70	100	150	50	20	↓
	123	200	700	100	<20	>10000	50	↓	50	7000	30	20	50	<10	10	↓
	124	500	<200	20	↓	>10000	70	↓	70	5000	30	10	50	<10	10	↓
	125	300	700	10	↓	>10000	70	↓	70	1000	50	500	50	10	10	↓
	126	1000	500	20	↓	>10000	100	↓	100	3000	70	150	100	15	20	↓
	127	200	1000	20	↓	>10000	30	↓	20	5000	50	10	30	<10	20	↓
	128	100	700	10	↓	>10000	20	↓	30	2000	70	<10	50	20	20	↓
	129	3000	200	3000	300	1500	500	70	50	>10000	100	200	30	<10	10	↓
	130	200	10000	20	300	10000	20	<50	20	5000	20	1000	100	<10	1000	↓
	131	100	<200	10	300	1000	<10	↓	10	100	5	<10	70	15	20	↓
	132	200	>10000	70	20	10000	20	↓	10	5000	20	>10000	20	<10	20	↓
	133	150	700	20	50	10000	20	↓	20	>10000	10	300	50	<10	700	↓
	134	100	2000	30	100	10000	10	↓	10	>10000	10	150	20	<10	150	↓
	135	5000	200	2000	100	700	500	↓	100	500	70	50	100	<10	10	↓
	136	5000	<200	2000	100	1000	200	↓	50	700	50	10	70	<10	10	↓

NOTE:

ANALYST ____ NO. SAMPLES ____ NO. DETERMINATIONS ____ DATE COMPLETED ____

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ________
REPORT NO. ________

DATE 4-[illegible]-61
REQUESTED BY Huff + Cooper

SERIAL NO.	FIELD NO.	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
	MN-117	10	300	1	<10	<10	10	1	<20	<50	<500
	118	<10	200	5		<10	<10	<1	<20		
	119	<10	200	<1		<10	<10	<1	<20		
	120	<10	150	15		10	10	1	20		
	121	<10	100	10		<10	10	2	<20		
	122	<10	300	100		20	10	5	20		
	123	<10	100	15		<10	<10	2	200		
	124	10	20	10		20	20	<1	30		
	125	10	50	2		20	20	<1	<20		
	126	10	200	7		20	20	<1	<20		
	127	<10	200	7		70	20	5	150		
	128		150	2		70	20	5	100		
	129		300	30		20	10	<1	100		
	130		10	10	20	<10	<10	1	<20		
	131		<5	<1	<10	<10	<10	<1	<20		
	132		5	100	70	<10	<10	1	<20		
	133		300	20	20	70	30	2	20		
	134		50	5	10	20	15	1	20		
	135	20	50	<1	<10	<10	10	1	<20		
	136	<10	15	<1	<10	<10	10	<1	<20		

NOTE:

ANALYST ________ NO. SAMPLES ________ NO. DETERMINATIONS ________ DATE COMPLETED ________

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
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REQUESTED BY Huff + Cooper

SERIAL NO.	FIELD NO.	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc
	MN-137	7000	<200	1000	100	2000	300	<50	70	300	70	20	70	<10	20	<10
	138	2000	<200	1500	100	700	300		30	1500	5	70	20	<10	50	
	139	5000	<200	1500	100	150	200		30	1500	<5	20	10	<10	20	
	140	5000	<200	1500	100	200	500		50	1500	<5	70	10	<10	30	
	141	500	2000	150	20	>10000	200		50	*	20	300	70	<10	50	
	142	7000	<200	500	100	5000	500		50	*	10	10	20	10	20	
	143	500	<200	200	<20	3000	100		10	*	30	20	20	<10	20	
	144	3000	200	1000	100	2000	200		70	*	50	50	50	10	50	
	145	5000	1500	500	150	10000	300		50	>10000	20	20	15	20	20	

NOTE: ____________

ANALYST ____________ NO. SAMPLES ____________ NO. DETERMINATIONS ____________ DATE COMPLETED ____________

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO.
REPORT NO.

DATE ...2-61
REQUESTED BY Huff & Kooper

SERIAL NO.	FIELD NO.	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
	MN-137	<10	20	<1	<10	<10	20	1	<20	<50	<500
	138	↓	500	<1	↓	↓	20	1	50	↓	↓
	139	↓	300	1	↓	↓	<10	1	<20	↓	↓
	140	↓	300	<1	↓	↓	10	1	<20	↓	↓
	141	↓	*	15	↓	↓	10	1	30	↓	↓
	142	↓	*	2	↓	↓	<10	1	<20	↓	↓
	143	↓	*	2	↓	↓	<10	<1	<20	↓	↓
	144	↓	*	2	↓	↓	10	2	<20	↓	↓
	145	↓	700	500	10	30	20	2	20	↓	↓

NOTE:

