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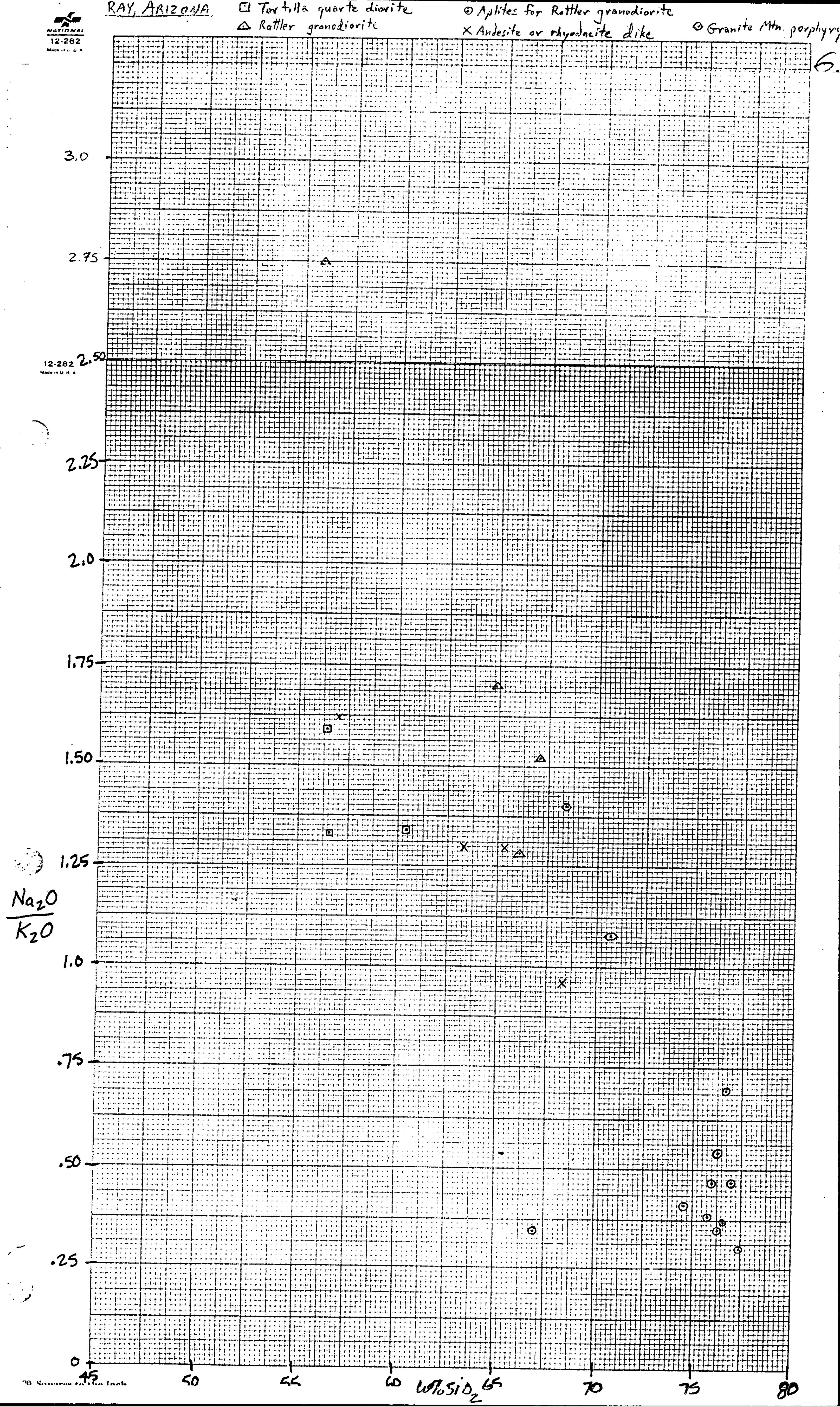

RAY, ARIZONA
Tortilla quartz diorite
Rattler granodiorite
Aplites for Rattler granodiorite
Andesite or rhyodacite dike
Granite Mtn. porphyry
6.
3.0
2.75
2.50
2.25
2.0
1.75
1.50
1.25
1.0
.75
.50
.25
0
Na_2O / K_2O
45
50
55
60
65
70
75
80
wt% SiO_2
12-282

