APPENDICES

APPENDICES

Abbreviations for Tables

Stratigraphic unit

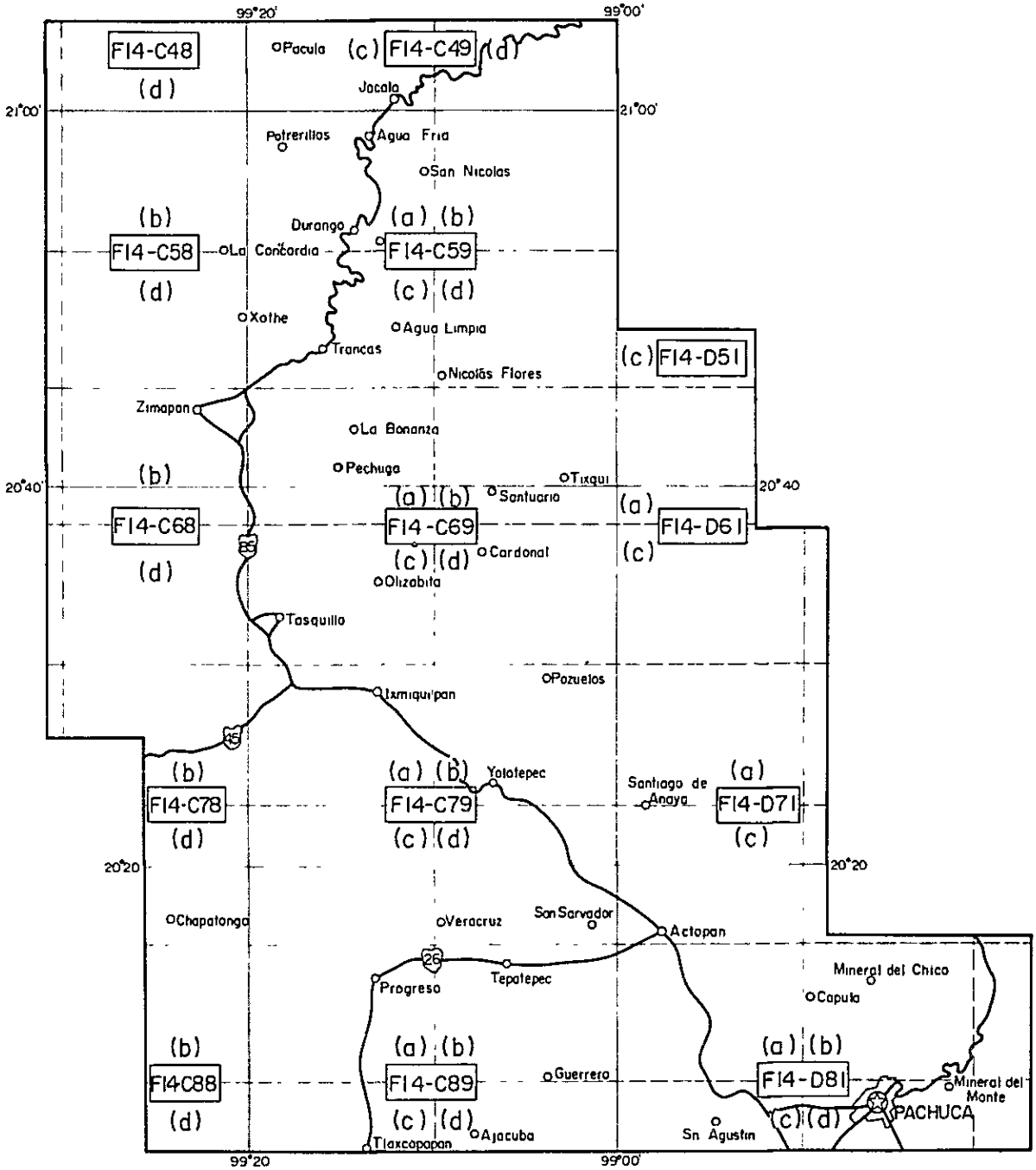
Quaternary System		Qba,	basalt lava
Tertiary System	Intrusive rocks	Tirh,	rhyolite dike
		Tian,	andesite dike
		Tiba,	basalt (dolerite) dike
		Tigd,	granitic rock
	Volcanic rocks	Tba3,	basalt lava
		Trhy2,	rhyolite lava
		Tan3,	andesite lava
		Ttf2,	acidic pyroclastic rocks
		Trhyl,	rhyolite lava and welded tuff
		Tba2,	basalt lava
		Tan2,	andesite lava
		Tbal,	basalt lava
		Ttfl,	acidic tuff
		Tanl,	altered andesite lava
		Tcg,	conglomerate
Cretaceous System		Ksh3,	shale, calcareous shale and sandstone
		Kls2,	Hippurites limestone
		Ksh2,	calcareous shale, sandstone and marl
		Klf,	flint-alternated limestone
		Kshl,	shale and sandstone
		Kcg,	conglomeratic limestone and calcarenite
		Klsl,	massive limestone
		Sk,	skarn

Minerals

ol,	olivine	ap,	apatite		
px,	pyroxene	ca,	calcite		
opx,	orthopyroxene	ga,	garnet		
hy,	hypersthene	vs,	vesvianite		
cpx,	clinopyroxene	wo,	wollastonite		
di,	diopside	ep,	epidote		
ag,	augite	ch,	chlorite		
hb,	hornblende	sr,	sericite		
bi,	biotite	sa,	saponite		
ru,	rutile	kn,	kaolin		
ti,	titanite	ze,	zeolite		
mg,	magnetite	gt,	goethite		
or,	orthoclase	sf,	sulfide		
pl,	plagioclase	az,	azurite		
qz,	quartz	ml,	malachite		
cr,	cristobalite	gl,	glass		
td,	trydymite	cl,	clay mineral		

Others

mf,	microfossil	xn,	xenolith
pu,	pumice	xncry,	xenocryst
lp,	lapilli	-brg,	-bearing



Apx. 1 Index Map of 1 : 25,000 Topographic Map

Apx. 2 Collected Cretaceous Macrofossils

(identified by Dr. K. TANAKA)

No	Sample no	Location			Stratigraphic unit	Ammonite					Pelecypoda												Gastropoda					
		Sheet no (1:25,000)	Coordinates E	Coordinates N		Baculitidae gn. et sp. indet.	Diplomoceratidae gn. et sp. indet.	coiled ammonite (evolute form)	ditto (involute form)	aberrant ammonite	Birdiolites? sp.	Bounonia sp.	Caprinidae gn. et sp. indet.	Corallochama sp.	Eorndiolites sp.	Hippurites sp.	Monopleuridae gn. et sp. indet.	Plagioptycus sp.	Radiolites sp.	Requienia sp.	Requieniidae gn. et sp. indet.	indeterminable rudists	Exogyra sp.	indeterminable pelecypoda	Actaeonella sp.	Nerinea sp.	indeterminable gastropoda	Echinoidae gn. et sp. indet.	Coral	indeterminable fossil
1	Ba14F	F14-C79b	497000	2258200	Kls_2																				○				
2	Ca35F	F14-C59b	483725	2318250	Keg																								○
3	Da48F	F14-C59c	471750	2308075	Kls_1													?			○			○					
4	Ba57F	F14-D71a	410300	2264100	Kls_1																○	○							
5	Ba60F	F14-D61c	400250	2775275	Kls_2						?		○		○											○			
6	Cb23F	F14-C69b	485675	2285450	Ksh_3																			?					
7	25F	ditto	485125	2287750	Klf																								○
8	Ab35F	F14-C79d	484800	2239400	Kls_2							○			○														
9	Bb62F	F14-C79b	489250	2261350	Kls_2																								
10	64F	ditto	487625	2261450	Kls_2																								
11	65F	ditto	486375	2261200	Kls_2																								○
12	66F	ditto	486250	2260675	Kls_2													○											
13	Db86F	F14-C68b	448975	2290700	Kls_2								○				○												
14	Cb97F	F14-C59c	472700	2299950	Ksh_3																	?							○
15	103F	ditto	473025	2300600	Ksh_3																			?					
16	Cb116F	ditto	475150	2307750	Kls_1																								
17	134F	F14-C59b	485150	2314350	Kls_1																								
18	250F	F14-C69b	485600	2285475	Ksh_3																							○	
19	251F	ditto	485450	2285525	ksh_3																							○	
20	252F	ditto	485125	2287750	Klf																								
21	253F	ditto	486725	2287875	Klf	○			○																				
22	254F	ditto	486750	2288100	Klf					○																			
23	255F	F14-C59c	472300	2299500	Ksh_3					○																			?
24	256F	ditto	472325	2299700	Ksh_3																								○
25	Bc10F	F14-C69d	497750	2279300	Kls_2																								
26	11F	ditto	493300	2278050	Kls_2						?			○				○											
27	Ac15F	F14-C79d	491200	2242900	kls_2															○									
28	Dc28F	F14-C68b	457500	2288350	Kls_2																○								
29	55F	F14-C58b	468425	2321750	Kls_1																								
30	56F	ditto	463800	2319750	Kls_1													○											
31	Cc83F	F14-C59d	487250	2302000	Kls_1																								
32	Bd12F	F14-C69d	490425	2275600	Kls_2						?				?														
33	13F	ditto	492900	2275100	Kls_2																○				○				
34	17F	ditto	498000	2270900	Kls_2																					○			
35	Ad22F	F14-C79d	488150	2242700	Kls_2																			○					
36	23F	ditto	487550	2243750	kls_2																								○
37	27F	ditto	487075	2243750	Kls_2																			○					
38	Dd38F	F14-C68d	451575	2269900	kls_2																?								
39	97F	F14-C59a	468675	2311025	ksh_1																			○					
40	98F	ditto	469275	2310925	Kls_1																				○				
41	159F	F14-C59c	473675	2307950	Kls_1																					○			
42	Cd212F	F14-C69b	488825	2281625	Klf										?										?				
43	Bd220F	F14-C69d	493850	2278100	Kls_2																				○				

○, abundant; ˋ, common; ?, genus uncertain.

Apx. 3 Collected Cretaceous Micro-nannofossils

(identified by Dr. H. OKADA)

No.	Sample no.	Location			Stratigraphic unit	Foraminifera	Nannoplankton									
		Sheet no. (1:25,000)	Coordinates E	Coordinates N			Broinsonia enormis	Cretarhabdus conicus	Cribrosphaera ehrenbergii	Eiffellithus eximus	E. turisseiffeli	Micula staurophora	Parhabdolithus angustus	P. embergeri	Watznaueria barnsae	W. aff. W. communis?
1	Cb136F	F14-C59b	486250	2312225	Klsl	○										
2	137F	ditto	486350	2311575	Klsl	○										
3	Bc8NP	F14-C69d	497150	2279500	Ksh3		○	○	○	○		○			○	○
4	Dc23NP	F14-C68b	457750	2291900	Ksh3										○	
5	Cc53NP	F14-C59c	474850	2308100	Ksh2										○	
6	Dc54NP	F14-C58b	468325	2319775	Ksh2										○	
7	Cc64NP	F14-C59d	484200	2296150	Ksh3										○	
8	Cc82NP	ditto	487175	2302000	Ksh2										○	
9	Dd62NP	F14-C59c	460000	2307825	Klf						○		○	○	○	
10	64NP	ditto	466275	2307100	Klf										○	
11	81NP	ditto	466100	2297025	Ksh3										○	
12	85NP	ditto	465625	2299400	Ksh3										○	

Fourty samples were examined for nannofossils, but only 10 samples yielded above nannofossils.

No	Sample no	Location: Sheet no (1 25,000)	Location: Coordinates E	Location: Coordinates N	Stratigraphic unit	Rock name	Texture	Phenocryst or fragment: ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	Groundmass: ol	opx	cpx	ht	bi	ru	ti	mg	or	pl
1	Aa 1T	F14-C79c	467750	2249675	Tan 2	cr-brg ag andesite	porphyritic, fluidal			○					•		○								px						•		◎
2	2T		468000	2249000	Tan 2	xn-brg hy-ag andesite	porphyritic, fluidal		○	○					•		○								px						•		◎
3	3T		469475	2248600	Tan 2	altered cr-td-brg hb andesite	porphyritic, fluidal				○						○								px						•		◎
4	4T		467550	2250535	Tan 2	cr-td-brg hb-hy-ag andesite	porphyritic		○	○	○				•		○		•						px						•		•
5	5T		466350	2251575	Qba	ag basalt	porphyritic, fluidal			○																◎					•		◎
6	7T		467050	2251625	Tan 2	cr-brg hy-ag-hb dacite	porphyritic, fluidal		○	○					•		○	•							px						•		◎
7	Ba 8T	F14-C79b	494475	2257750	Kls 2	crystalline limestone	equigranular																										
8	9T		494800	2258600	Kcg	conglomeratic limestone														◎														
9	10T		493800	2259425	Kls 2	mf-brg limestone																		•										
10	Da 17T	F14-C68d	461150	2272675	Ttf 2	altered andesitic tuff	lapilli-bearing			px					•		•				○												
11	18T		457750	2272400	Tan 2	ag andesite	porphyritic, fluidal			•						•	○										•				•		◎
12	19T		457600	2272300	Tan 2	px andesite	porphyritic, vesicular, fluidal			px						•	○									px					•		◎
13	20T		458075	2273175	Ttf 2	bi-andesitic tuff	andesite lapilli-bearing			px		•			•	•	○				○												
14	21T		458300	2273225	Ttf 2	argillaceous sandstone	bedded			px					•		◎																
15	22T		458325	2273600	Ttf 2	glassy rhyolite	porphyritic, vesicular								•		○	•															
16	23T		458500	2273600	Ttf 2	autobrecciated rhyolite	porphyritic, fluidal brecciated											•								px						○	
17	24T		463325	2275150	Tan 2	cr-hb-brg hy-ag andesitie	porphyritic, fluidal		○	○	•						○	•							px					•			
18	26T		463050	2274700	Ttf 2	rhyolite	porphyritic, spherulitic, fluidal											○								px					•		○	
19	27T		462850	2274475	Ttf 2	rhyolite	porphyritic, fluidal											○								px					•		○	
20	28T	F14-C59a	466350	2308750	Klf	mf-brg sandy limestone	bedded											•		◎			◎										
21	29T	F14-C59c	465350	2308025	Klf	alternation of calcareous shale and limestone	bedded																•										
22	30T		466000	2307850	Klf	mf-brg limestone	bedded																•										
23	Ca 33T-NP	F14-C59b	483950	2317700	Kls 1	mf-brg limestone																	◎										
24	34T		484050	2317850	Kls 1	mf-brg limestone															○		•										
25	36T		483300	2318575	Kls 1	crystalline limestone	equigranular														○												
26	37T-a	F14-C69b	488325	2293550	Tian	altered bi-brg hb andesite	porphyritic				◎	•			•		○		•						px								◎
27	37T-b	F14-C59a	481850	2319350	Kls 1	crystalline limestone	equigranular																										
28	38T	F14-C69b	487900	2292950	Ksh 3	calcareous sandstone						•					○	○		◎			•										
29	39T	F14-C69b	488000	2292825	Tian	altered hb andesite	porphyritic, fluidal				○				•		○		•						px						•		◎
30	40T		487550	2292750	Tian	altered hb andesite	porphyritic, fluidal				○				•		•		•						px						•		◎

Microscopic Observations of Rock Thin Sections

Phenocryst or fragment															Groundmass or matrix																					Secondary mineral																	Remarks
x	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	ti	ru	ti	mg	or	pl	qz	cr	td	ap	ca	ga	vs	wo	ep	gl	cl	sf	px	ga	vs	wo	ac	ep	bi	or	pl	qz	cr	td	ca	ch	sr	sa	kn	ze	gt	sf	
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(Apx. 4 — Continued)