ANALYST

NO. SAMPLES

NO. DETERMINATIONS

DATE COMPLETED

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
REPORT NO. ____________

DATE 4- -61
REQUESTED BY Hutt + Cooper

SERIAL NO.	FIELD NO.	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Be	Cr	Co	B	Sc
	MN-146	5000	7000	200	20	10000	200	<50	70	7000	50	<10	30	15	20	<10
	147	5000	<200	1000	200	5000	200		50	1500	50	50	50	<10	<10	
	148	7000	<200	1000	200	3000	100		100	2000	50	50	50	<10	10	
	149	10000	<200	500	200	3000	200		50	700	70	70	50	<10	10	
	150	2000	700	500	100	5000	100		50	2000	50	70	50	<10	20	
	151	10000	500	200	30	>10000	1000		100	3000	30	70	30	10	20	
	152	10000	500	500	100	10000	500		150	3000	50	100	50	10	<10	
	153	5000	<200	1000	200	2000	300		70	500	50	20	30	<10	10	
Avg	61 samples	1543	1305	217	44	8241	92	<50	51	3754	41	66	61	14	14	<10

NOTE:

ANALYST   NO. SAMPLES   NO. DETERMINATIONS   DATE COMPLETED

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
REPORT NO. ____________

DATE 4-[illegible]-61
REQUESTED BY Hubbert Cooper

SERIAL NO.	FIELD NO.	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
	MN-146	20	100	20	15	20	15	1	50	<50	<500
	147	<10	30	1	<10	<10	10	<1	<20	↓	↓
	148	<10	7	1	10	<10	<10	1	<20	↓	↓
	149	<10	20	<1	<10	<10	20	<1	20	↓	↓
	150	10	7	5	50	20	20	2	300	↓	↓
	151	20	7	10	50	30	20	5	300	↓	↓
	152	20	7	5	15	20	20	1	30	↓	↓
	153	15	50	<1	<10	<10	10	<1	20	↓	↓
		10.6	270	16.6	18.9	15.9	15	1.5	62	<50	<500

NOTE:

ANALYST NO. SAMPLES NO. DETERMINATIONS DATE COMPLETED

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ____________
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DATE 4-[illegible]2-61
REQUESTED BY Huff + Cooper

SERIAL NO.	FIELD NO.	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc
	MN-154	3000	<200	1000	100	2000	300	<50	70	500	100	70	70	<10	10	<10
	155	3000	200	1500	100	2000	200		70	2000	70	100	50	<10	<10	
	156	2000	700	700	50	2000	100		20	>10000	70	200	30	20	20	
	157	2000	200	700	50	>10000	200		70	5000	50	20	50	<10	10	
	158	2000	3000	100	20		200		100	700	50	20	50	<10	20	
	159	300	<200	20	<20		30		50	700	50	10	20	20	<10	
	160	700	5000	50	20		100		70	2000	50	200	30	10	10	
	161	1000	2000	70	20		100		100	5000	70	10	70	<10	20	
	162	500	2000	30	<20		70		100	1500	30	20	50	<10	20	
	163	500	1000	20	<20		70		100	1000	30	30	100	<10	10	
	164	500	500	20	<20		70		100	1000	50	70	100	<10	10	
	165	300	500	30	<20		50		100	7000	50	30	50	15	10	
	166	200	200	10	<20		20		50	2000	50	50	20	10	10	
	167	300	500	20	<20		20		50	3000	30	30	30	15	10	
	168	1000	700	500	50		100		50	5000	100	150	70	10	10	
	169	1500	<200	1500	100	1500	200		20	700	100	70	50	<10	10	
	170	1500	>10000	1000	100	10000	300		30	2000	70	1000	20	<10	20	
	171	300	500	30	<20	>10000	50		30	2000	70	70	50	10	<10	
	172	300	<200	30	<20	>10000	70		50	2000	30	70	30	<10	10	
	173	300	1500	50	<20	>10000	50		50	7000	50	100	20	10	10	

NOTE:

ANALYST NO. SAMPLES NO. DETERMINATIONS DATE COMPLETED

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ________
REPORT NO. ________

DATE 4-[illegible]-61
REQUESTED BY Huff & Cooper

SERIAL NO.	FIELD NO.	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As
	MN-154	10	200	<1	<10	10	10	1	20	<50	<500
	155	10	300	10	10	10	10	<1	50		
	156	<10	200	50	70	20	10	<1	20		
	157	10	150	7	<10	30	20	<1	100		
	158	10	150	1	10	20	20	1	100		
	159	<10	20	2	<10	<10	<10	2	20		
	160	<10	70	5	10	10	20	5	200		
	161	10	30	30	<10	20	20	2	50		
	162	<10	30	3	30	20	20	1	<20		
	163	<10	15	2	30	20	10	1	20		
	164	<10	30	<1	<10	20	20	1	<20		
	165	<10	30	5	10	20	10	<1	30		
	166	<10	15	5	<10	<10	<10	2	50		
	167	<10	20	5	<10	50	<10	5	100		
	168	10	700	3	10	30	15	5	70		
	169	<10	150	<1	<10	<10	15	3	50		
	170	<10	200	100	70	15	15	2	20		
	171	<10	20	2	10	10	<10	3	100		
	172	<10	20	1	<10	<10	10	3	<20		
	173	<10	30	200	300	15	10	2	50		

NOTE:

ANALYST ____ NO. SAMPLES ____ NO. DETERMINATIONS ____ DATE COMPLETED ____

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO.
REPORT NO.