Williamson Canyon Volcanics (33b)

basalt ⊡   all one symbol A: ⊡

(ALT: T-5309, T-4592, OCA-16)

Sample #	T-5309	SAM-1	~~T-4493~~	T-4592	OCA-1	OCA-16	T-5527	OCA-4	T-5580	OCA-5
SiO_2	45.3	46.56	47.2	47.9	48.4	48.8	48.8	48.9	49.1	49.3
Al_2O_3	19.7	14.9	17.8	18.9	19.2	18.4	19.3	19.1	19.0	18.1
Fe_2O_3	4.65	12.4	4.93	3.35	6.12	5.6	4.73	7.13	4.5	5.95
FeO	5.19		5.23	6.34	4.97	2.16	5.2	2.46	4.94	2.89
MnO	.06	.07	...		.10	.09	.065	.085	.06	.10
MgO	5.14	9.4	7.42	4.88	5.96	4.3	6.48	4.52	5.12	5.08
CaO	8.18	9.4	1.82	5.21	8.73	8.84	6.43	7.64	8.14	6.98
Na_2O	3.07	2.6	1.82	3.55	3.27	3.24	2.55	4.12	2.90	4.23
K_2O	1.34	.72	1.7	2.13	.708	.982	1.75	1.12	1.31	.792
P_2O_5	.13				<.10	<.10	.10	<.10	<.10	<.10
TiO_2	.85	1.6	.75	.75	.8	.70	.85	.65	.72	.70
CO_2	1.28		4.01	2.78	.75	2.35	1.21	1.67	1.38	1.38
H_2O^+	3.18	.41	4.23	3.82	2.67	3.58	4.2	3.36	3.03	4.08
H_2O^-										
Totals	98.07	100.06	99.35	98.86	101.68	99.04	101.67	100.76	100.2	101.99
$^{20}/K_2O$	2.29	3.61	~~1.07~~	1.67	4.62	3.30	1.46	3.68	2.21	5.34
/CNK	0.91	0.66	~~2.14~~	1.05	0.86	0.81	1.07	0.86	0.89	0.87
O-MgO	-3.80	-8.68		-2.95	-5.25	-3.32	-4.73	-3.4	-3.81	-4.29
O-CaO	-6.84	-8.68		-3.08	-8.02	-7.86	-4.68	-6.52	-6.83	-6.19
Fe*/MgO	1.82	1.19		1.92	1.76	1.67	1.46	1.96	1.76	1.62
	1.8	1.2		1.9	1.8	1.7	1.5	2.0	1.8	1.6