No	Sample no	Location			Stratigraphic unit	Rock name	Texture	Phenocryst or fragment														Groundmass c										
		Sheet no (1 25,000)	Coordinates E	Coordinates N				ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz
31	Ca 41DT	F14-C69b	487525	2292775	Tlan	altered bi-brg hb andesite	porphyritic				○			•			○		•						px•							◎	
32	42T		486750	2288200	Klf	mf-brg crystalline limestone																◎							•				
33	43T		486600	2287500	Klf	mf-brg crystalline limestone	equigranular															◎											
34	49T		488400	2293875	Tan 1	altered bi rhyolite	porphyritic, spherulitic					○			•		○							px•			•				◎	◎
35	51T	F14-C59d	489750	2294400	Ksh 3	mf-brg crystalline limestone	bedded															•											
36	52T		488750	2294725	Tigd	hb-ag quartz diorite porphyry	porphyritic			○	○		•		•		◎		•											•	?	◎	◎
37	53T		488825	2294700	Sk	ep-di skarn	equigranular																		○			•	•		•	
38	Ba 58T	F14-D71a	407400	2256250	Tan 2	qz-cr-brg ol-px basalt	porphyritic, fluidal	•	•	•					•		•	•						px•						•		◎	
39	Ca 61T	F14-C59c	476400	2303575	Klf	skarnized argillaceous limestone	porphyroblastic																										
40	62T	F14-C69a	474525	2287725	Tigd	skarnized granodiorite ?	equigranular																					○		•		◎	
41	65T		474525	2287725	Sk	ca-brg ga skarn	equigranular																								•		•	•
42	Cb 1DT	F14-C59c	478800	2307650	Tigd	ag-bi-hb quartz diorite porphyry	porphyritic			○	○	○			•		◎											?			•		•	◎
43	Db 2T	F14-C58d	453900	2301750	Klf	mf-qz-brg crystalline limestone	bedded										•	•		○			•										
44	4T		453725	2301000	Klf	mf-brg crystalline limestone																	◎										
45	7T		453775	2300075	Tirh	altered hb-bi dacite	porphyritic				○	○			•		○	○														◎	◎
46	13T	F14-C68b	460625	2288075	Trhy 2	altered hb(?) rhyolite	porphyritic, spherulitic				○						○	◎							px•								◎
47	14T		457775	2284350	Ttf 2	tuff	pumice-lapilli-bearing		px•		•				•		•	•				○											
48	18T		456000	2284225	Tba 1	altered ag andesite	porphyritic, fluidal			○					•		○	•							px•					•		◎	
49	Cb 20DTC	F14-C69b	485075	2284300	Trhy 2	hb-bi rhyolite	porphyritic, fluidal				○	○			•	○		○							px•					•	◎		◎
50	30T		487075	2289400	Ksh 3	mf-brg limestone	bedded																•										
51	33T	F14-C69d	488050	2280000	Klf	crystalline limestone	equigranular																										
52	Ab 40T	F14-C79a	474900	2257300	Tan 2	cr-brg ag andesite	aphanitic, fluidal																		○	○					•		◎	
53	42T		469900	2256350	Tan 2	hb-andesitic lapilli tuff				•	○				•		○																	
54	Cb 44T	F14-C69a	481300	2282000	Ksh 3	mf-brg crystalline limestone																	◎										
55	50T		480675	2284025	Tan 2	hb andesite	porphyritic, fluidal			•	○				•		○								px•					•		◎	
56	58T		477825	2286500	Tan 2	andesitic volcanic breccia				•	•				•		○				○												
57	Bb 60T		490250	2259500	Tba 1	px andesite or basalt	porphritic, fluidal	?	px•															px○						•		◎	
58	67T	F14-C79b	485750	2259500	Klf	mf-brg crystalline limestone	bedded													○			◎										
59	Db 71T	F14-C68b	457250	2294975	Ksh 3	calcareous sandstone											•	◎		○													
60	72T		456375	2291875	Tirh	altered hb-bi dacite	porphyritic				○	○			•		○	○							px•							○	◎

Phenocryst or fragment														Groundmass or matrix																						Secondary mineral																				Remarks
cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	cr	td	ap	ca	ga	vs	wo	ep	gl	cl	sf	px	ga	vs	wo	ac	ep	bi	or	pl	qz	cr	td	ca	ch	sr	sa	kn	ze	gt	sf	
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(Apx 4 — Continued)

No	Sample no	Location			Stratigraphic unit	Rock name	Texture	Phenocryst or fragment														Groundmass									
		Sheet no (1 25,000)	Coordinates E	Coordinates N				ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	hb	bi	ru	ti	mg	or
61	Db 74T	F14-C68b	456300	2291825	Tiba	altered qz-brg px basalt	porphyritic, intergranular			○					•		○	•							px ◎						○	
62	81T		451650	2291050	Ksh 3	calcareous sandstone	bedded					•				?	○	○		◎												
63	83T		450225	2291250	Ttf 2	hb-bi-andesitic tuff	andesite lapilli-bearing			•	○	○			•		◎				○						○	○			•	
64	84T		449075	2291200	Ksh 3	calcareous sandstone										?	•	•		○			•									
65	87DT		452250	2291025	Trhy 2	bi rhyolite	porphyritic, spherulitic, myrmekitic					○					○								px •					•	fd ◎	
66	89T	F14-C59c	465650	2295450	Tba 1	px-ol basalt	porphyritic, fluidal	○																•	px ◎					○	
67	91T		467500	2297275	Tba 1	hb rhyolitic welded tuff	welded, spherulitic				•				•		○	○							px •						
68	94T		471325	2299750	Ttf 2	rhyolitic pumiceous tuff									•		•	•				○									
69	96T		472600	2299950	Ksh 3	crystalline limestone	porphyroclastic, schistose													○											
70	99T		472800	2300300	Ksh 3	sandy shale											•	•		•											
71	104T		473250	2300925	Klf	calcareous sandstone														◎			•								
72	106T		472825	2301750	Klf	calcareous sandstone	bedded													◎			•								
73	112T		475375	2305700	Tian	altered bi-hb andesite	porphyritic				○	○			•		○	•	•						px •					•	
74	Cb 115T		475850	2306250	Kls 1	mf-brg crystalline limestone	bedded, equigranular																◎								
75	118T		476925	2307000	Kls 1	crystalline limestone	equigranular																								
76	120T		477700	2307125	Tigd	bi-ag-hb granodiorite	granular																			•	○	○		•	•	○
77	123T		480000	2299975	Tirh	rhyolite	porphyritic, fluidal, spherulitic										○	○							px •						
78	127T		481750	2299925	Ksh 3	mf-brg crystalline limestone	bedded																◎								
79	130T	F14-C59d	483650	2298450	Tigd	hb granodiorite porphyry	porphyritic, hollocrystalline									○	○										•				
80	131T		483525	2297700	Tan 2	altered andesitic tuff breccia			px ○						•		◎				◎										
81	141T	F14-C59b	487275	2310825	Kcg	calcareous conglomerate										fd •		•		◎			•								
82	157T	F14-C59c	478400	2307250	Sk	px skarn	equigranular																			◎				•	
83	166T		479550	2307425	Tian	altered hb dacite	porphyritic				○	•			•	•	○	•	•								•			•	
84	167T		478975	2307475	Tian	altered hb dacite	porphyritic				○				•	•	○	•	•									•			•	
85	180T	F14-C59d	488950	2295700	Tan 1	altered ag-hb andesite	porphyritic, fluidal			○	○				•		○		•						px •					•	
86	184T		486825	2295725	Tan 1	cpx basalt	porphyritic, fluidal			○							○									◎				○	
87	186T	F14-C69a	482250	2294150	Ksh 3	mf-brg crystalline limestone	bedded, equigranular																○								
88	188T	F14-C59d	483000	2295000	Tiba	ag dolerite	porphyritic, intergranular			○					•		○									◎				○	
89	Ab 190T	F14-C89b	486025	2326375	Tba 1	hy-brg ag basalt	porphyritic, fluidal										○								•	◎				•	
90	194T		494275	2232775	Tba 1	quartz basalt	porphyritic, fluidal				?						○	•							px ◎					•	

Phenocryst or fragment															Groundmass or matrix																						Secondary mineral																				Remarks
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(Apx. 4 — Continued)

No	Sample no	Location: Sheet no (1 25,000)	Location: Coordinates E	Location: Coordinates N	Stratigraphic unit	Rock name	Texture	Phenocryst or fragment: ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	Groundmass: ol	opx	cpx	hb	bi	ru	ti	mg	or	pl	qz
91	Ab 197T	F14-C89b	487000	2229000	Tba 1	hy-ag quartz basalt	porphyritic, fluidal			•							•	•							○	◎					•		◎	
92	Cb 211T	F14-C59c	477500	2303775	Tigd & Sk	px diorite and skarn	equigranular																			○				○	•		◎	
93	213T		477500	2303500	Sk	ga-vs-ep-wo skarn	equigranular																													○
94	217TPC		477825	2303375	Sk	sf-ga skarn	equigranular																													?
95	Ac 1T	F14-C79a	471250	2261750	Tan 2	hy-brg hb-cr dacite	porphyritic, fluidal		•		◎				•		○	○						px							•		◎	
96	2T		470000	2264600	Qba	ag-hy andesite	porphyritic, fluidal		○	•					•		○							px ⊙							•		◎	
97	4T		469500	2255600	Tan 2	hb-cr dacite	porphyritic				○				•		○	◎						px •							•		◎	○
98	5T		468100	2257800	Tan 2	ag-hy andesite	porphyritic, fluidal		○	○					•		○							px ◎							•		◎	
99	Bc 9T	F14-C69d	497150	2279500	Ksh 3	sandstone	fine-grained					•				•	◎	◎		◎												○	◎	◎
100	Ac 14T	F14-C79d	489000	2244750	Tian	td-hb andesite	porphyritic, trachytic				○													px •							•		◎	
101	Dc 24T	F14-C68b	456650	2290650	Tian	bi-brg hb-ag andesite	porphyritic			○	○	•			•		◎							px •							•		◎	•
102	25T		456500	2289550	Tirh	silicified rhyolite	porphyritic										•	•													•		○	◎
103	Cc 29T	F14-C69c	465550	2273750	Tan 2	hy-ag basalt	porphyritic		•	•							•								○	◎					○		◎	
104	30T		465550	2273850	Ttf 2	glassy bi rhyolite	autobrecciated, perlitic					•					•																		
105	33T	F14-C68d	464150	2275250	Tba 1	xn-cr-brg oxyhb basalt					•							•						px •							•		◎	
106	38T	F14-C69c	465250	2279500	Ttf 2	tuffaceous sandstone	lapilli-bearing					•			•		○	○						px •							•		•	
107	40T	F14-C69a	466250	2285800	Tan 2	hb-andesitic volcanic breccia	brecciated				○				•		○							px •							•		◎	
108	46T	F14-C59a	477750	2317500	Kls 1	limestone	very fine-grained																												
109	51T		475600	2309750	Tan 3	td-hb andesite	porphyritic, fluidal				•						•							px •							•		◎	
110	Dc 57TX	F14-C58b	463750	2319750	Kls 1	conglomeratic limestone	limestone pebble-bearing													◎		○													
111	Cc 66T	F14-C59d	484050	2298525	Tian	altered bi-hb andesite	porphyritic				○	○		•	•		○		•					px •							•		◎	○
112	67T		484050	2298700	Tian	altered hb andesite	porphyritic, fluidal				○				•		○		•					px •							•		◎	
113	68T		484050	2298700	Ksh 3	skarnized crystalline limestone	porphyroblastic, foliated																													
114	69T		484050	2298700	Sk	vs-di skarn	porphyroblastic, foliated																													○
115	72T	F14-C59c	478250	2303800	Tigd	bi-ag monzonite porphyry	porphyritic			○		○		•	•	○	◎									○		○		•	•	◎	◎	
116	77TPC		477600	2303950	Sk	ga-vs-wo-sf skarn	equigranular, banded																													
117	78T	F14-C59d	485000	2299050	Tian	altered volcanic rock	porphyritic										○																	◎	
118	80T		485800	2300800	Klf	epidotized sandy argillite	porphyroblastic, bedded																													
119	81T		486000	2301700	Ksh 1	sandstone	fine-grained					•					○	○		◎								•				◎	◎
120	84T		489050	2302500	Tan 1	hb rhyolite	porphyritic, spherulitic, fluidal		px •	○					•	○	○							px •							•	◎	◎	◎

Phenocryst or fragment														Groundmass or matrix																						Secondary mineral																				Remarks
cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	cr	td	ap	ca	ga	vs	wo	ep	gl	cl	sf	px	ga	vs	wo	ac	ep	bi	or	pl	qz	cr	td	ca	ch	sr	sa	kn	ze	gt	sf	
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No	Sample no	Location: Sheet no (1 25,000)	Location: Coordinates E	Location: Coordinates N	Stratigraphic unit	Rock name	Texture	Phenocryst or fragment: ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	Groundmass: ol	opx	cpx	ht	bi	ru	ti	mg	or	pl
121	Cc 86T	F14-C59d	489050	2302500	Q orQTcg	conglomerate	pebble-bearing									O	O	O		◎													
122	88T		485400	2300350	Tigd	px-brg bi-hb granodiorite	equigranular																		•	•	O	•		•	O	O	◎
123	Ac 91T	F14-C89b	494300	2232750	Tba 1	quartz basalt	porphyritic, fluidal										•	•							px ◎						O		◎
124	92T		497350	2232100	Tba 1	px basalt	vesicular, microcrystalline																		○	○							◎
125	93T		498000	2232650	Tba 1	cr-brg px basalt	(glomero-) porphyritic		○								○								○	○					O		◎
126	94T		498450	2232700	Tba 1	px basalt	porphyritic										○	•							?	◎					•		◎
127	96T		496300	2235300	Trhy 2	cr rhyolite	porphyritic, fluidal		px •		•				•		○	•							px •						•		◎
128	Cc 97T	F14-C69a	472000	2287050	Klf	skarnized argillaceous limestone	porphyroblastic																										
129	98T		472025	2282050	Tan 2	ag-brg cr-hb andesite	porphyritic, fluidal			•	○				•		○	•							px •						•		◎
130	103T		471250	2287750	Tan 2	hy-ag-hb-cr andesite	porphyritic, fluidal		•	•	○						•								px ◎						•		◎
131	105T		470725	2288250	Tan 2	cr-px andesite or basalt	porphyritic, fluidal		px •																px ◎						•		◎
132	106T		470400	2288900	Trhy 1	rhyolitic welded tuff	welded, spherulitic				•				•		○	○															
133	109T	F14-C59c	477450	2304300	Sk	ep-ga skarn	equigranular																										
134	112TC		477050	2304650	Sk	ml-az-ga skarn	equigranular																										
135	119T		479000	2304100	Sk	ga-wo-di skarn	equigranular																			○							
136	Ad 5T	F14-C79c	475450	2239400	Tba 1	px basalt	intersertal, fluidal																		px ◎						O		◎
137	8T	F14-C89a	471600	2235775	Ttf 2	rhyolitic tuff	lapilli-bearing								•		○	•															
138	11T		475950	2237600	Qba	ol-ag basalt	porphyritic, vesicular, fluidal	○		○					•										px ◎						O		◎
139	23T	F14-C79d	487725	2242950	Kls 2	crystalline limestone	bedded, equigranular																										
140	Dd 31T	F14-C68d	453850	2269925	Kls 2	crystalline limestone	equigranular																										
141	33T		453000	2270125	Kls 2	crystalline limestone	equigranular																										
142	36T		452550	2269925	Ksh 1	sandstone	very fine-grained					○							◎		◎												
143	40T		451400	2269550	Kls 2	crystalline limestone	very fine-grained																										
144	42T		451875	2269050	Ttf 2	bi-rhyolitic tuff	bedded		px •			○			•		○	○							px ○						•		
145	53T	F14-C68b	452500	2282800	Tan 3	ag-hy andesite	porphyritic		○	○							○									○						•		◎
146	60T		460425	2285075	Ttf 2	rhyolitic lapilli tuff	lapilli-bearing					○					○				◎	○					•						
147	67T	F14-C59c	466750	2306000	Klf	mf-brg limestone	bedded, very fine-grained																○										
148	76T		467575	2304000	Tba 3	hy-brg ag basalt	porphyritic, fluidal		•	○															px ◎						O		◎
149	77T		466800	2300225	Tba 1	hy basalt	porphyritic, fluidal		○																px •						•		◎
150	86T		465525	2299250	Ksh 3	mf-brg limestone	bedded, very fine-grained																◎										

Phenocryst or fragment														Groundmass or matrix																						Secondary mineral																				Remarks
px	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	cr	td	ap	ca	ga	vs	wo	ep	gl	cl	sf	px	ga	vs	wo	ac	ep	bi	or	pl	qz	cr	td	ca	ch	sr	sa	kn	ze	gt	sf	
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(Apx. 4 — Continued)