DATE 4-[illegible]-61
REQUESTED BY Huff & Cooper

SERIAL NO.	FIELD NO.	Y	Mo	Ag	Bi	Sn	Ga	Be	W	Sb	As					
	MN-174	<10	10	3	15	<10	10	<1	<20	<50	<500					
	175		20	2	<10	<10	<10									
	176		<10	2		<10	<10									
	177		100	2		<10	<10									
	178		20	3		20	30									
	179		7	2		20	10									
	180	10	15	1		<10	20									
	181	10	20	<1		10	20		30							
	182	<10	300	5	10	20	20		70							
	183	10	300	10	<10	15	20	1	50							
	184	<10	500	1		15	20	2	50							
	185	10	7000	<1		15	20	1	20							
	186	10	3000	1		15	30	<1	100							
	187	10	500	100		30	30		70							
	188	<10	150			15	20		50							
	189		300	200		30	30		150							
	190		200	10		15	30		200							
	191		500	10		15	20		150							
	192		10	20		10	20		300							
	193		10	10		10	20		200							

NOTE:

ANALYST NO. SAMPLES NO. DETERMINATIONS DATE COMPLETED

SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS

FILM NO. ______
REPORT NO. ______

DATE 4-[illegible]-61
REQUESTED BY Huff & Cooper

SERIAL NO.	FIELD NO.	Ti	Zn	Ba	Sr	Mn	Zr	La	V	Cu	Ni	Pb	Cr	Co	B	Sc
	MN-174	1500	200	20	20	>10000	20	<50	30	5000	20	70	30	<10	<10	<10
	175	300	>10000	10	<20		10		10	5000	20	50	10	10	<10	
	176	1500	2000	30			20		20	2000	15	20	30	<10	<10	
	177	1000	1500	10			20		20	2000	20	20	50	<10	<10	
	178	700	2000	10			30		50	1500	20	50	200	<10	<10	
	179	500	3000	10			15		20	2000	20	150	150	<10	<10	
	180	1000	500	10			20		70	1000	20	20	100	<10	10	
	181	300	<200	10		10000	10		30	700	15	<10	50	<10	<10	
	182	500	<200	20		>10000	20		70	3000	20	50	70	<10	10	
	183	500	300	70			20		70	7000	30	150	70	15	10	
	184	1000	700	10			30		100	1500	20	10	300	10	15	
	185	1000	200	10			20		70	1000	15	<10	100	<10	10	
	186	1000	500	10			30		100	3000	50	<10	200	<10	15	
	187	500	500	70			20		15	>10000	50	50	150	30	10	
	188	300	200	30			20		15	>10000	50	<10	100	30	10	
	189	200	200	70			20		<10	>10000	50	10	50	20	20	
	190	500	<200	30			30		20	>10000	30	<10	100	<10	20	
	191	700	<200	20			30		300	5000	20	10	100	<10	10	
	192	200	<200	20			30		<10	7000	20	10	20	<10	15	
	193	500	1000	15			20		<10	5000	10	10	20	<10	10	

NOTE:

ANALYST ______ NO. SAMPLES ______ NO. DETERMINATIONS ______ DATE COMPLETED ______

Check surrounding core

PROPERTY

Petrographic Rock Name:

Megascopic: (Sirvas SB 34b) Black to dark brown aphanitic rock which may contain as much as 20 or 30 percent fine-grained "sandy" material.

By: JEK Date

Formation:

DDH No. 33 @ 337 ft. Depth

Sent for: T.S. ✓ P.S.

Date: —

Other Location:

Purpose:

Microscopic by: Date

For additional comments use/see reverse

33 - 337'

check on MP designation by Dubois

PROPERTY

Megascopic: (Sirvas SB 34) 20 ± % phenocrysts of quartz (some show resorption embayments) and white euhedral feldspar in a light grey aphanitic groundmass

By: Date

Purpose:

Microscopic by: Date

Petrographic Rock Name:

Formation:

DDH No. 33 @ 353 ft. Depth

Sent for: T.S. ✓ P.S.

Date:

Other Location:

For additional comments use/see reverse

33-353'

138 - 301'	diop
42 - 610	diop (20% Max hedenbergite)
151 - 344	"
- 351	"
- 313	"
122 - 281	"
151 - 370	"
- 213	Mostly Carbonate (Recheck)
- 380	" " , some diop.