Sample #	OCA-6	39AB74	T-5585	OCA-13	OCA-20	OCA-2	OCA-12	OCA-8	74AB75	OCA-6	OCA-19	OCA[illegible]
SiO_2	49.4	49.4	49.8	50.0	50.4	50.4	50.7	50.7	50.8	50.9	51.1	5[illegible]
Al_2O_3	14.7	17.4	19.3	19.1	16.9	19.4	17.0	18.5	16.8	15.7	17.1	17[illegible]
Fe_2O_3	4.78	4.6	1.04	6.23	7.36	5.42	7.79	4.92	4.3	4.06	7.96	6[illegible]
FeO	5.07	5.1	5.84	2.1	2.02	4.2	1.6	3.84	5.4	4.98	1.29	1.[illegible]
MnO	.15	.10	.065	.095	.08	.10	.11	.095	.12	.10	.085	.[illegible]
MgO	8.08	5.8	5.25	3.49	5.58	5.12	5.68	4.89	5.8	6.81	5.71	4.[illegible]
CaO	7.82	9.5	8.25	8.2	7.87	8.02	7.68	6.54	10.0	8.62	7.39	6.[illegible]
Na_2O	2.31	2.2	3.42	3.24	3.11	4.61	3.45	3.86	2.6	2.43	3.09	2.[illegible]
K_2O	2.09	.9	1.03	1.24	1.59	.868	1.26	2.49	.89	1.21	1.95	1.4[illegible]
P_2O_5	.33	.22	<.10	<.10	<.10	<.10	.15	.27	.14	.30	.17	<.1[illegible]
TiO_2	.65	.95	.85	.85	.70	.65	.70	.60	1.1	.70	.70	.7[illegible]
CO_2	.39	.02	.37	.54	<.2	.97	.22	.78	.06	.32	.48	2.[illegible]
H_2O^+	3.79	2.1	2.08	4.54	4.02	3.04	4.1	3.51	.97	2.9	3.02	4.5[illegible]
H_2O^-		.34							.13			
Totals	99.56	98.63	97.30	99.63	99.63	102.8	100.44	101.	99.11	98.33	100.05	100.[illegible]
$^{20}/K_2O$	1.11	2.44	3.32	2.61	1.96	5.31	2.74	1.55	2.92	2.01	1.58	1.[illegible]
/CNK	0.72	0.79	0.88	0.87	0.79	0.82	0.80	0.87	0.71	0.74	0.82	0[illegible]
O-MgO	-5.99	-4.9	-4.22	-2.25	-3.99	-4.25	-4.42	-2.4	-4.91	-5.6	-3.76	-[illegible]
O-CaO	-5.73	-8.6	-7.22	-6.96	-6.28	-7.15	-6.42	-4.05	-9.11	-7.41	-5.44	-[illegible]
Fe*/MgO	1.16	1.59	1.29	2.21	1.55	1.77	1.52	1.69	1.6	1.3	1.5	
	1.1	1.6	1.3	2.2	1.6	1.8	1.5	1.7				

all o.c symbol A:□

andesites

rhyolite

OCA-6	39AB74	T-5585	OCA-13	OCA-20	OCA-2	OCA-12	OCA-8	74AB75	OCA-6	OCA-19
49.4	49.4	49.8	50.0	50.4	50.4	50.7	50.7	50.8	50.9	51.1
14.7	17.4	19.3	19.1	16.9	19.4	17.0	18.5	16.8	15.7	17.1
4.78	4.6	1.04	6.23	7.36	5.42	7.79	4.92	4.3	4.06	7.96
5.07	5.1	5.84	2.1	2.02	4.2	1.6	3.84	5.4	4.98	1.29
.15	.10	.065	.095	.08	.10	.11	.095	.12	.10	.085
8.08	5.8	5.25	3.49	5.58	5.12	5.68	4.89	5.8	6.81	5.71
7.82	9.5	8.25	8.2	7.87	8.02	7.68	6.54	10.0	8.62	7.39
2.31	2.2	3.42	3.24	3.11	4.61	3.45	3.86	2.6	2.43	3.09
2.09	.9	1.03	1.24	1.59	.868	1.26	2.49	.89	1.21	1.95
.33	.32	<.10	<.10	<.10	<.10	.15	.27	.14	.30	.17
.65	.95	.85	.85	.70	.65	.70	.60	1.1	.70	.70
.39	.02	.37	.54	<.2	.97	.22	.78	.06	.32	.48
3.79	2.1	2.08	4.54	4.02	3.04	4.1	3.51	.97	2.9	3.02
	.34							.13		
99.56	98.63	97.30	99.63	99.63	102.8	100.44	101.	99.11	98.33	100.05
1.11	2.44	3.32	2.61	1.96	5.31	2.74	1.55	2.92	2.01	1.58
0.72	0.79	0.88	0.87	0.79	0.82	0.80	0.87	0.71	0.74	0.82
-5.99	-4.9	-4.22	-2.25	-3.99	-4.25	-4.42	-2.4	-4.91	-5.6	-3.76
-5.73	-8.6	-7.22	-6.96	-6.28	-7.15	-6.42	-4.05	-9.11	-7.41	-5.44
1.16	1.59	1.29	2.21	1.55	1.77	1.52	1.69	1.6	1.3	1.5
1.1	1.6	1.3	2.2	1.6	1.8	1.5	1.7			