No	Sample no	Location			Stratigraphic unit	Rock name	Texture	Phenocryst or fragment												Groundmass or									
		Sheet no (1 25,000)	Coordinates E	Coordinates N				ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz
151	Dd 96T	F14-C59a	468025	2310550	Klf	quartzose conglomerate												○																○
152	Cd 108T	F14-C69a	474900	2283175	Tan 2	ag-hy-hb-td andesite	porphyritic, fluidal		○	○	○				•		○								px					•		◎	
153	110T		475550	2285625	Tan 2	hy-brg ag-hb-td andesite	porphyritic, fluidal		•	○	○				•		○								px					•		◎	
154	114T		474575	2286425	Ksh 3	mf-brg limestone	bedded, very fine-grained																○										
155	118T		474025	2287750	Klf	crystalline limestone	equigranular																											
156	120T		474525	2287675	Tigd	granophyre	graphic or myrmekitic								•		○								px				•	•	○	◎	◎	
157	123T		474525	2287700	Tigd	hb granodiorite	equigranular																				○			•	•	○	◎	◎	
158	124T		474425	2287725	Klf	crystalline limestone	equigranular																										•	
159	126T		474325	2288825	Ksh 3	argillaceous limestone	bedded																											
160	134DT	F14-C59a	479700	2315525	Tigd	bi-hy-ag quartz diorite	equigranular																		○	○		○			•	•	◎	○
161	135T		479875	2315475	Tigd	bi-ag diorite	equigranular																			◎		○			•	•	◎	•
162	136T		480175	2315475	Sk	wo-vs-hd skarn	equigranular																			○							◎	◎
163	141T	F14-C69a	474775	2290825	Klf	sandy shale											•	•																
164	142T		475000	2291500	Trh	altered bi rhyolite	porphyritic, felsitic				•	○					○	○	•													◎	◎
165	145T		476075	2293650	Tcg	calcareous conglomerate												○		◎														
166	146T		476350	2293975	Tba l	ag-ol basalt	porphyritic, fluidal	○		○							○								px ○					•		◎		
167	163T	F14-C59d	487625	2297750	Tan l	altered bi-andesitic lapilli tuff						•					○				◎													
168	164T		487450	2298000	Tan l	altered hb andesite	porphyritic, felsitic				○						○														•		◎	◎
169	166T		486175	2298700	Tigd	hb granodiorite	equigranular																			•	○			•	•	○	◎	◎	
170	172T	F14-C59c	476500	2300975	Ksh 3	mf-brg limestone	bedded, very fine-grained																•											
171	Ad 178T	F14-C81a	408325	2230625	Tba l	cr-brg ag basalt	porphyritic, fluidal			•							•	•							px						•		◎	
172	179T		408975	2229150	Qba	xn-brg hy-ag-ol basalt	porphyritic, fluidal	○	○	○							○								px ○						○		◎	
173	Bd 183T		414025	2232025	Trhy 2	ag-hb rhyolite	porphyritic, fluidal			•	○				•		○								px							fd ◎		◎	
174	Cd 192T	F14-C69a	467600	2286725	Tan 2	td-cr-hb andesite	porphyritic, fluidal				○						○								px						•		◎	
175	200T	F14-C59c	477400	2304050	Tigd	ag diorite	equigranular																			○				○		•	◎	
176	201T		477000	2304350	Sk	ga-wo skarn	equigranular																											
177	204TX		477450	2303250	Klf	skarnized limestone	porphyroblastic																											
178	213T	F14-C69b	489000	2281875	Klf	sandstone												•																

Phenocryst or fragment													Groundmass or matrix																						Secondary mineral																				Remarks
ht	bi	ru	ti	mg	or	pl	qz	ap	ca	lp	pu	mf	ol	opx	cpx	ht	bi	ru	ti	mg	or	pl	qz	cr	td	ap	ca	ga	vs	wo	ep	gl	cl	sf	px	ga	vs	wo	ac	ep	bi	or	pl	qz	cr	td	ca	ch	sr	sa	kn	ze	gt	sf	
							○																○										◎																						
○				•		○								px •						•		◎			◎																														
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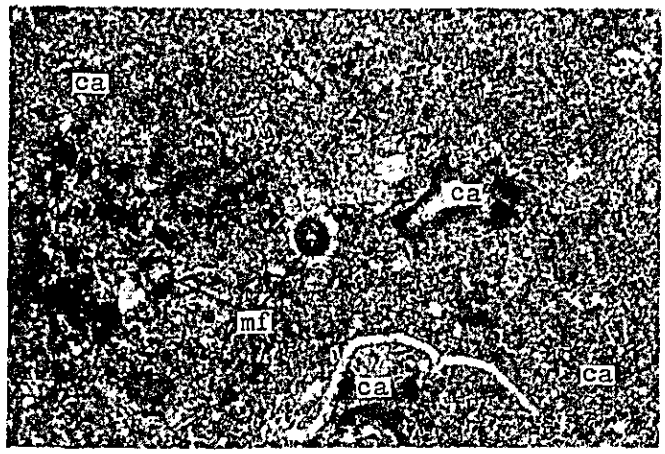
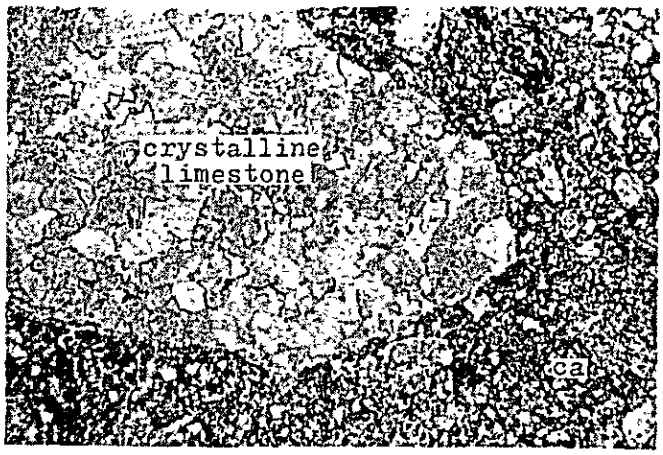
Apx. 5 Photomicrographs of Rock Thin Sections



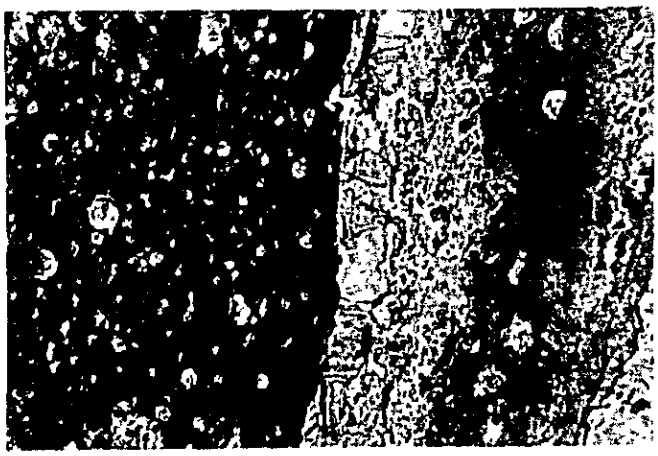
(1) Ca 33 T (Klsl)
Microfossil-bearing limestone; spherical foraminfera? remains replaced by carbonate and cementing very fine-grained carbonates.

0 0.3 mm
open nicol



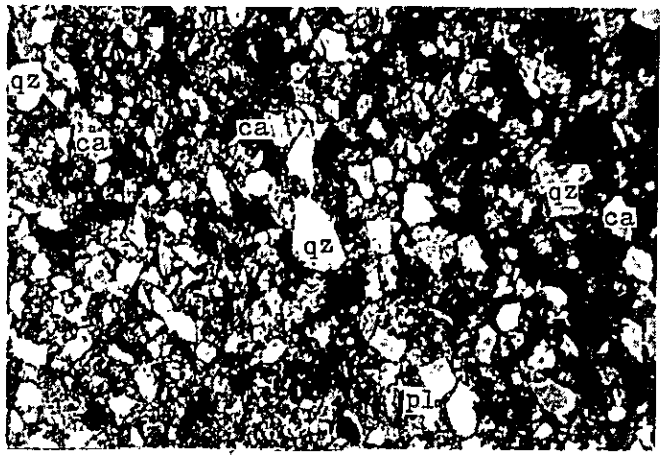
(2) Ba 9 T (Kcg)
Conglomeratic limestone; recrystallized limestone fragements cemented by minute carbonate grains.

0 1.0 mm
open nicol



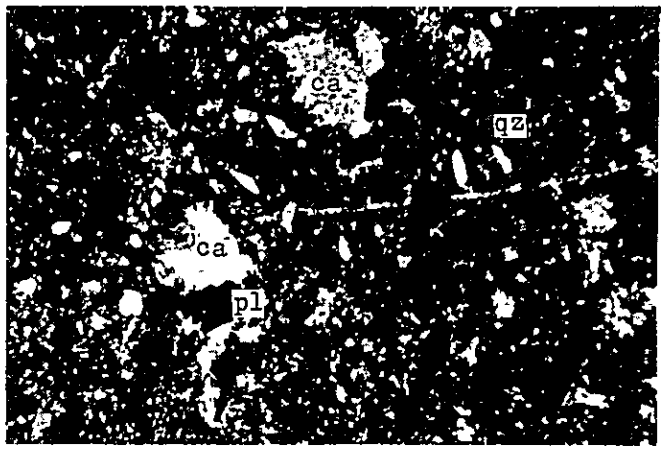
(3) Da 29 T (Klf)
Banded limestone and calcareous shale; spherical microfossils are abundant in calcareous shale.

0 1.0 mm
open nicol



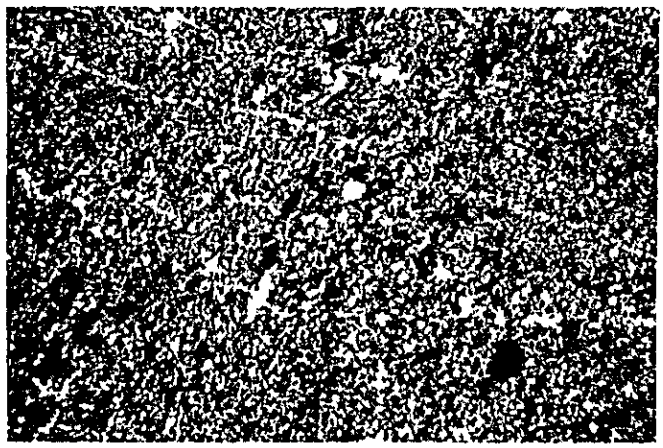
(4) Db 71 T (Klf)
Calcareous sandstone; quartz, plagioclase and carbonate grains are cemented with carbonates.

0 1.0 mm
open nicol



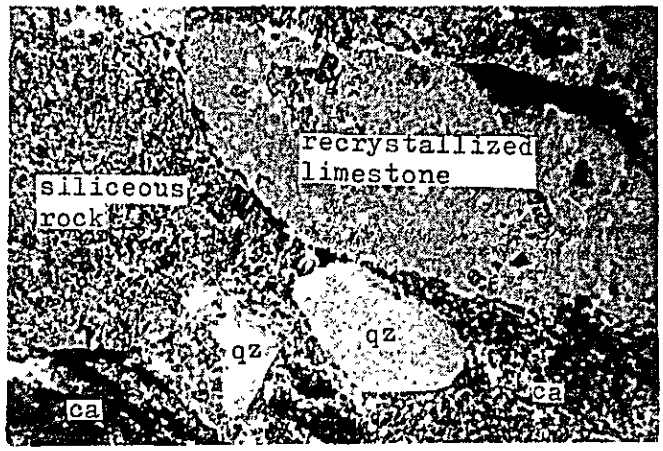
(5) Db 99 T (Ksh3)
Calcareous sandy shale; quartz, plagioclase and carbonate grains are cemented with carbonaceous and clayey materials.

0 1.0 mm
crossed nicols



(6) Dd 86 T (Ksh3)
Bedded calcareous shale; black carbnaceous materials show a fine banding structure.

0 1.0 mm
crossed nicols

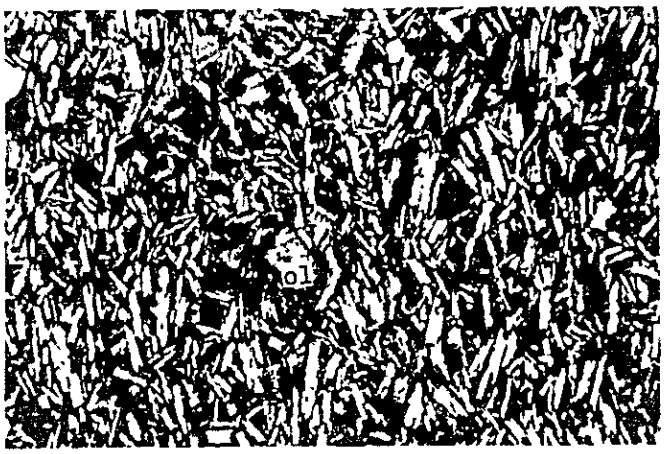


0 1.0 mm

open nicol

(7) Cd 154 T (Tcg)

Conglomerate; fragments of limestone and siliceous rock are cemented with carbonates.

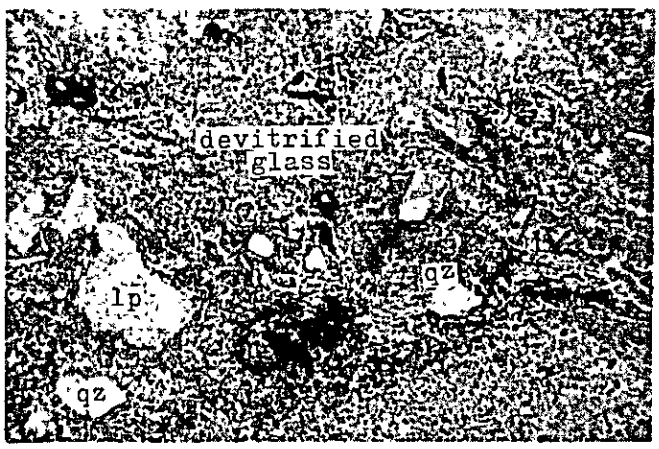


0 1.0 mm

open nicol

(8) Db 89 T (Tbal)

Pyroxene-olivine basalt; euhedral olivine phenocryst and intergranular-textured groundmass composed of plagioclase and pyroxene.



0 1.0 mm

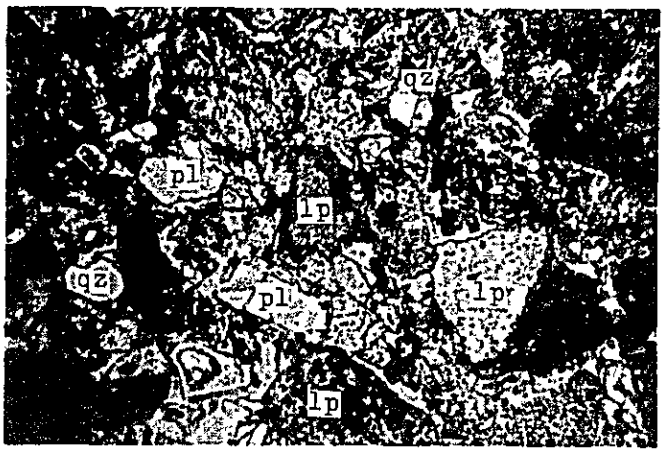
open nicol

(9) Cc 106 T (Trhyl)

Rhyolitic welded tuff; rhyolitic lapilli and fragmental quartz grains cemented with devitrified glass.

(10) Aa 7 T (Tan2)
Cristobalite-bearing hypersthene-augite-hornblende andesite; cristobalite patches are scattered in the groundmass.

0 1.0 mm
open nicol

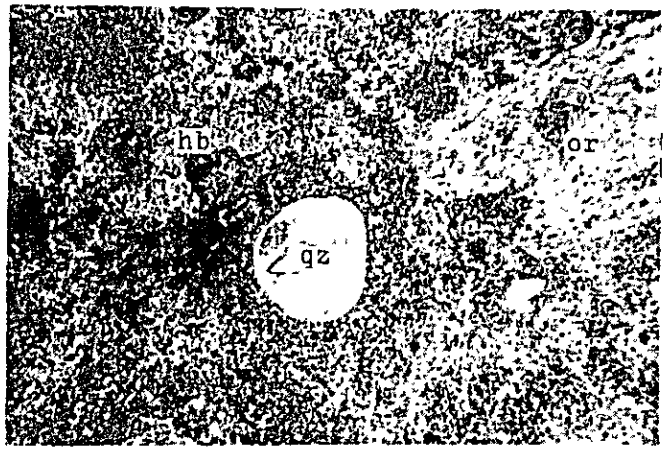


(11) Dd 60 T (Ttf2)
Rhyolitic lapilli tuff; rhyolite, quartz and plagioclase fragments cemented with glass.

0 1.0 mm
open nicol

(12) Dd 53 T (Tan3)
Augite-hypersthene andesite; augite and plagioclase phenocrysts cemented with intergranular-textured groundmass composed of plagioclase, clinopyroxene and magnetite.