Return to JEK

J. H. C.
MAR 15 1965

March 12, 1965

Mr. John Cooper
Box 55
Sahuarita, Arizona

Dear John:

I have reviewed some hand specimens of the biotite rhyolite (or at least what we correlate with it) and I can find no megascopic relicts of altered biotite. The thin sections that have been cut are probably at the Mission Mine Office. My notes on these sections are very sketchy, but I call your attention to drill holes 182, 207, 200, 186, and 217, all of which have been sectioned, and I have the hand specimens here in Tucson.

I find that my old notes refer to carbonated and sericitized matrix and fragments, but also note that the igneous feldspar phenocrysts are less altered.

Particularly DDH 182 @ 545' and DDH 200 @ 237' are noted as having biotite rhyolite textures. Some muscovite which occurs in small shedded laths may be altered biotite.

The Mission thin sections, I believe, were set up to be available to you. A thin section near Beehive Peak which I examined contained mostly orthoclase, whereas the type locality at Beehive Peak contains many plagioclase phenocrysts. Helmet Peak

The outcrop on Red Hill you referred to will no doubt be affected by supergene alteration as well as the original hydrothermal solutions. I really wonder if biotite pseudomorphs would be preserved under those conditions. In other deposits which contain biotite as a hydrothermal alteration product in porphyry, I have found the supergene alteration affects, in capping and chalcocite zones, sufficient to destroy the outline of biotite books that occured deeper in the primary sulphide zone.

Yours very truly,

J. E. KINNISON

JEK/jak

April 1, 1963

Mr. Bob Gale
1171 Noel Drive
Menlo Park, California

Dear Bob:

Paul Eimon handed me your note requesting certain thin sections. None of us here knows where these sections are if you do not have them. They may be here somewhere and will turn up eventually. In this case I would forward them to you.

The next time I am at Mission I will see if anyone there knows about these sections.

We have not yet had time to sort out the pulp samples mentioned in your letter of January 27, but we will try to select these pulps sometime in the near future.

I trust your studies are proceeding satisfactorily.

Yours very truly,

KENYON RICHARD

KR/kw
cc: JEKinnison

December 7, 1962

Mr. Rudolf von Huene
865 North Mentor Avenue
Pasadena, California

POLISHED SURFACES

Dear Sir:

On October 19, I sent you 21 bakelite mounted polished surfaces which needed to be repolished. We are in need of these surfaces, and I would appreciate advice from you as to when we will receive them.

Yours very truly,

KENYON RICHARD

KR/kw
cc: JEKinnison ☜
REGale

October 19, 1962

Mr. Rudolf von Huene
865 North Mentor Avenue
Pasadena, California

POLISHED SURFACES

Dear Sir:

By parcel post, I am shipping you 21 bakelite mounted polished surfaces. These surfaces need to be repolished -- in fact, some of them are in such poor condition that they may need to be re-ground. In any case, would you please repolish these and send the bill to this office to my attention.

Yours very truly,

KENYON RICHARD

KR/kw
cc: JEKinnison
REGale

Blind note to Mr. Gale:
John Kinnison finally found Sirvas' surfaces. They are in pretty bad shape. I will let you know when we have gotten them back. KR

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona
April 14, 1958

Von Huene
865 North Mentor Avenue
Pasadena, California

Dear Mr. Von Huene:

Under separate cover I am mailing you a specimen which I wish to be prepared as a mounted polished section. This should be done by a mechanical device (which I understand you have available) to insure a smooth, well-polished surface.

Sirvas' Surfaces

I also have 21 mounted polished sections, set in round bakelite mounts 1 1/2 inches in diameter and which vary from 0.3 to 0.7 inches in height, which have a poorly polished surface. Please advise if these can be repolished to a smooth surface in your polishing apparatus.

The sample being sent is marked by a red line along the approximate surface to be cut and polished. Please return the rejected portion of the sample along with the finished section.

Yours very truly,

JOHN E. KINNISON
Geologist

JEK/ds

RUDOLF VON HUENE
865 NORTH MENTOR AVE., PASADENA, CALIF.

May 5, 1958

1 p.s.
ws 2.28

Mr. John E. Kinnison
American Smelting &
Refining Company,
Tucson, Arizona

Dear Mr. Kinnison :

We shipped today your polished section. According to the dimensions which you give for the 21 mounted sections, which you want repolished,our machines will accomodate this size.I therefore believe that we can do the job without much trouble.

Very truly yours,

Rudolf von Huene

Rudolf von Huene

RvH/eb

Service's Polished Sect.

P-1 MP

P-2 Tt

P-3

P-4 Tt (?) massive sulf

P-5 Hf w/ qtz veins

P-6

P-7 Mass Zn-py 7a - Tt

P-8 - Woll.

P-9 - Tt w/ Mo

P-10 Tt

P-11 Massive Zn

P-12 - Tt

P-13 Mass Zn

P-14 Calc Arg (?) w/ garnt.