OCA-17 (ALT) X	OCA-3	OCA-15	OCA-11	OCA-9	DH-248-320 (ALT)	OCA-10	TT	SM-1 (ALT ?)	RP-2 (ALT)	RP-1 (ALT)
51.1	51.4	52.0	52.3	52.7	56.0	57.0	58.64	63.44	71.2	73.74
17.3	18.9	17.1	17.4	18.2	16.8	17.7	18.7	14.2	13.9	13.3
6.42	5.26	7.92	7.38	5.72	2.4	5.56	6.4	6.4	2.3	2.0
1.85	4.24	1.18	1.11	3.53	4.2	1.60		4.08		
.095	.11	.09	.10	.10	.07	.09	.09	.10	.04	.03
4.91	5.34	5.31	4.79	4.17	6.5	2.35	1.8	1.8	1.1	.86
6.38	8.17	6.96	7.98	5.78	4.6	5.57	5.9	2.5	1.3	1.9
2.77	3.45	2.85	3.15	3.58	2.2	4.00	3.2	2.0	3.5	6.7
1.42	.747	1.91	1.65	2.52	2.6	2.12	3.1	4.7	3.2	.53
<.10	<.10	<.10	.15	.30	.21	.36				
.70	.70	.65	.7	.60	.99	.65	1.1	.94	.34	.20
2.76	.61	<.2	.34	1.7	.02	1.33				
4.56	2.37	3.58	2.58	2.95	3.7	3.06	1.2	1.3	2.4	
					1.7					
100.27	101.3	99.55	99.63	101.85	100.99	101.39	98.93	98.7	96.88	99.26
1.95	4.62	1.49	1.91	1.42	0.85	1.89	1.03	0.43	1.09	12.64
0.96	0.87	0.87	0.80	0.94	1.12	0.91	0.95	1.08	1.17	0.85
-3.49	-4.59	-3.40	-3.14	-1.65	-3.9	-0.23	1.30	2.90	2.1	
-4.96	-7.42	-5.05	-6.33	-3.26	-2.00	-3.45	-2.8	2.2	1.90	
1.6	1.7	1.6	1.6	2.1	1.0	2.8	3.2	5.5	1.9	

COUNTY: GILA MINING DISTRICT: CHRISTMAS

MINE NAME - CHRISTMAS
MINE OPERATORS - SAM KNIGHT + F. R. DELGCIDO, SAM KNIGHT; CHRISTMAS COPPER, INSPIRATION CONS, ANACONDA; C. B. HANRATY, CU CO.; GILA CU SULFIDE, SAM KNIGHT; COLUMBIA M + M C, RIVIERA MINES CO