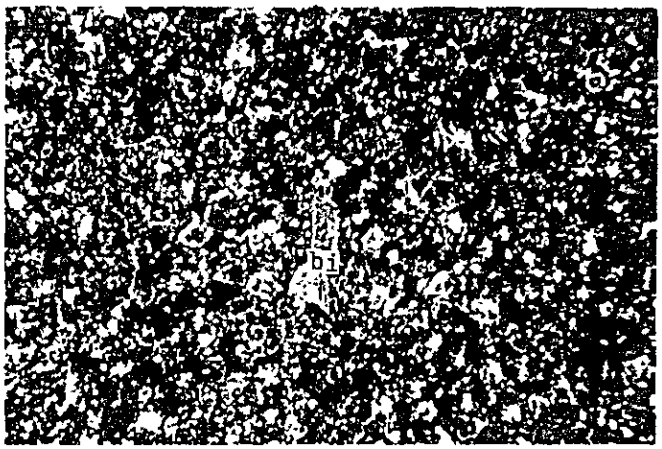
0 1.0 mm
open nicol



0 1.0 mm

open nicol

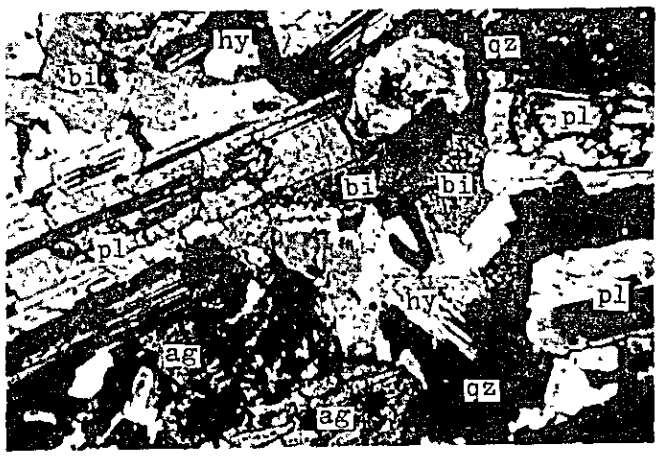
(13) Cb 20 DT (Trhy2)
Hornblende-biotite rhyolite; orthoclase phenocrysts are replaced by sericite.



0 1.0 mm

crossed nicols

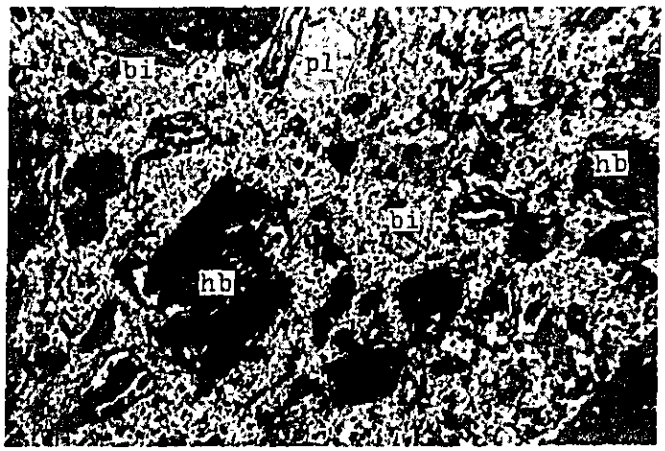
(14) Db 87 DT (Trhy2)
Biotite rhyolite; biotite phenocryst and spherulitic-tuxured ground mass composed of quartz and feldspar.



0 1.0 mm

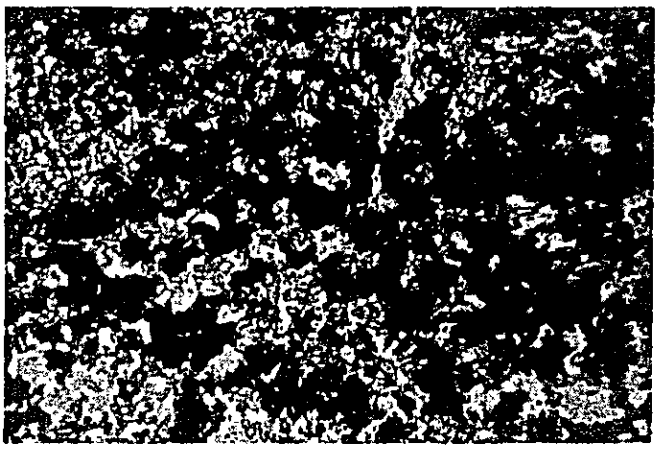
crossed nicols

(15) Cd 134 DT (Tigd)
Biotite-hypersthene-augite quartz diorite.



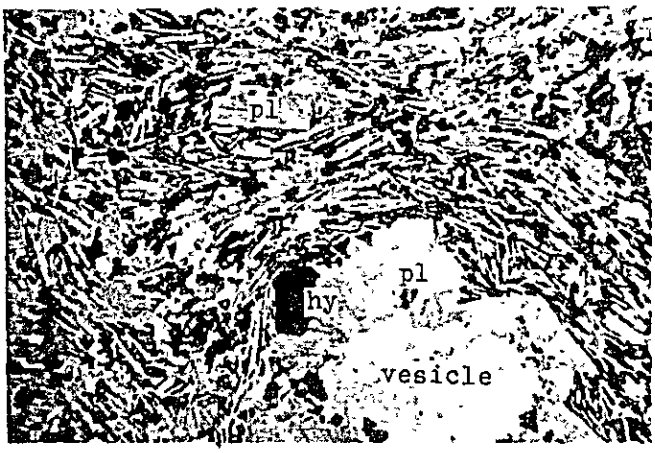
(16) Ca 41 DT (Tian)
Altered biotite-bearing hornblende andesite; chloritization, sericitization and carbonitization are observed through the whole rock.

0 1.0 mm
open nicol



(17) Cc 77 TPC (Sk)
Garnet-wollastonite-epidote-sulfide skarn; some zoning is observed; black patches are sulfides.

0 1.0 mm
open nicol



(18) Ad 179 T (Qba)
Hypersthene-augite-olivine basalt; fluidal and intergranular -textured groundmass composed of plagioclase and pyroxene.

0 1.0 mm
open nicol

Apx. 6 Whole-Rock K-Ar Datings of Some Igneous Rocks

No.	Sample no.	Sheet no. (1:25,000)	Coordinates		Rock name and stratigraphic unit	K (%)	scc $^{40}Ar^{R}$/gx10^{-5}	$^{40}Ar^{R}$	Age (m.y.)
			E	N					
1	Ca41DT	F14-C69b	487525	2292775	Altered biotite-hornblende andesite (Tian)	3.40 3.39	0.506 0.512	74.8 78.7	38.1±1.9
2	Ba70D	Out of the survey area	-	-	Andesite (Tan2)	1.47 1.45	0.152 0.159	64.3 61.8	27.2±1.4
3	Cb1DT	F14-C59c	478800	2307650	Augite-biotite -hornblende quartz diorite porphyry (Tigd)	2.29 2.29	0.458 0.460	79.5 80.2	50.9±2.5
4	Cb20DTC	F14-C69b	485075	2284300	Hornblende-biotite rhyolite (Trhy2)	7.02 7.00	0.731 0.724	90.2 92.6	26.5±1.3
5	Db87DT	F14-C68b	452250	2291025	Biotite rhyolite (Trhy2)	3.57 3.56	0.381 0.375	79.5 80.1	27.1±1.4
6	Cd134DT	F14-C59a	479700	2315525	Biotite-augite diorite (Tigd)	1.76 1.75	0.269 0.290	74.8 74.2	40.5±2.0

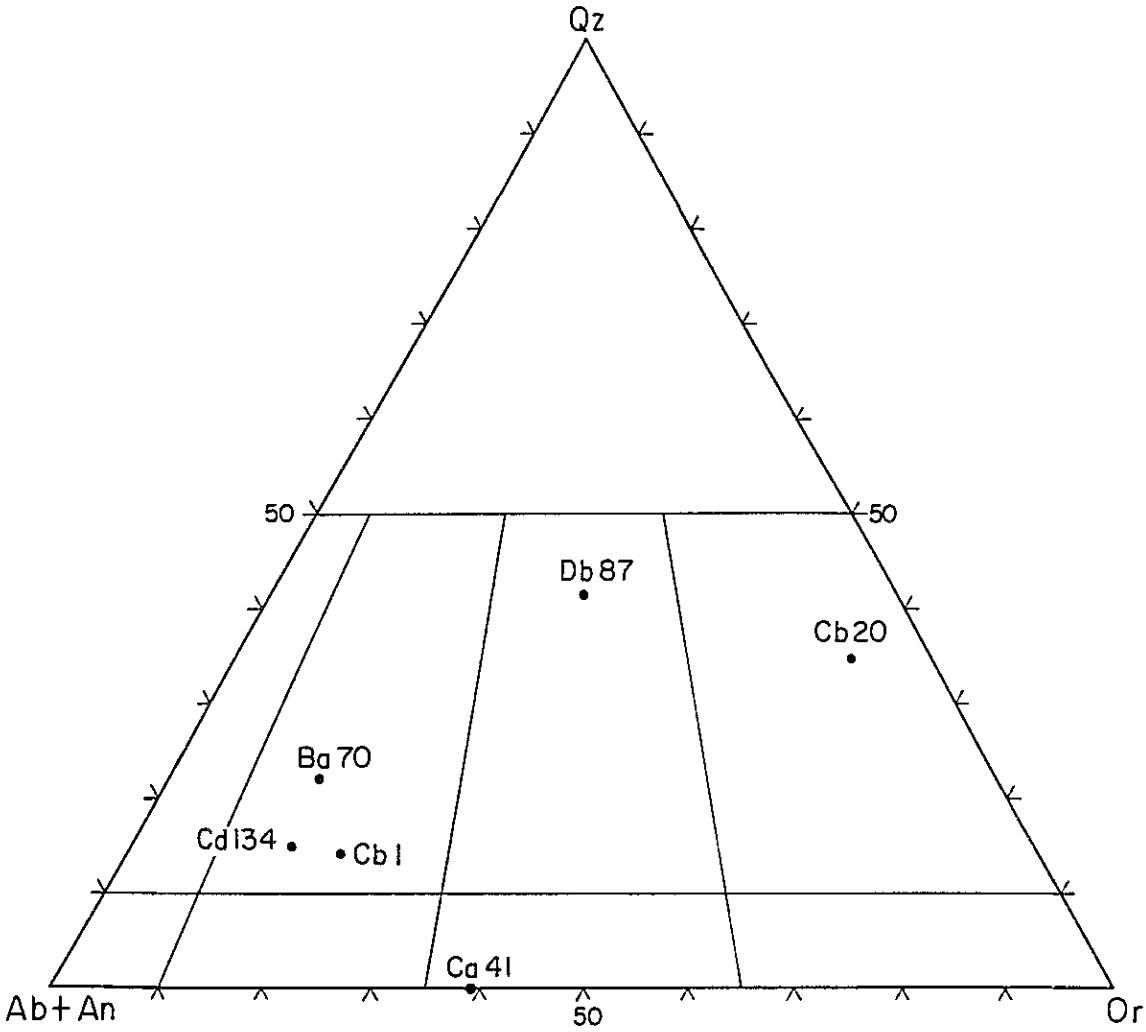
$\lambda_\varepsilon = 0.581 \times 10^{-10}\,yr^{-1}$, $\lambda_\beta = 4.962 \times 10^{-10}\,yr^{-1}$, $^{40}K/K = 1.167 \times 10^{-4}$

$^{40}Ar^{R}$, radiogenic argon 40.

All samples were analyzed in duplicate.

Apx. 7 Chemical Composition and C.I.P.W. Norm of Some Igneous Rocks

Sample no.			Ca41DT	Ba70D	Cb1DT	Cb20DTC	Db87DT	Cd134DT
Location	Sheet no. (1:25,000)		F14-C69b	Out of the survey area	F14-C59c	F14-C69b	F14-C68b	F14-C59a
	Coordinates	E	487525	——	478800	485075	452250	479700
		N	2292775	——	2307650	2284300	2291025	2315525
Rock name			andesite	andesite	quartz diorite	rhyolite	rhyolite	quartz diorite
Chemical compositions	SiO_2 %		51.81	60.24	59.11	72.31	75.40	56.95
	TiO_2		1.25	0.82	1.00	0.28	0.10	1.34
	Al_2O_3		15.85	18.66	17.20	13.77	13.22	17.82
	Fe_2O_3		0.49	2.38	3.39	2.06	0.60	3.80
	FeO		5.42	1.58	2.80	0.33	0.58	3.59
	MnO		0.16	0.08	0.14	0.02	0.02	0.15
	MgO		4.97	2.15	2.58	0.15	0.15	3.36
	CaO		8.84	4.34	5.99	0.10	0.57	6.61
	Na_2O		3.14	3.85	3.83	0.75	2.59	3.25
	K_2O		4.10	1.95	2.78	9.06	4.49	2.02
	$H_2O^{(+)}$		3.02	3.17	0.60	1.07	1.45	0.65
	$H_2O^{(-)}$		0.19	1.10	0.11	0.22	0.82	0.10
	P_2O_5		0.49	0.18	0.45	0.04	0.02	0.31
	Total		99.73	100.50	99.98	100.16	100.01	99.95
								weight in percent
C.I.P.W. normative calculations	apatite		1.13	0.41	1.04	0.09	0.05	0.71
	orthoclase		24.30	11.47	16.43	53.46	26.53	11.94
	albite		20.86	32.41	32.41	6.34	21.91	27.51
	nepheline		3.13	0	0	0	0	0
	anorthite		17.09	20.26	21.54	0.24	2.70	28.09
	corundum		0	2.74	0	2.64	3.11	0
	ilmenite		2.38	1.55	1.90	0.53	0.19	2.55
	magnetite		0.71	2.96	4.92	0.32	0.87	5.51
	diopside		19.32	0	4.17	0	0	2.15
	hematite		0	0.33	0	1.84	0	0
	hypersthene		0	5.33	5.41	0.37	0.81	8.87
	olivine		7.86	0	0	0	0	0
	quartz		0	18.29	11.48	32.94	41.56	11.91
	Total		96.77	95.75	99.29	98.72	97.74	99.25



Apx. 8 Normative Quartz-Orthoclase-(Albite+Anorthite) Triangular Diagram of Some Igneous Rocks

Apx. 9 Microscopic Observations of Ore Polished Sections

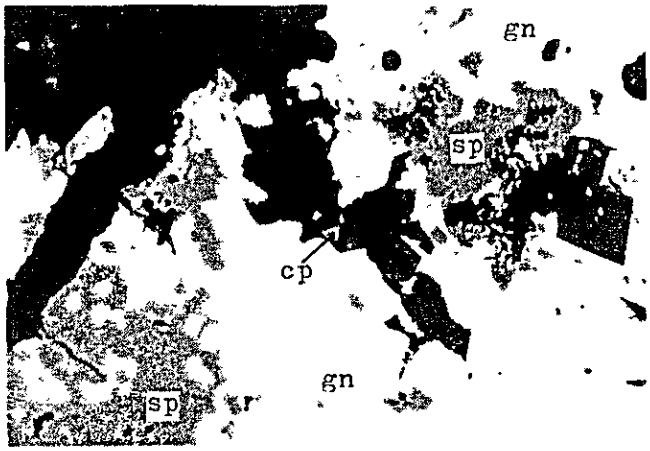
No.	Sample no.	Location				Ore type	Primary mineral												Secondary mineral						
		Sheet no. 1:25,000	Coordinates E	Coordinates N	Mine name		mg	po	py	ma	cp	bn	gn	sp	st	pg	ag	pn	ap	bi	hm	ma	gt	cc	cv	ml
1	Da201PC	F14-C58d	453700	2299275	Lomo de Toro; 220 ML	manto-type Ag-Pb-Zn ore			○		•		◎	◎												
2	Da202PC		ditto	ditto	; Manto Nuevo	ditto			◎		•		○	○												
3	Da203PC		ditto	ditto	; Santa Luisa -40ML	ditto			◎	•	•		○	◎												
4	Ca205P	F14-C69a	474525	2287725	Pechuga ; San Miguel	pyrometasomatic Ag-Pb-Zn ore			•		•		○	○							•		•			
5	Cb149PC	F14-C59c	478250	2307050	El Zapote ; La Trinidad	pyrometasomatic Fe ore	○				•										•		•			
6	154PC		478975	2306150	Encarnación ; nameless	pyrometasomatic Fe-Cu ore	◎		•		•										○		○			○
7	156PC		479250	2306825	; San Francisco	ditto	○		•		•										○		○		•	○
8	159PC		478400	2307250	; Dulces Nombres	pyrometasomatic Fe ore	◎		•		•											•			•	
9	162PC		ditto	ditto	; ditto	ditto	◎		○		•															
10	164PC		479550	2307425	; Aguila Roja	ditto	◎		○		•								•							
11	168PC		478975	2307475	; San Ricardo	pyrometasomatic Fe-Cu ore	◎	•	•		•			•							○		○	•	•	○
12	169PC		478825	2307425	; ditto	pyrometasomatic Fe ore	◎	•	○		•			•					•		•			•	•	
13	216PC		477825	2303375	El Zapote ; Los Gallos	pyrometasomatic Cu ore			•		○										◎		◎	•	•	◎
14	217TPC		ditto	ditto	; ditto	ditto			•		•							•			•			•	•	○
15	219PC		ditto	ditto	; ditto	ditto			○		○										○		○	•	•	◎
16	Cc 73P		478250	2303800	; La Trinidad	ditto			•		•										•			•	•	•
17	74P		ditto	ditto	; ditto	pyrometasomatic Fe-Cu ore	◎		•		○										•			•	•	•
18	77TPC		477600	2303950	; San José del Oro	pyrometasomatic Cu ore		•	○	○	◎													•	•	•
19	115PC		476850	2304400	; Ignacio Zaragoza	ditto			○		○		•					•			•			•	•	
20	Dc118P$_1$C	F14-C68b	454100	2292850	Zimapán ; Maria Antonietta	vein-type Ag-Pb-Zn ore			•	○	•		◎	•		•										
21	118P$_2$		ditto	ditto	; ditto	vein-type pyrite ore		•	◎					•												
22	Cd125PC	F14-C69a	474525	2287725	Pechuga ; San Miguel	pyrometasomatic Ag-Pb-Zn ore			•		•		○	○		•									•	
23	Bd250P	F14-D71b	428000	2235000	El Chico	vein-type Ag-Pb-Zn ore			•		•		◎	◎		•										