P-15 Tt (?) Massive Zn

P-16

P-17 Calc Arg?

P-18 Tt w/ qtz veins

P-19 Woll. w/ minor garnt. Zn - bornite - cpy.

P-20 Hf. (diopside?)

Megascopic description

DDH No X215

Depth

Formation

Purpose

Sent for: T.S. ☑ P.S. ☐

Date

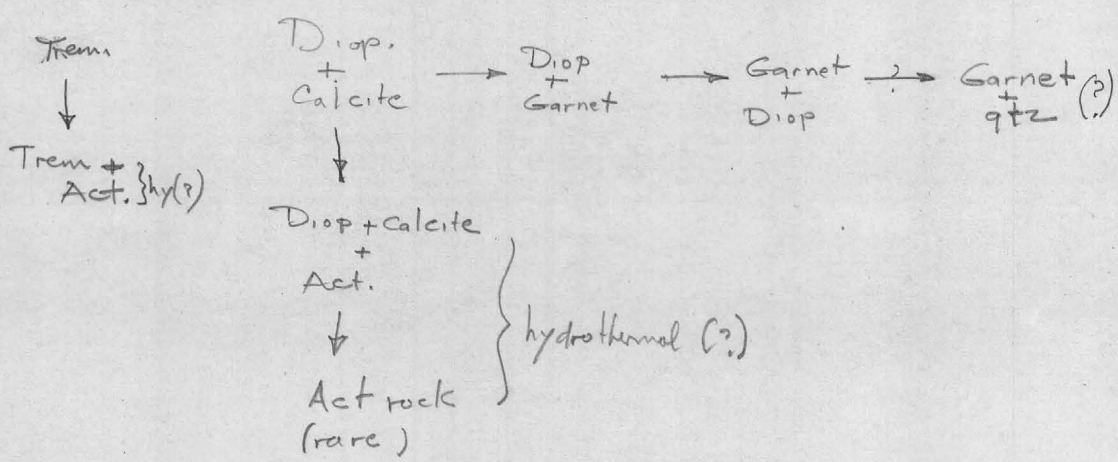
Received: 11/16/57 OK JEK

Microscopic: By [illegible] Date

Preliminary ☑ Final ☐

Additional Remarks: The [illegible] description has been received from Du Bois as follows:

X215



1. Is the calcite residual, or introduced after the diop.
2. Do the sulphides replace the calcite, or the diops.
3. Do " " " diop, or the garnet.
4. Does the garnet form after or before the diopside
5. What role does the qtz play with the garnet.
6. Are there more than one generation qtz (i.e. hydrothermal and metamorphic)

University of Arizona

TUCSON 25, ARIZONA

COLLEGE OF MINES
ARIZONA BUREAU OF MINES

May 14, 1959

Mr. Norman Whaley
American Smelting and Refining Company
Mining Department
Valley National Bank
Tucson, Arizona

Dear Norman:

The mineral specimen left at our laboratory has been examined. It is a Calcium Magnesium Silicate, as determined by a spectroscopic analysis. Optical and compositional data indicate that the mineral is diopside.

Sincerely,

H. W. Peirce

H. W. Peirce
Assistant Mineralogist

HWP:mr

Sample of the green bladed mineral from
Raise 1500 W, 3750N, 370 Level Mission. 50' ± height.

P-10.10.2

File memo.

~~Memo to K.R.~~

East Pima

Petrography

Preliminary Petrographic study by Dr. Du Bois on some thin sections from D.D.H. 109 at East Pima renders the following conclusions (see attached log for megascopic and microscopic details).

The rocks above the unconformity have been extensively recrystallized to produce a feldspathic rock containing some medium grained feldspathic areas in a matrix of extremely fine-grained recrystallized feldspar. The rock originally must have been a very fine siltstone or mudstone. The recrystallized areas are inter-spaced with argillite, sandy argillite, and conglomerate. No information was obtained on the formation of tactite in the Papogo formation.

Feldspathic alteration near the Pima - Papogo formation contact is fairly common, but the reason for its considerable thickness in D.D.H. 109 is not apparent. A similar type of feldspathic alteration of argillite and conglomerate may occur in the northeastern area, such as penetrated in D.D.H. 188. The section at 292' contained an unrecrystallized band of sediment with a very high feldspar content. Some petrographers prefer to use such a composition as an indication of tuffaceous material. In any event, it is unusual for the Papago formation.

John E. Kinnison

cc to KR
JHC

Relog of DDH 109, East Pima

Bedrock @ 215.5'

215.5 - 240' Logged arkose. probably argillite.

240 - 265' Logged conglomerate.

Beginning of relogging

265-273' Arg., light grey to white. A very few 1/2" rounded pebbles or alteration areas. Bottom contact sharp.

273-282 Tactite. slight resemblence to hornfels. Fine-grained.

@ 277': 2" qtz vein or qtzt lens, dipping 45° ±. Just below are 2" of banded cpy-py-hematite in 1/8" layers, with abundant chlorite. At the upper contact, separating it from the 2" qtz vein(?), is a thin Bx or arkose lens.

282-288 Feld rock. Pink or salmon colored dense material with angular patches, and veinlets, of chlorite. Brecciated appearance near top.

Petrographic: @ 283' Argillite. Local qtz-feld replacement plus local recrystallization forming a feldspar matrix (very fine-grained, probably orthoclase)

288-289 Arg. dark grey.

289-312 Sandy Arg. Pinkish colored rock with some chlorite veins and patches, and about 30 % small (1/2-1 mm) qtz grains. looks generally like 282-288', but contains less chlorite. A considerable part of this intercept is entirely aphanitic.

302-303' Tactite

307-312 Tactite with gradational aspects into argillite

Petrographic: @ 292'. This section contains (1) a band of sandy arg. with high orthoclase content and (2) feldspathic rock as in section 283' described above.

@ 300' Considerable feld formed from recrystallization, set in a fine grained feldspathic matrix. Unrecrystallized areas show some mineral outlines of igneous aspect.

@ 303 Same as 300', with more intense recrystallization. The grain size varies from coarse to fine. Note: this sample is @ the fringe of a 1' tactite layer, and contains a band of garnet cutting the rock. The section failed to cut this band, and an additional one will be made.

312- 347' Feldspar rock with chlorite, slightly brecciated. Like 282-288, mixed gradationally with sandy argillite and conglomerate.

Petrographic: @ 315' - Like 283'.
@ 320 - Sandy arg.

347 - 386' Sandy Arg and arkose with occasional dark grey pebbles 1/2" max. 1/4" more common. Local alteration (?) banding @ 55° dip. Local conglomerate.
354' - 4" feld rock.

Petrographic: @ 379 - Sandy Arg.

386-392' Feld. rock - pinkish, slightly brecciated. Gradational upper contact. Bottom contact grades to tactite through about 2'. Qtz grains as in 289-312 near bottom contact.
@ 387' - Qtz veins (1/8") parallel, forming "ribbon rock".

Papago fm - - Probable location unconformity
Pima fm

392 - 408' Tactite. Below 398' contains patches and veins of qtz-feldspar.

Petrographic: @ 398' Qtz-feld banded rock.
@ 406' Orthoclase-garnet rock with epidote.

408 - 423 Andesite

423 - 427 Mb. Thin sulfide veins bordered by a white granular silicat.
~~Bottom con~~

427 - 433 Dark brown Tactite with qtz interstitial Hematite veining.

433 - Hornfels. White, granular. Local garnet areas. Local marble. Hematite heavy below 438

445' end of relogging.

~~interstitial~~

~~Interstitial~~ In

University of Arizona
TUCSON 25, ARIZONA

COLLEGE OF MINES
ARIZONA BUREAU OF MINES

February 13, 1959

Mr. John F. Kinnison
813 Valley Bank Bldg.
Tucson, Arizona

Dear Mr. Kinnison:

The determination of specific gravity with available equipment proved frustrating. It was found that it is necessary to reduce the fragments to an impracticable size before minimum contamination could be guaranteed. The berman balance is not equipped to handle powders or even pinhead size fragments. A platinum basket is necessary and this we do not have. However, I did try for an order of magnitude on the samples that I could obtain multiple fragments from.

In lieu of the specific gravity failure I determined indices of refraction as I think that the IR's are quite significant. Following are the data that I was able to obtain:

	IR	SG
E.P. 32 @ 556'	1.88-1.90	3.82±
44 @ 706'	too fine grained	
50 @ 458'	1.87+	
51 @ 376'	1.88 - 1.89	
65 @ 304	1.88 - 1.89	
76 @ 409	1.82 - 1.84 } small amounts Mg, Al	
122 @ 289	1.82 - 1.84	3.80±
151 @ 278	1.82 - 1.84	3.68±

The last three samples differ in some respects from the others studied. The IR's are much lower; the last three show birefringence; the spectroscope indicates that calcium and silicon are dominant with iron, manganese, and small amounts of aluminum and magnesium. Although not a major constituent alumina seems to be more abundant in the latter three samples. I wonder if the latter haven't been altered somewhat in comparison to what seems to be definite andradite?

Yours very truly,

H. W. Peirce

H. W. Peirce

P.S. The thin sections have been cleaned.

— Copy —

1/30/59

W. H. Pierce

A. Bur. Mines

Tucson

Dear Wes:

Here are 8 samples of garnet from drill cores.

They are from the approximate positions of the samples ~~which~~ you previously determined to be andradite, or close to it. As per our phone conversation, I request that you separate small pieces of pure garnet from each of these samples, and check them for specific gravity.

I think 2 small pellets from each sample should be determined, as a check measure.

Samples for sp. grav. determination.