Abbreviations;
mg, magnetite
po, pyrrhotite
py, pyrite
ma, marcasite
cp, chalcopyrite
bn, bornite
gn, galena
sp, sphalerite
st, stibnite
pg, pyrargyrite
ag, argentiferous mineral
pn, pentlandite
ap, arsenopyrite
bi, bismuth telluride
hm, hematite
gt, goethite
cc, chalcocite
cv, covellite
ml, malachite
◎, abundant
○, common
•, rare

Apx. 10 Photomicrographs of Ore Polished Sections

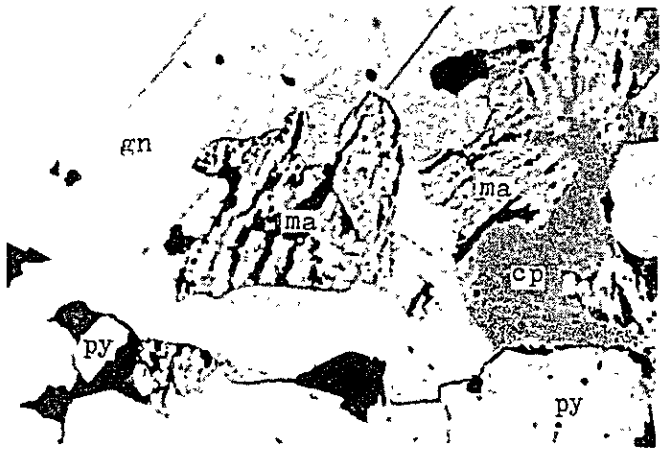
Abbreviations

bi, bismuth telluride
bn, bornite
cc, chalcocite
cp, chalcopyrite
cv, covellite
ag, argentiferous mineral
ga, garnet
gn, galena
gt, goethite
hm, hematite
ma, marcasite
mg, magnetite
pg, pyrargyrite
pn, pentlandite
po, pyrrhotite
py, pyrite
sb, stibnite
sp, sphalerite



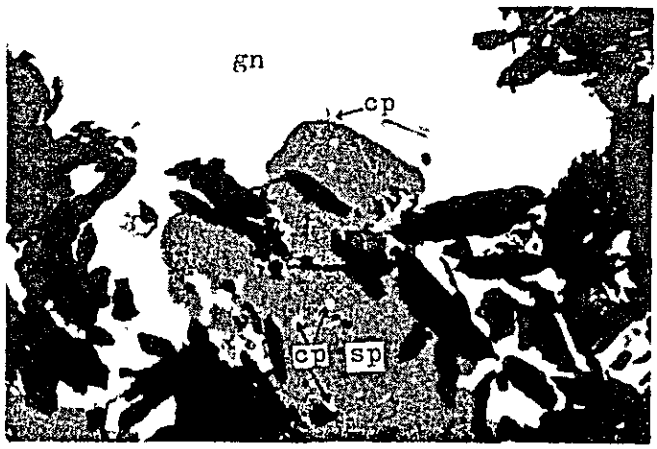
(1) Da 201 PC
Zimapán; Lomo de Toro mine, 220 ML.
Ag-Pb-Zn-(Cu) ore;
coexisting galena and sphalerite.

0 0.2 mm
open nicol



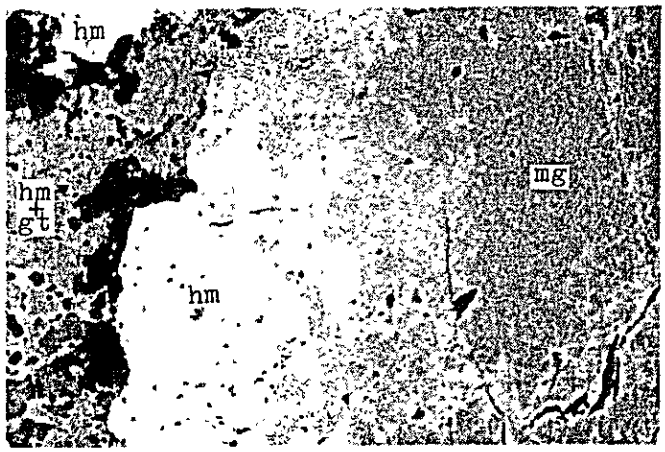
(2) Da 203 PC
Zimapán; Lomo de Toro mine, Santa Luisa-40ML.
Ag-Pb-Zn-(Cu)ore;
marcasite embayed by galena, and coexisting marcasite and chalcopyrite.

0 0.2 mm
open nicol



(3) Ca 205 P
Pechuga; San Miguel mine
Ag-Pb-Zn-(Cu) ore;
coexisting galena and sphalerite, and chalcopyrite inclusions in sphalerite.

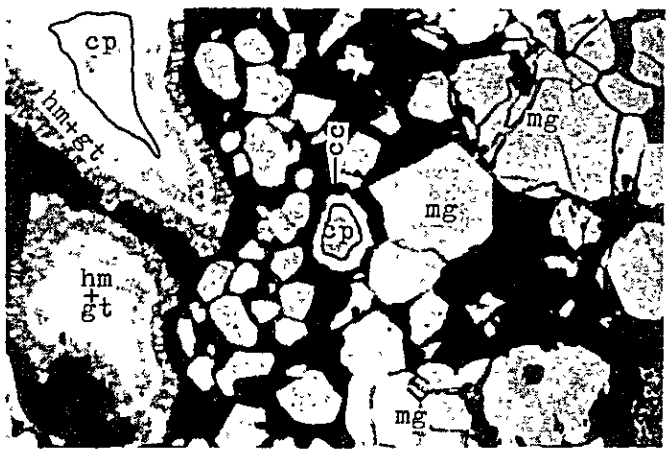
0 0.2 mm
open nicol



0 0.2 mm

open nicol

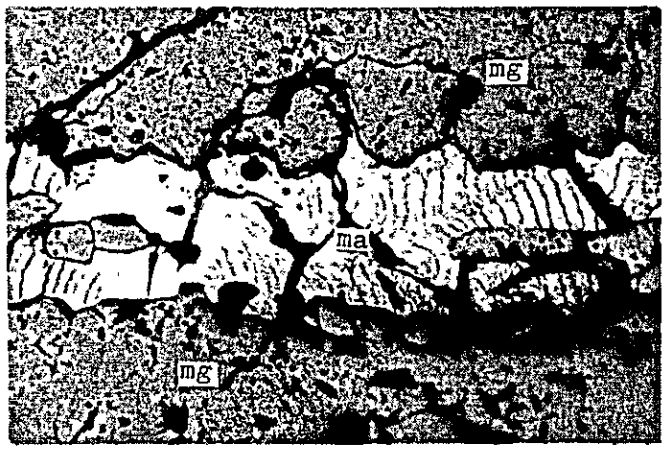
(4) Cb 154 PC
Encarnación; San Francisco mine.
Fe-Cu ore; widmanstätten figure by hematite replacing magnetite.



0 0.2 mm

open nicol

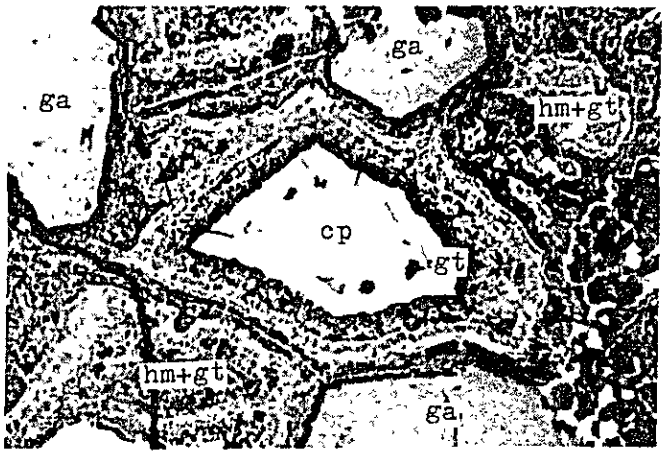
(5) Cb 156 PC
Encarnación; San Francisco mine.
Fe-Cu ore; euhedral magnetite and liesegang-structured interstitial chalcopyrite.



0 0.2 mm

open nicol

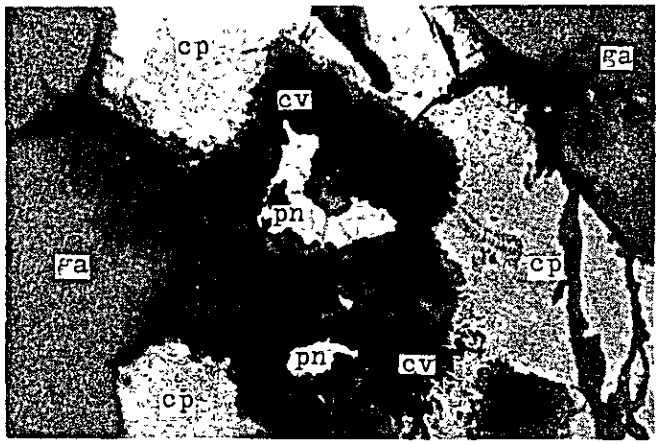
(6) Cb 159 PC
Encarnación; Dulces Nombres mine
Fe-(Cu) ore; magnetite and banded interstitial marcasite after pyrrhotite?



0 0.2 mm

open nicol

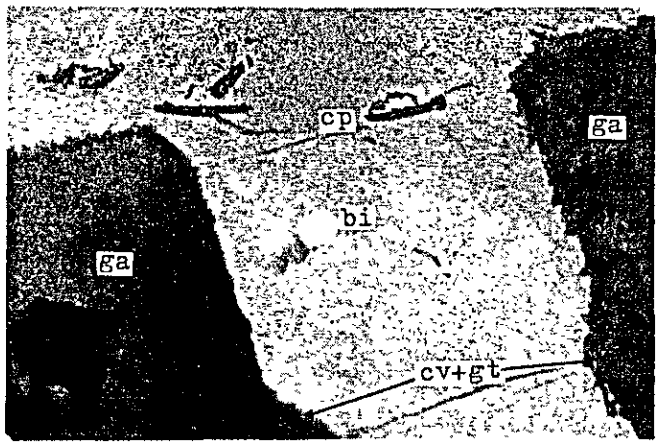
(7) Cb 216 PC
El Zapote; Los Gallos mine.
Ag-Cu ore; zonal-structured euhedral garnet and liesegang-structured interstitial chalcopyrite.



0 0.05 mm

open nicol

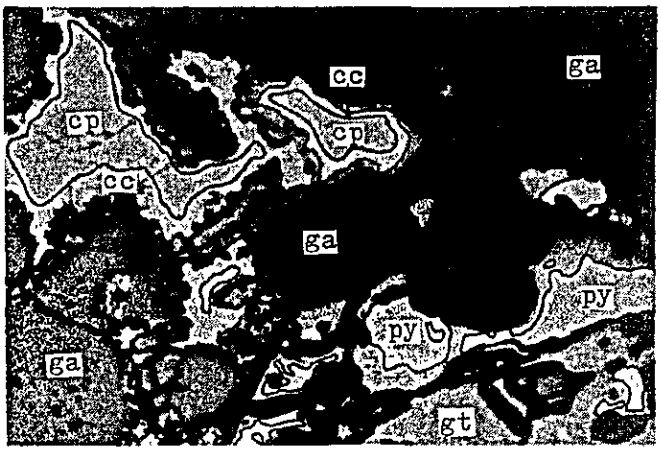
(8) Cb 217 PC
El Zapote; Los Gallos mine.
Cu ore; pentlandite relics including chalcopyrite fine lattices.



0 0.05 mm

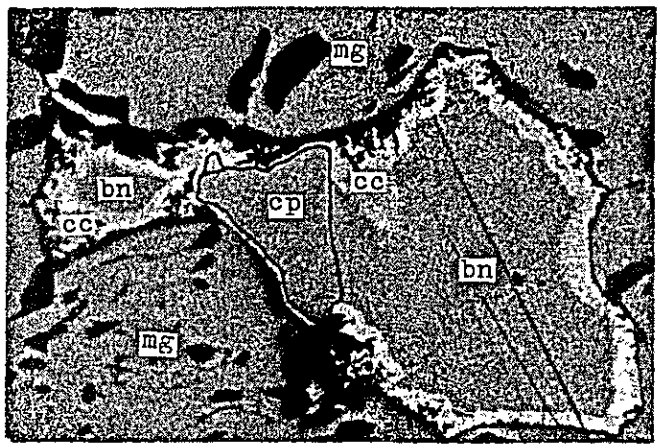
open nicol

(9) Cb 217 PC
Same as above;
bismuth telluride inclusion in chalcopyrite.



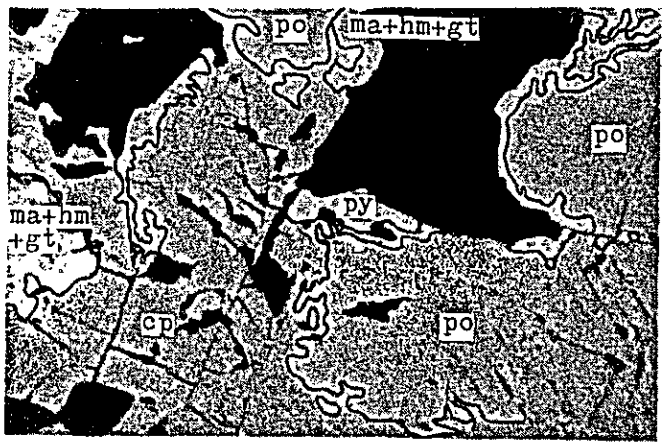
(10) Cb 219 PC
El Zapote; Los Gallos mine.
Cu ore; euhedral garnet and liesegang-structured interstitial pyrite and chalcopyrite.

0 0.2 mm
open nicol



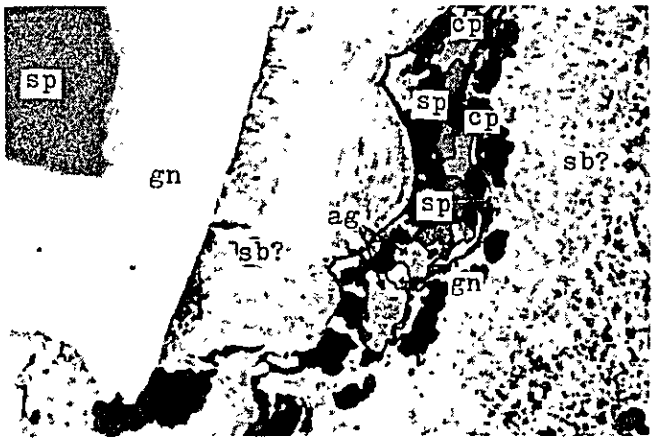
(11) Cc 74 P
El Zapote; La Trinidad mine.
Fe-Cu ore; magnetite and interstitially coexisting bornite and chalcopyrite; chalcocite replaces bornite from the margin.

0 0.2 mm
open nicol



(12) Cc 77 TPC
El Zapote; San José del Oro mine.
Cu ore; coexisting chalcopyrite, pyrrhotite and pyrite.

0 0.2 mm
open nicol



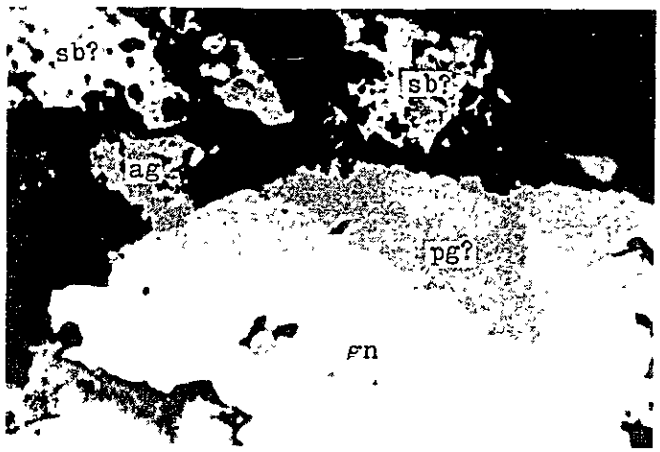
0 0.2 mm

open nicol

(13) Dc 118 P1C

Zimapán; María Antonietta mine.

Ag-Pb-Zn ore; colloform stibnite ? developed along the margin of galena, and coexisting minute sphalerite, chalcopyrite, galena and argentiferous mineral.