EP 32 @ 556',
44 @ 706,
50 @ 458'
51 @ 376
65 @ 304
76 @ 409
122 @ 289
151 @ 278

Please keep the samples and I will pick them up

JEK

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona
March 11, 1958

MEMORANDUM TO KENYON RICHARD

EAST PIMA
Petrography - Garnet

The rocks at East Pima contain garnet which varies from a very pale straw yellow to brownish color. Some areas contain red garnet, and green garnet has been penetrated in a few drill holes. Because the dominant garnet is light yellow or brown it was assumed to be grossularite.

The Arizona Bureau of Mines has tested a number of garnet specimens on the visual spectrascope, and reports that iron and calcium are abundant, but that aluminum is present only in trace amounts. These results indicate that the garnet is andradite.

Test Results

DDH 44 @ 706.5' (Sirvas SA 17)	Separation of garnet not affected.
DDH 50 @ 458' (Sirvas SB 52)	Andradite. Considerable contamination but non-aluminous.
DDH 51 @ 376.5' (Sirvas SA 20)	Andradite.
DDH 65 @ 304.0' (Sirvas SA 18)	Andradite.
DDH 76 @ 408.5 (Sirvas SB 41)	Probably andradite. Separation of garnet not good.
DDH 32 @ 559' (Sirva	Close to andradite (relatively non-aluminous). This was a green garnet.
DDH 122 @ 289'	This sample contains garnet dispersed in a slick clay-like material. Bureau Mines reports: Clay-like surfaces very low in aluminum. Potassium not detected. Dominant constituents are calcium, magnesium, and silicon.
DDH 151 @ 273'	Andradite. Trace aluminum, possibly a little more than in the other samples.

Some of the above, and several additional specimens, were tested in 1.76 index oil and all showed high positive relief, showing that oil immersion will probably serve to distinguish the East Pima andradite from any high-aluminum garnet (grossularite) which may be present.

The tactite rocks commonly exhibit a white clay-like mineral previously thought to be clay alteration of the garnet. Since andradite will not alter to clay, this cannot be the case. Petrographic study suggests that the apparent clay alteration of garnet is actually an admixture of diopside. Talc may be present as an alteration product.

It is not necessary, then, to assume any impurity in the original limestone other than magnesium, which may also have been introduced. Silica, of course, may have been anoriginal constituent.

JOHN E. KINNISON

JEK/ds
cc: JHCourtright
JEKinnison
JLClark
RLDubois

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona
December 3, 1957

MEMORANDUM TO K. E. RICHARD

EAST PIMA - PETROGRAPHY

Dr. DuBois has completed a preliminary study of thin sections from the south and east extremities of the East Pima property. We recently discussed his results and examined some of the sections together. The following are the thin sections studied and classified by Dr. DuBois in this recent special project. The comments on alteration are my own.

DDH No.	Footage	
180	607'	Tuff(?). Some wisps of sericite suggest former shards, some small quartz grains appear igneous.
181	216'	Arkose. Fairly abundant sericite.
	253'	Sandy argillite - moderate sericite in matrix
	268'	Silty arkose - moderate sericite in matrix
	296'	Argillite. Moderate sericite in matrix
182	286'	Breccia of sedimentary and volcanic fragments in a matrix which is indefinite as to a volcanic or sedimentary origin.
	305'	Similar to 286', but some of the quartz of the matrix appears to be of igneous origin.
	306'	Igneous matrix (volcanic) with volcanic fragments
	312'	Igneous matrix with volcanic and sedimentary fragments
	408'	Igneous matrix with porphyry fragments
	429'	Uniform-textured igneous rock
	512'	Fine-grained arkose. (This may be a large fragment)
	545'	Rhyolite porphyry. Euhedral crystals and crystal fragments make up the bulk of the section. Some muscovite in small, shredded laths may have been altered from biotite.

These sections show carbonated and sericitized fragments and matrix, but the igneous feldspars of contemporaneous origin are relatively fresh.

DDH No.	Footage	
186	199'	Quartz latite porphyry
	235'	As above, but appears to contain rounded or corroded fragments of the same material.
195	238'	Arkose, with small rock fragments. The fragments and matrix contain abundant sericite, but the feldspars of the arkose are unaltered.
200	237'	Igneous. Similar to DDH 182 @ 545'.

The texture of the rocks near the bottom of DDH 182, particularly @ 545', is strikingly similar to that shown by a section of biotite rhyolite from Beehive Peak, Tucson Mountains. The principal difference is that the Beehive section contains many plagioclase feldspars, and is of dacitic composition, whereas the feldspars of DDH 182 are predominantly orthoclase. A section (not examined by DuBois) made from an exposure of biotite rhyolite near Helmet Peak shows the same type of texture and abundant plagioclase that characterizes the Beehive thin section.

I believe that Dr. DuBois' cursory examination should be expanded to include a restudy of the southern East Pima area and comparison with the biotite rhyolite on the San Xavier Reservation. The purpose, other than to gain general information, would be (1) to be sure that no microscopic evidence is overlooked that would reject the apparent field evidence that the biotite rhyolite is intrusive, and (2) to determine, if possible, why alteration is confined principally to foreign fragments and matrix, as this in turn may concern the entire East Pima alteration pattern.

JOHN E. KINNISON

JEK/ds
cc: JHCourtright
KERichard (1 extra)

September 10, 1957

Dr. R. L. DuBois
1309 East Elm Street
Tucson, Arizona

EAST PIMA PETROGRAPHIC STUDIES

Dear Sir:

The following information has been compiled to assist your petrographic determinations of East Pima cores.

1. The following sections have been correlated with the unit termed "calcareous argillite," which occurs generally at deep levels in the east ore body.

DDH	Petrographic Name
151 @ 525'	Sandy calc. arg (JEK)
149 @ 742'	Argillite
149 @ 770'	Hornfels
149 @ 788'	Calcareous argillite
41 @ 581'	Argillite
62 @ 418'	Argillite

2. The following sections, within tactite or hornfels units, show feldspathic aspects, and may be of a related alteration type.

DDH	Megascopic	Petrographic
134 @ 265'	Mass. feldspar	Feld. replacement
134 @ 275'	Mass. feldspar	Qtz-feld. replacement
152 @ 310'	Feldspathic rock	Qtz-carbonate-feld rock (JEK)*
152 @ 357'	Qtz veins (Ribbon rock)	Banded qtz-carbonate and feld rock (JEK)
152 @ 360'	Feldspathic rock	Qtz-carbonate-feld rock (JEK)

*Those sections followed by (JEK) indicate sections sent to you after your original report of 6-19-57 and to which I have given a preliminary petrographic name.

3. The following sections apparently identify fragments or horses of Kino formation in the breccia zone of the east ore body.

DDH	Megascopic	Petrographic
152 @ 579'	Conglomerate or breccia with feldspar	Felsite porphyry(JEK)
152 @ 701'	Perlitic breccia	Pyroclastic(?) similar to 151 @ 694
41 @ 644'	Conglomerate	Argillite (probably part of matrix of Cgl)

4. The following sections are related to the identification problems of the Papago-Pima formation contact, and will serve for comparison with the series of sections from DDH 109 which you are presently studying.

DDH			
53	500'	Qtzt	Pgf?
19-D	255'	Diop. calcite Hf	Pgf?
88	414'	Arg	Pgf
	420'	Calc. arg	Pgf
	------------------	------------------	------------------
	425'	Trem. Hf	Pgf?
	429'	Epidote-garnet Tt	
	437'	Diop-garnet Tt	
	451'	Arg	
	453'	Qtzt	
	462'	Actino-tremolite Hf	
	468'	Qtz-calcite-feld Hf	
	475'	Trem. Hf	Pgf?
	------------------	------------------	------------------
	478'	Sericite bearing qtzt	Pif
48	455'	Arg	Pgf?
	482'	Arg	Pgf?
49	466'	Arg	Pgf?
65	271'	Diop-garnet Tt	Pgf?
63	420'	Qtzt	Pgf?
74	245'	Sandy arg	Pgf?
109	398'	Qtz-feld banded rock	Pgf?

Yours very truly,

JOHN E. KINNISON

JEK/ds

AMERICAN SMELTING AND REFINING COMPANY

813 Valley National Building
Tucson, Arizona
January 19, 1961

E & G Scientific
854 South Figueroa Street
Los Angeles 17, California

Attention Sales Department

Gentlemen:

Please furnish me with descriptive literature and cost on the following item:

Your Catalog -- AO No. 507 -- Polarizing Attachment for Stereoscopic Microscope.

Yours very truly,

JOHN E. Kinnison
Geologist

JEK/ds

M-9.9

AMERICAN SMELTING AND REFINING COMPANY

ASARCO

SOUTHWESTERN MINING DEPARTMENT

813 VALLEY NATIONAL BLDG., TUCSON, ARIZONA

T. A. SNEDDEN
MANAGER

A. C. HALL
ASSISTANT MANAGER

KENYON RICHARD
CHIEF GEOLOGIST

May 1, 1961

Mr. John R. Cooper
U. S. Geological Survey
Federal Center
Denver 2, Colorado

MISSION
Spectographic Samples

Dear John:

Thanks very much for the Mission spectrographic results. And particularly, our thanks to Joyce for typing the key.

John K. has looked over this material briefly. He says he notes nothing obviously unusual, except that titanium is about ten times greater in the Papago and Kino formations than in the Pima tactites and hornfels -- whatever that means.

Every year you depart from Tucson just when the weather is becoming decent. Anyway, we will be looking forward to having you and Joyce back with us next fall.

Best regards,

Original Signed By
K. Richard

KENYON RICHARD

KR/ds
cc: JEKinnison