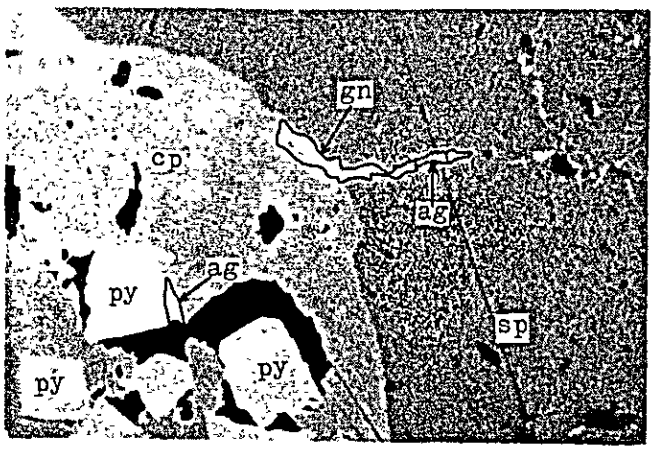


0 0.2 mm

open nicol

(14) Dc 118 P1C

Same as above; coexisting galena, pyrargyrite ? and another argentiferous mineral.



0 0.2 mm

open nicol

(15) Bd 250 P

El Chico mine.

Ag-Pb-Zn-(Cu) ore; coexisting sphalerite, chalcopyrite, pyrite and argentiferous mineral; galena-argentiferous mineral veinlet cuts sphalerite.

Apx. 11 Qualitative Analysis of Minerals by Electron Probe Microanalyzer

No.	Sample no.	Analyzed mineral	Detected element															
			Ag	Cu	Pb	Zn	Bi	Sb	As	Cd	Te	Fe	Ni	Mn	Co	Mg	S	Ca	Si
1	Da201PC	chalcopyrite		◎								◎					◎	•	
2	"	gangue mineral										◎		•				◎	
3	"	ditto							○								◎		
4	"	ditto														◎	◎		
5	Da202PC	sphalerite				◎				○		◎					◎		
6	Da203PC	pyrrhotite										◎					◎		
7	Ca205P	hematite		•								◎							
8	"	ditto										◎					•	?	
9	"	ditto				○						◎		○					
10	Cb169PC	chalcopyrite		◎								◎					◎		
11	Cb217TPC	bismuth telluride		◯			◎				◎	○					◎		
12	"	pentlandite		○								◎	◎				◎		
13	Cb219PC	chalcocite		◎								○					◎		
14	Cc73P	chalcocite & hematite	•	◎								◎					◎		
15	"	ditto	•	◎								○					◎		
16	Cc74P	chalcocite	•	◎								•					◎		
17	Cc77TPC	pyrrhotite										◎					◎		
18	"	marcasite										◎					◎	?	
19	Cc115PC	pyrite										◎	•		?		◎		
20	"	hematite?		•								◎						•	•
21	"	pyrite?		•								◎					◎		
22	"	iron oxide		•								◎					•		
23	Dc118P1C	argentiferous mineral	◎	◎		◎		◎	○			○							
24	"	pyrargyrite ?	◎					◎	○								◎		
25	"	stibnite						◎	◎								◎		
26	"	galena	•		◎			•									◎		
27	"	ditto			◎			•											
28	"	ditto			◎			•									◎		
29	Dc118P2	pyrrhotite										◎					◎		
30	"	ditto										◎					◎		
31	Cd125PC	argentiferous mineral	◎	◎	•	•		◎				○					◎		
32	"	galena			◎												◎		
33	"	galena?	•		◎			•									◎		
34	"	galena?	•		◎			•									◎		
35	Bd250P	argentiferous mineral	◎	◎		○		◎				•					◎		
36	"	ditto	◎	◎				◎	○			○					◎		

◎, strong; ○, intermediate; •, weak; ?, very weak.

For locations of samples, see appendix 9.

Apx. 12 Quantitative Analysis of Silver Minerals by Electron Probe Microanalyzer

	Dc118P1C					
	name undetermined		name undetermined		pyrargyrite?	
	wt. %	atomic ratio (%)	wt. %	atomic ratio (%)	wt. %	atomic ratio (%)
Ag	31.21	18.48	32.13	19.43	64.80	44.68
Cu	16.35	16.44	14.83	15.23	n.d.	-
Fe	3.48	3.98	5.89	6.88	n.d.	-
Pb	n.d.	-	n.d.	-	n.d.	-
Zn	3.06	2.99	n.d.	-	n.d.	-
Sb	27.09	14.21	23.10	12.38	16.91	10.33
As	2.88	2.45	6.98	6.08	4.67	4.64
S	20.84	41.44	19.66	40.00	17.39	40.35
Total	104.86	100	102.59	100	103.77	100

	Cd125PC		Bd250P			
	name undetermined		name undetermined		name undetermined	
	wt. %	atomic ratio (%)	wt. %	atomic ratio (%)	wt. %	atomic ratio (%)
Ag	19.62	11.58	80.22	59.75	73.30	49.79
Cu	23.31	23.35	4.19	5.30	7.65	8.82
Fe	2.91	3.32	0.43	0.62	1.14	1.49
Pb	2.19	0.67	n.d.	-	n.d.	-
Zn	2.48	2.41	1.19	1.47	n.d.	-
Sb	27.70	14.49	8.95	5.91	3.72	2.24
As	1.14	0.97	0.88	0.95	4.51	4.41
S	21.76	43.21	10.38	26.01	11.55	33.24
Total	101.11	100	106.25	100	104.86	100

For location of sample, see appendix 9.

Apx. 13 Chemical Analysis of Ore Samples

No.	Mineralized zone	Sample no.	Location			Occurrence	Analytical result				
			Sheet no. (1:25,000)	Coordinates E	Coordinates N		Au g/t	Ag g/t	Cu %	Pb %	Zn %
I	San Antonio-La Luz	Da44C	F14-C59c	471800	2307850	iron oxide (hematite-jarosite)	21.7	720.0	0.006	12.05	0.11
		Da45C	"	"	"	iron-oxide (hematite)	4.8	475.6	0.027	2.57	0.38
		Da46C	"	"	"	manganese oxide	tr.	1.2	0.002	0.012	0.082
		Da47C	"	470550	2308250	manganese oxide (silicified)	0.5	1,995.1	0.031	0.60	0.14
II	Dos de El Aguila	Dd149C	F14-C59c	474275	2307275	ore dump of iron oxide	0.3	16.2	0.004	4.72	0.098
		Dd151C	"	"	"	"	0.2	5.8	0.042	2.36	0.31
		Dd153C	"	473400	2307925	ore dump from copper-bearing oxide manto?	0.1	34.5	14.49	0.016	1.62
		Dd155C	"	"	"	ore dump of iron oxide	0.1	126.5	0.52	0.032	1.19
		Dd157C	"	473475	2307725	"	0.2	4.9	0.34	0.012	0.082
III	Encarnacion	Cb119C	F14-C59c	477650	2307225	pyrometasomatic ore	tr.	0.9	4.51	0.007	0.063
		Cb149PC	"	478250	2307050	iron ore from pyrometasomatic ore body	0.2	0.5	0.084	0.009	0.063
		Cb154PC	"	478975	2306150	pyrometasomatic ore	0.8	5.7	1.63	0.007	0.093
		Cb156PC	"	479250	2306825	"	0.1	2.3	1.03	0.006	0.30
		Cb159PC	"	478400	2307250	"	0.1	0.7	0.13	0.008	0.060
		Cb162PC	"	"	"	"	0.1	1.4	0.077	0.016	0.23
		Cb164PC	"	479550	2307425	"	0.3	1.4	0.21	0.009	0.018
		Cb168PC	"	478975	2307475	"	0.3	2.1	2.14	0.009	0.20
		Cb169PC	"	478825	2307425	"	0.1	1.2	0.11	0.007	0.020
IV	El Zapote	Cb216PC	F14-C59c	477825	2303375	pyrometasomatic ore	1.4	313.9	13.33	0.009	0.14
		Cb217TIC	"	"	"	"	1.8	25.6	1.46	0.009	0.013
		Cb218PC	"	"	"	network-ore	43.4	9.3	0.77	0.006	0.013
		Cb219PC	"	"	"	pyrometasomatic ore	13.8	65.6	5.06	0.009	0.15
		Cc70C	"	478250	2303800	copper-iron ore from pyrometasomatic ore body	4.2	167.1	8.63	0.010	0.17
		Cc75C	"	478150	2303850	"	1.0	30.0	1.90	0.012	0.27
		Cc76C	"	477950	2303900	"	2.8	45.0	2.21	0.010	1.60
		Cc77TPC	"	477600	2303950	"	13.8	56.2	8.69	0.007	0.040
		Cc112TC	"	477050	2304650	"	0.5	6.30	4.42	0.009	0.47
		Cc113C	"	476850	2305050	"	0.5	30.0	3.00	0.021	0.40

No.	Mineralized zone	Sample no.	Location			Occurrence	Analytical result				
			Sheet no. (1:25,000)	Coordinates E	Coordinates N		Au g/t	Ag g/t	Cu %	Pb %	Zn %
IV	El Zapote	Cc115PC	F14-C59c	476850	2304600	copper-iron ore from pyrometasomatic ore body	4.6	180.0	23.70	0.007	5.00
		Cc116	"	476750	"	"	1.8	8.1	0.095	0.010	0.027
V	Zimapán (Lomo de Toro)	Da204PC (San Vicente 40 ML.)	F14-C58d	453700	2299275	contact, vein ore	0.8	365.9	0.010	26.13	0.80
		Da203PC (Santa Luisa 40 ML.)	"	"	"	"	tr.	475.6	0.041	32.57	27.73
		Da202PC (Manto Nuevo)	"	"	"	"	0.4	203.4	0.022	4.71	6.36
		Da201PC (Level 220 m, Manto)	"	"	"	"	0.7	402.4	0.015	23.63	32.73
VI	South Zimapán (María Antonieta and others)	Dc27C	F14-C68b	457200	2288800	copper-bearing iron oxide vein	tr.	0.5	0.017	0.01	0.012
		Dc117C	"	454100	2292850	iron oxide - quartz vein	"	43.1	0.012	1.25	1.20
		Dc118PC	"	"	"	silver-lead ore from vein	"	281.8	0.029	9.71	1.00
VII	Poterero	Mina Poterero ①	F14-C59d	488900	2294550	vein-type ore	tr.	0.3	0.004	0.024	0.012
		" ②	"	"	"	"	"	2.6	0.020	0.042	0.019
		Ca50C	"	489325	2294675	"	"	2.1	0.003	0.010	0.019
VIII	Pechuga	Ca205PC (Mina Pechuga)	F14-C69a	474525	2287725	contact metasomatic ore	tr.	750.0	0.003	65.64	0.52
		Ca63C	"	"	"	"	"	394.7	0.015	32.34	20.91
		Ca64C	"	"	"	"	"	74.20	0.048	0.028	1.78
		Cd121C ⓐ	"	474373	2287600	"	0.2	126.3	2.790	0.013	0.014
		Cd121C ⓑ	"	"	"	"	tr.	34.8	5.29	0.007	0.42
		Cd122C	"	474525	2287725	quartz veinlets	"	2.9	0.019	0.008	0.011
		Cd125PC	"	"	"	stock pile of contact metasomatic ore	"	243.9	0.190	2.68	11.54
IX	Yonthe-San Joaquin	Yonthe C	F14-C69d	488050	2280000	iron oxide	tr.	7.1	0.006	0.87	1.00
		Cb31C	"	"	"	"	"	2.6	0.006	1.57	1.32
		Cd209C	F14-C59b	488750	2281750	"	0.3	5.8	0.005	0.016	0.27
		Cd211C	"	488950	2282200	"	tr.	11.2	0.002	0.040	0.23
		Cd214C	"	488825	2282700	iron oxide (jarosite)	"	1.9	0.003	0.16	19.21
		Cd215C	"	488700	22814-	iron oxide	"	12.2	0.003	0.021	0.16
		Cd260C	"	487850	2280575	smelting slag	1.1	44.6	0.007	0.94	0.30

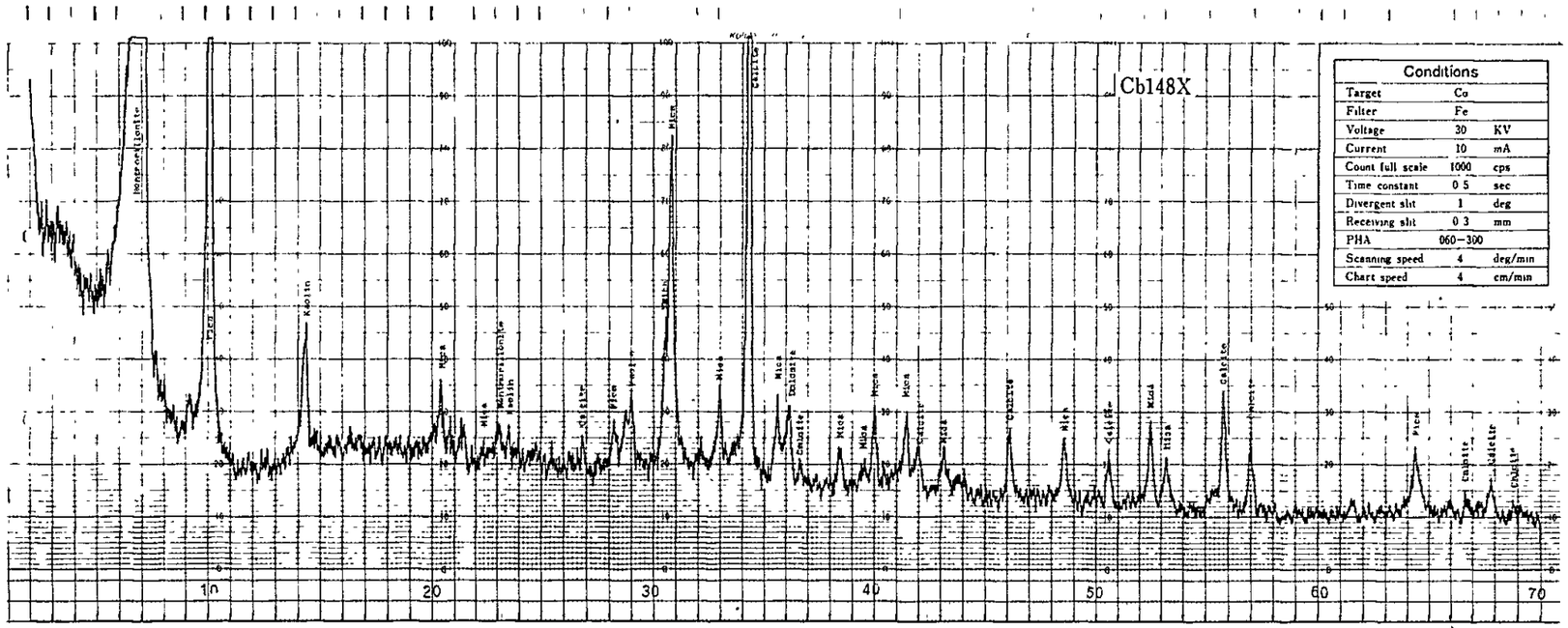
No.	Mineralized zone	Sample no.	Location			Occurrence	Analytical result				
			Sheet no. (1:25,000)	Coordinates E	Coordinates N		Au g/t	Ag g/t	Cu %	Pb %	Zn %
X	San Clemente (gold)	Cb20DTC	F14-C69b	485075	2284300		0.13	41.9	-	-	-
		Cb220C	"	482500	2283810		15.4	7.9	0.065	0.027	0.098
		Cb223C	"	"	"		0.13	17.1	-	-	-
		Cb224C	"	"	"		0.11	21.0	-	-	-
		Cb225XC	"	"	"		22.7	7.3	0.010	0.11	0.14
		Cb227C	"	"	2284300		0.62	7.6	-	-	-
		Cb228C	F14-C69a	482500	2283750		0.13	7.6	-	-	-
		Cb234C	F14-C69b	482925	2283050		0.94	22.5	-	-	-
XI	North of Yolotepec	Ba12C	F14-C79b	492400	2259700	iron oxide vein (hematite)	tr.	9.4	0.002	0.022	0.023
		Bb63C	"	487750	2261500	float of iron oxide	0.1	0.4	0.006	0.007	0.057
XII	Northeast of Tepatepec	Ac15C	F14-C79d	491200	2242900	iron oxide manto in recrystallized limestone	tr.	0.4	0.005	0.012	0.017
		Ad20C	"	488775	2242750	iron oxide veinlets	2.6	19.3	0.067	0.011	0.017

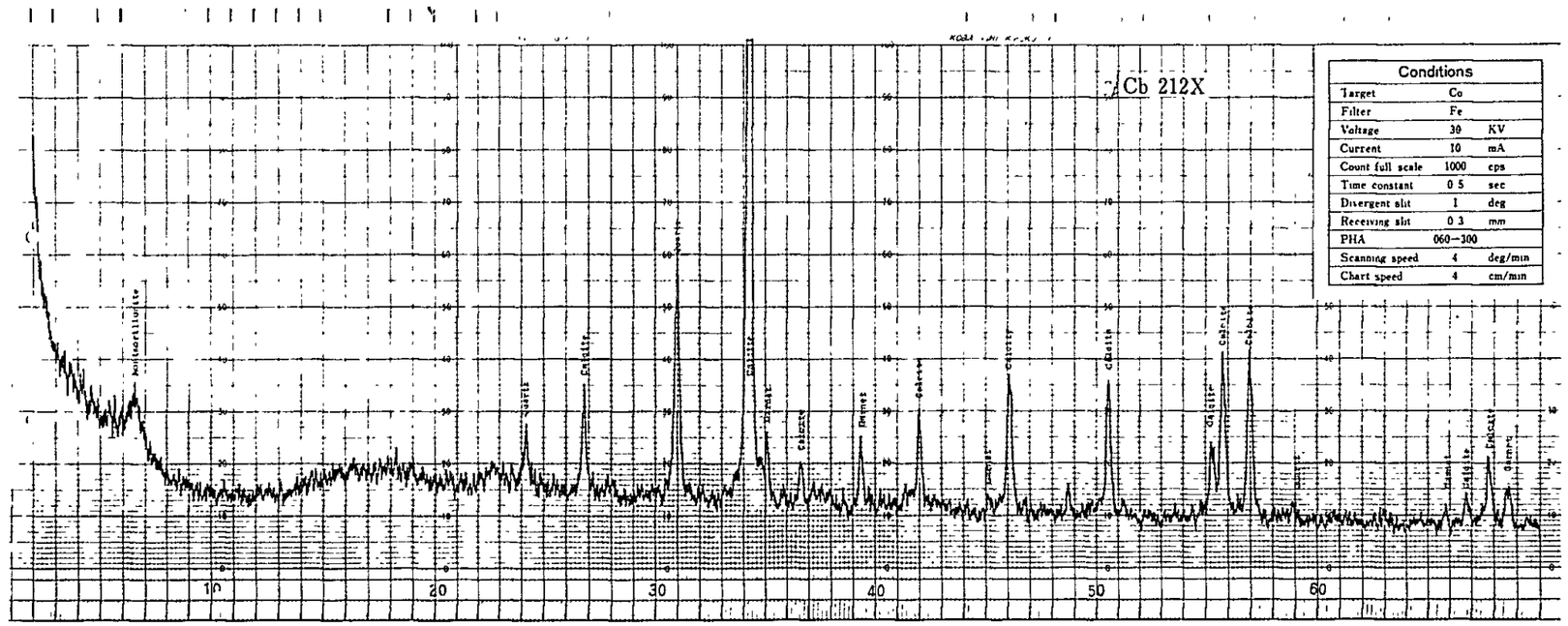
Apx. 14 X-ray Powder Diffractions

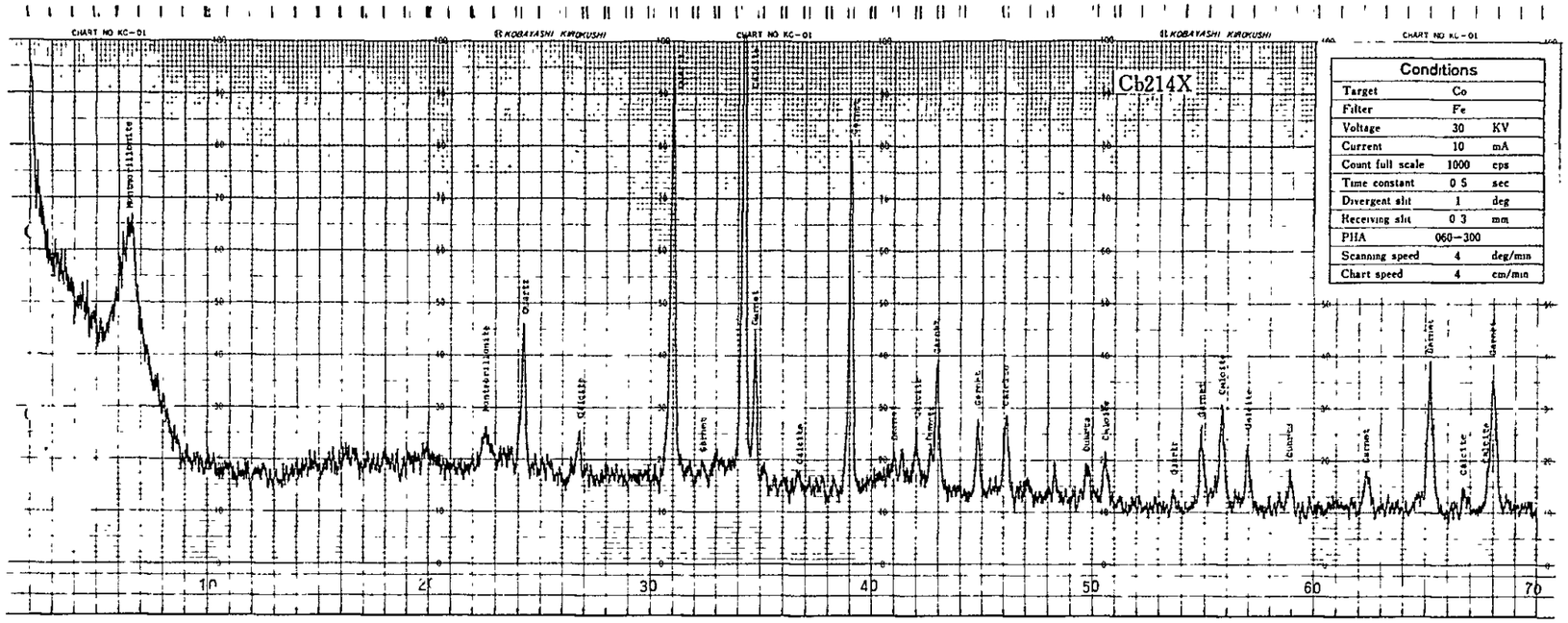
No.	Sample no.	Location			Occurrence	Detected minerals										
		Sheet no. (1:25,000)	Coordinates E	Coordinates N		fd	qz	ga	wo	ca	do	fa	mc	mm	kn	hm
1	Cb148X	F14-C59c	478000	2307300	Clay in cracks of recrystallized limestone					◎	•		○	◎	•	
2	212X	ditto	477425	2303600	Clayey garnet skarn		•	•		◎				•		
3	214X	ditto	477825	2303375	Clayey ganet skarn		◎	○		◎				○		
4	225XC	F14-C69b	482800	2284350	Auriferous clayey veinlet penetrating rhyolite	○	◎							•	•	
5	DC57TX	F14-C58b	463750	2319750	Phosphorite patches (< 2cm) in massive limestone					◎		•				
6	Cd117X	F14-C69a	474050	2288100	Clayey vein associated with granophyre dike		◎						•			
7	130X	F14-C59a	479325	2315700	Clayey vein penetrating recrystallized marl		?			◎	○					
8	132X	ditto	479250	2315200	Recrystallized muddy limestone					•	◎					
9	Dd156X	ditto	473375	2307875	Argillized granodiorite		◎							•		
10	Cd204TX	ditto	477450	2303250	Iron oxide-patched skarnized limestone		•			◎						
11	210X	F14-C69b	489050	2282300	Iron oxide-quartz vein		◎									○

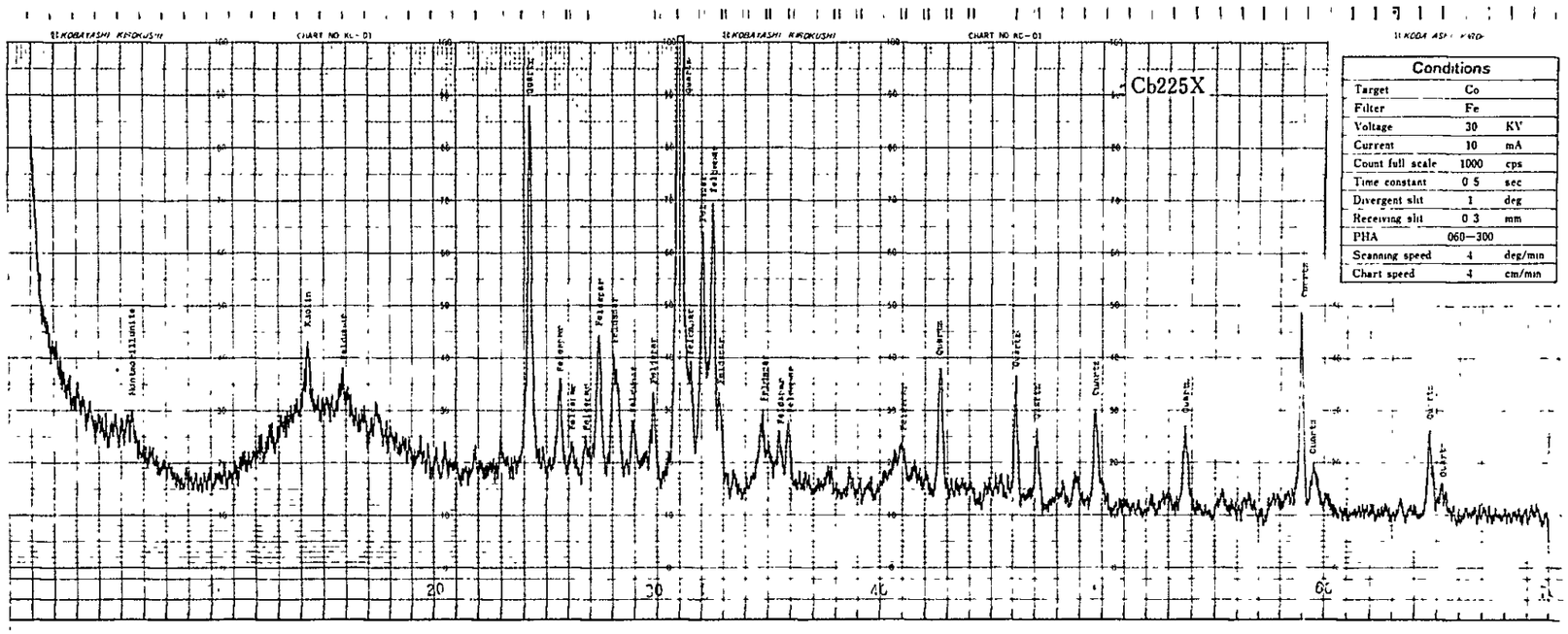
fd, feldspar ; qz, quartz ; ga, garnet ; wo, wollastonite ; ca, calcite ; do, dolomite; fa, fluorapatite; mc, mica ; mm, montmorillonite ; kn, kaolin ; hm, hematite.
◎, abundant ; ○, common ; • ; rare ; ?, uncertain because of weak reflection.

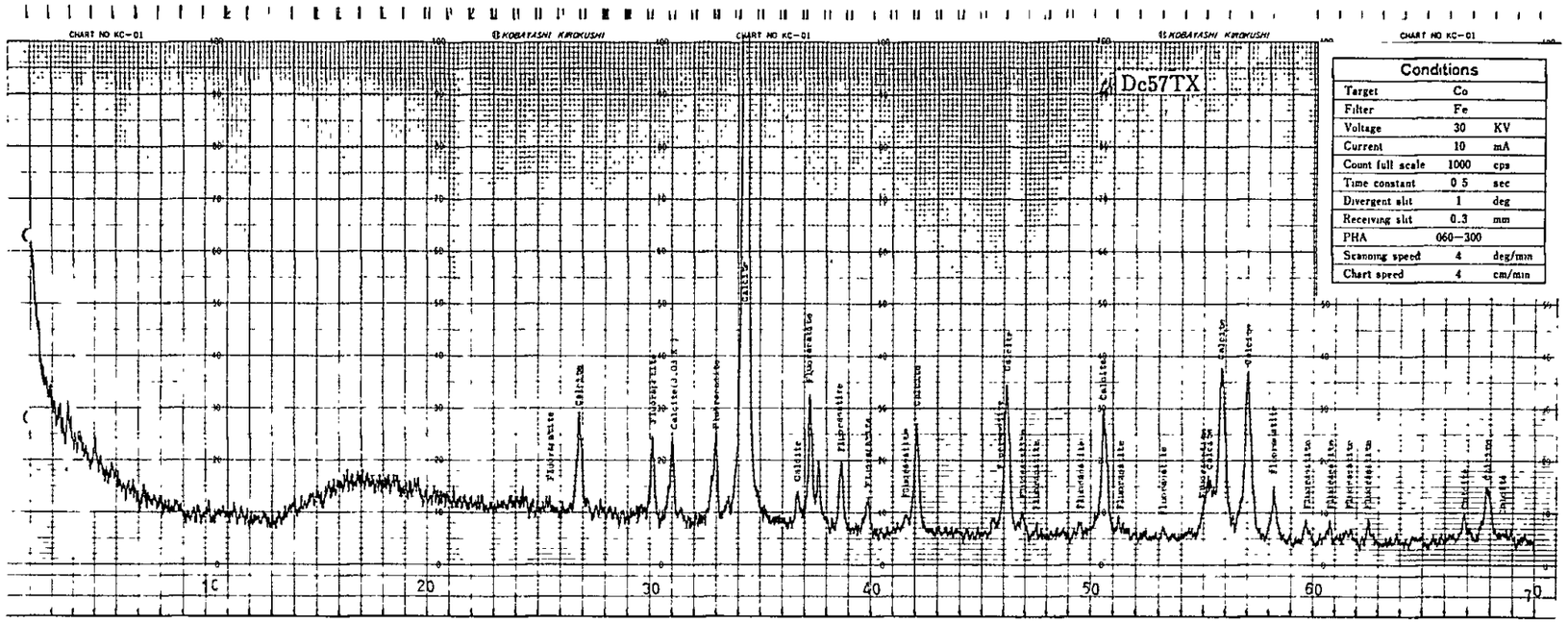
Apx. 15 X-ray Powder Diffraction Charts


Cb148X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
10
20
30
40
50
60
70


Cb 212X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
10
20
30
40
50
60


Cb214X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min


Cb225X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min


Dc57TX
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0.3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
10
20
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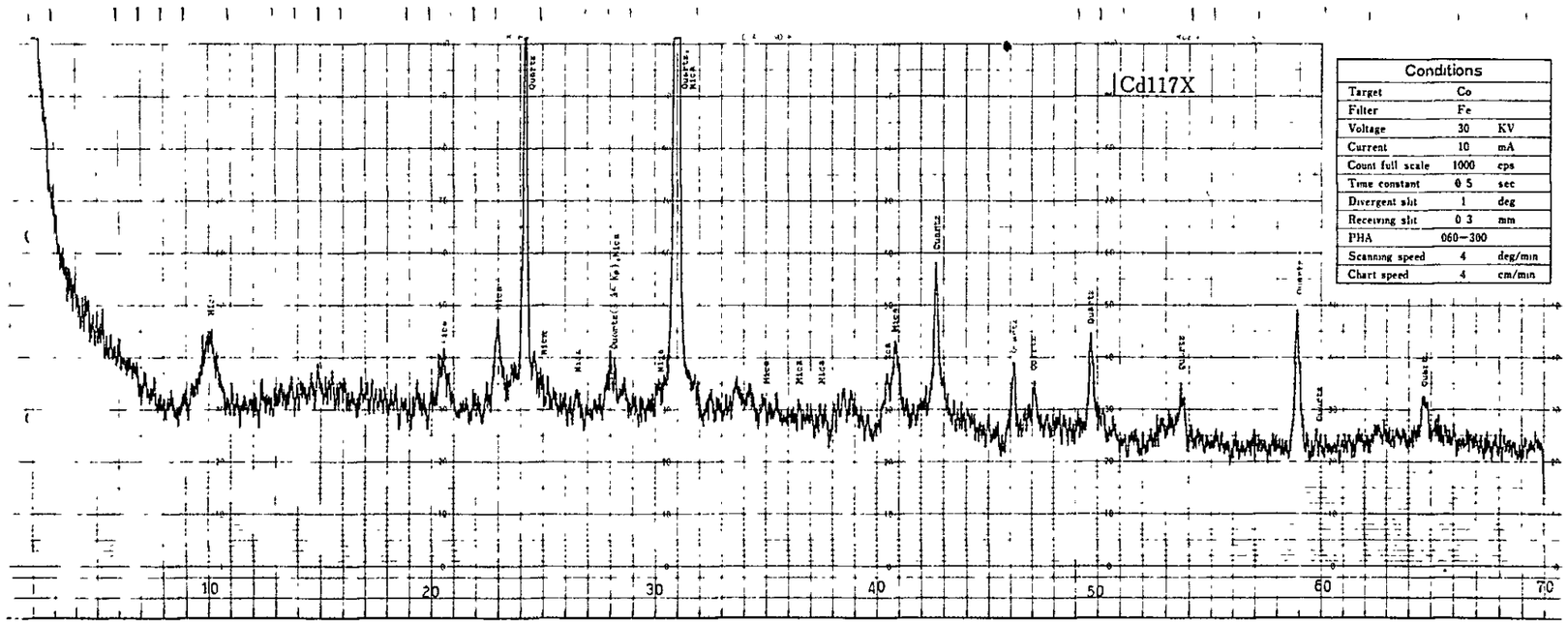
60
70


Cd117X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
10
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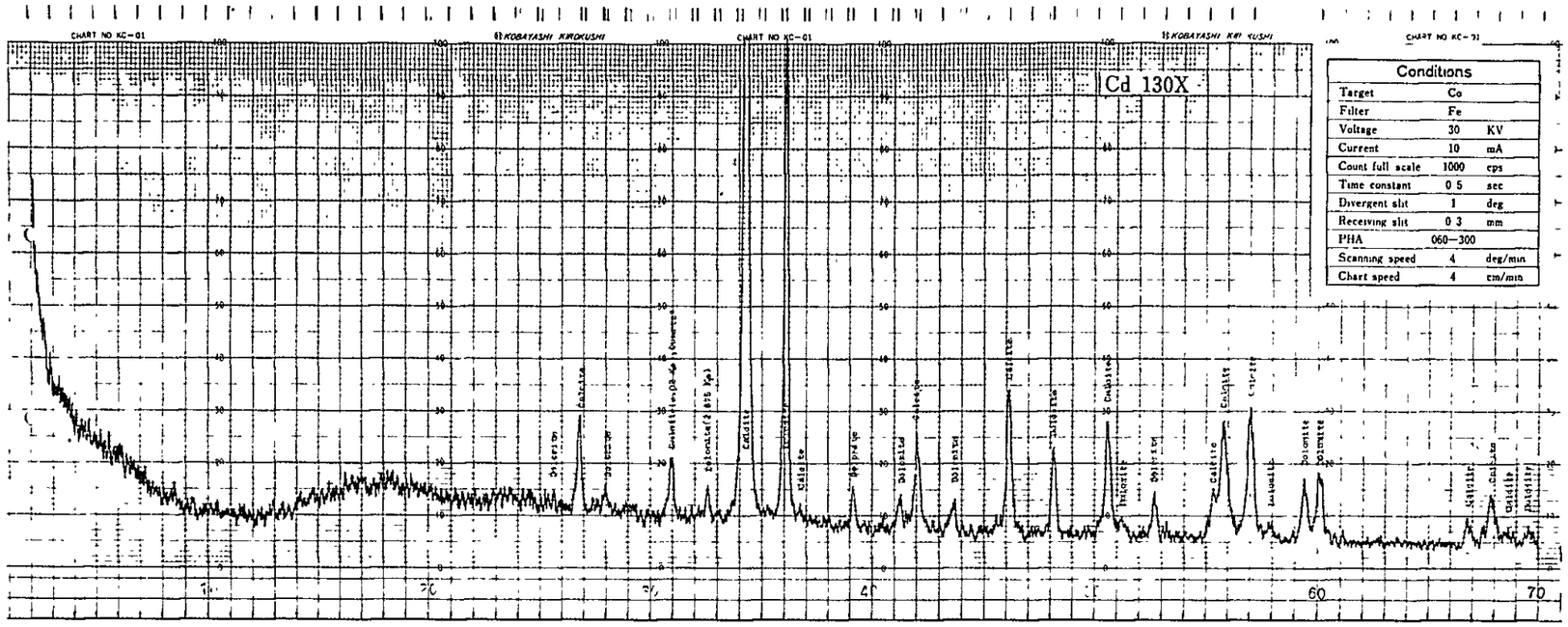
Cd 130X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
10
20
30
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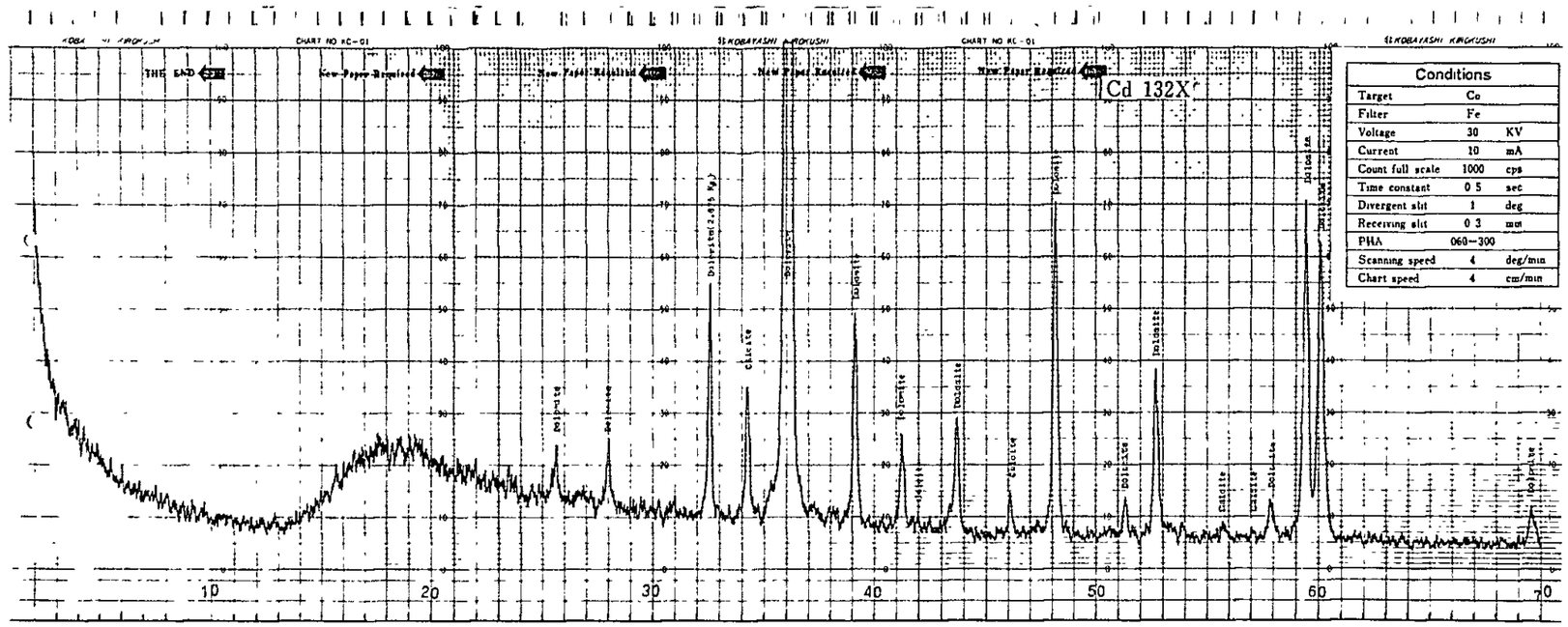
Cd 132X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
10
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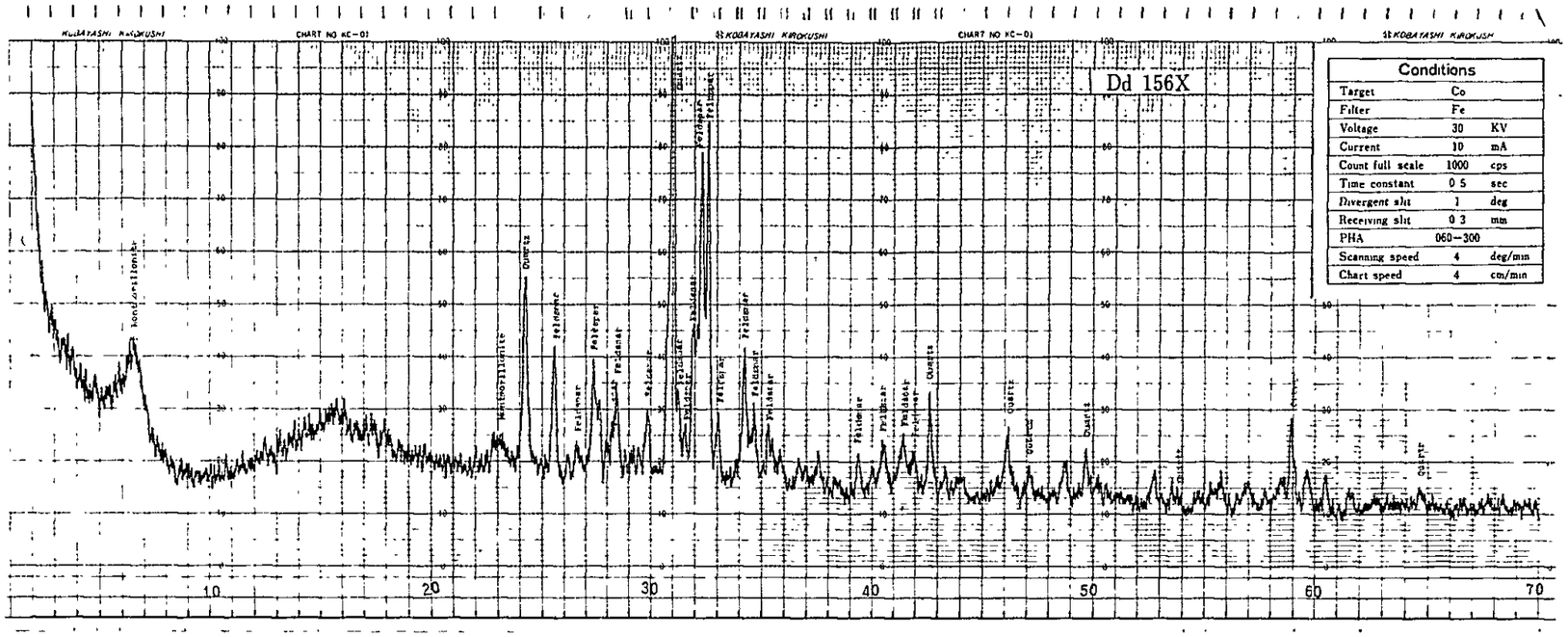
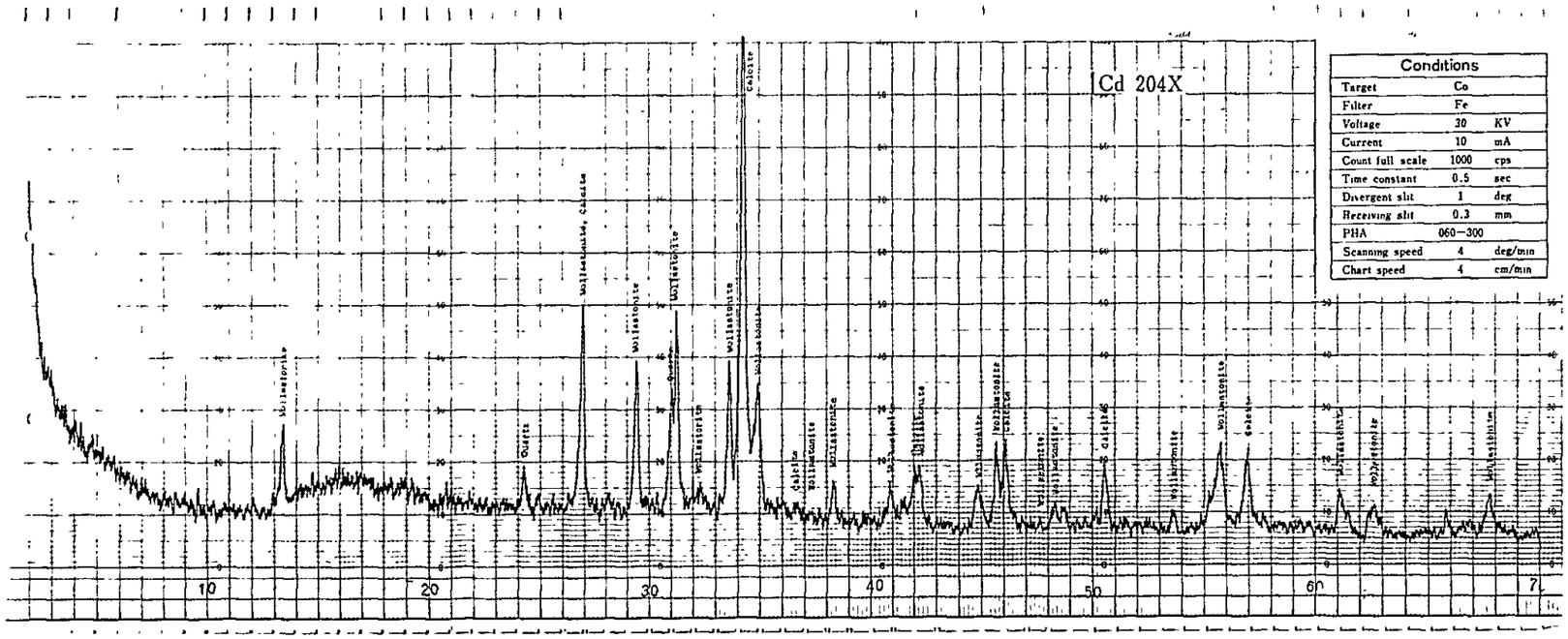
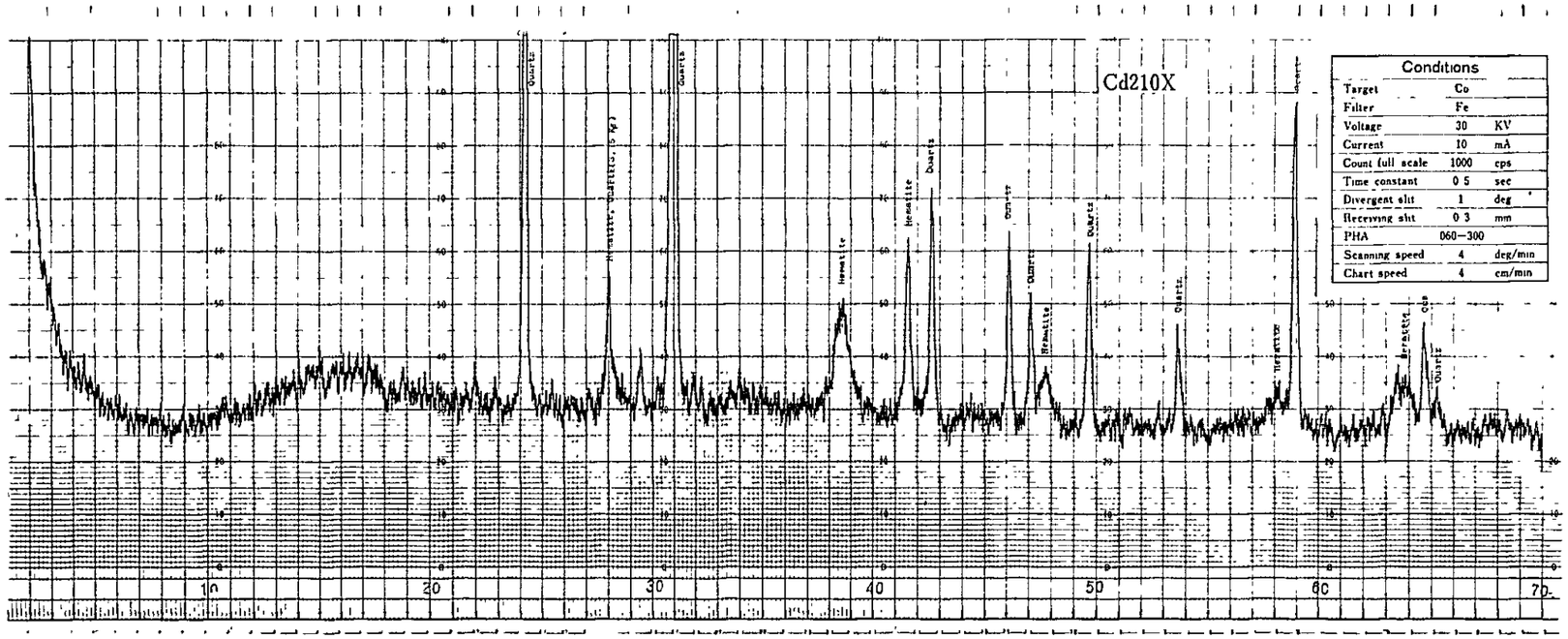
30
40
50
60
70


Dd 156X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/mn
Chart speed 4 cm/min


Cd 204X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0.5 sec
Divergent slit 1 deg
Receiving slit 0.3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min


Cd210X
Conditions
Target Co
Filter Fe
Voltage 30 KV
Current 10 mA
Count full scale 1000 cps
Time constant 0 5 sec
Divergent slit 1 deg
Receiving slit 0 3 mm
PHA 060—300
Scanning speed 4 deg/min
Chart speed 4 cm/min
Quartz
Hematite
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40
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