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1915	NC	2144.	219694.	37952.	1051.	522.	15.	310.	38784.
1917	NC	90358.	4850488.	1318363.	23868.	19433.	626.	12941.	1350736.
1918	NC	90869.	5333421.	1313515.	25727.	24897.	649.	13416.	1351827.
1919	NC	92596.	5325480.	995385.	29762.	33072.	660.	13643.	1042101.
1919	NC	35.	4477.	837.	84.	93.	1.	21.	951.
1920	NC	62510.	3178477.	554835.	17689.	17848.	417.	8620.	581303.
1921	NC	2296.	120633.	15082.	752.	471.	17.	351.	15904.
1925	NC	6460.	339346.	47651.	0.	0.	35.	724.	48374.
1926	NC	44142.	2303185.	317724.	11391.	7075.	226.	4672.	329471.
1927	NC	37086.	1805112.	233220.	11109.	6262.	155.	3204.	242687.
1928	NC	37928.	1703600.	248215.	11970.	6964.	172.	3556.	258734.
1929	NC	137650.	4736770.	857687.	33515.	17761.	711.	14698.	890145.
1930	NC	182241.	6924735.	898969.	38806.	14806.	1007.	20817.	934592.
1931	NG	79110.	2594617.	210579.	17476.	5016.	399.	8248.	223843.
1937	NC	30170.	1470000.	193555.	9650.	4331.	96.	3360.	201246.
1938	NC	6098.	314691.	31469.	2330.	1007.	19.	665.	33141.
1939	NC	24790.	1055380.	115722.	6500.	2540.	119.	4165.	122428.
1940	NC	25871.	1200000.	135552.	5616.	1953.	73.	2555.	140060.
1941	NC	35791.	1545000.	182264.	9675.	3365.	106.	3710.	189339.
1942	NC	39837.	1668337.	196447.	10838.	4155.	120.	4200.	204801.
1943	NC	27330.	1107215.	130375.	5670.	2537.	82.	2870.	135782.
1944	NC	21987.	855073.	100685.	3800.	1701.	65.	2275.	104660.
1945	NC	19260.	740042.	87140.	3546.	1841.	58.	2030.	91011.
1946	NC	19921.	775939.	107235.	4400.	3527.	86.	3010.	113771.
1947	NC	26637.	991100.	207715.	5619.	4036.	77.	2695.	214445.
1948	NC	32715.	1414530.	311734.	6710.	4990.	232.	8120.	324844.
1949	NC	31741.	1637000.	314337.	7094.	5103.	222.	7770.	327209.
1950	NC	24007.	1340000.	284549.	5327.	3951.	168.	5880.	294380.
1951	NC	66821.	72000.	17424.	688.	615.	0.	0.	18039.
1951	NC	30305.	1577000.	381634.	9083.	8117.	242.	8470.	398221.
1952	NC	19267.	1182350.	286129.	5415.	4600.	148.	5180.	295938.
1952	NC	18165.	185707.	44941.	1572.	1335.	0.	0.	46276.
1953	NC	13018.	825000.	237584.	2459.	2095.	70.	2450.	242128.
1953	NC	3633.	310300.	89360.	747.	636.	31.	1085.	91082.
1953	MGT	10110.	96000.	27646.	900.	767.	0.	0.	28413.
1954	NC	24602.	1435100.	426139.	5095.	4343.	147.	5145.	435627.
1958	MGT	1660.	15700.	4045.	79.	70.	0.	0.	4115.
1959	NC	11089.	293500.	90105.	1687.	1521.	53.	1855.	93431.
1959	MGT	9000.	67600.	20753.	512.	463.	0.	0.	21216.
1960	NC	17052.	448400.	143488.	2260.	2034.	66.	2310.	147832.
1960	MGT	13952.	71600.	22912.	636.	572.	0.	0.	23484.
1961	MGT	14069.	50200.	15060.	507.	468.	0.	0.	15528.
1962	NC	129617.	3175400.	978023.	24115.	26165.	522.	182870.	1187058.
1963	NC	638755.	19381300.	5969441.	108066.	139066.	2740.	95900.	6204407.
1964	MGT	10584.	38800.	12649.	492.	636.	0.	0.	13235.
1964	NC	953231.	24952500.	8134515.	132383.	171171.	3582.	125370.	8431056.
1965	NC	715671.	17281700.	1664.	86980.	85.	2428.	0.	1749.
1965	MGT	1319.	4700.	6117722.	66.	111564.	0.	84980.	6314266.
1967	NC	856926.	8988300.	3415554.	61803.	95795.	1774.	62090.	3573439.
1968	NC	1173407.	15282700.	6418734.	101361.	216912.	2747.	107133.	6742779.
1969	NC	1913813.	21301300.	10224624.	127960.	229048.	3507.	147294.	10500956.
1970	NC	1827355.	16909600.	9756839.	67031.	118700.	2014.	73289.	9948828.
1971	NC	1380432.	13652000.	7099040.	77547.	119868.	2083.	85924.	7304852.
1972	NC	1973853.	22488926.	11514330.	139836.	235624.	4420.	259012.	12008956.
1973	NC	1852928.	18490028.	11001567.	140172.	358560.	3460.	338423.	11698550.
1974	NC	1581860.	12613776.	9750449.	87645.	412808.	2306.	358360.	10521617.
1975	NC	1267435.	19176696.	12311439.	89478.	395493.	2169.	350272.	13057204.
1976	NC	1558165.	13559014.	9437074.	104912.	456367.	2783.	348756.	10242207.
1977	NC	950186.	10101355.	6747704.	76027.	351245.	1915.	284014.	7382963.
1979	NC	909425.	11966397.	11123339.	58507.	648843.	1416.	435420.	12207602.
1980	NC	1292119.	12704880.	13012338.	97975.	20222040.	2051.	1256361.	91450344 3.
1981	NC	1922974.	17200119.	14640569.	78283.	8234100.	1952.	897217.	23771836.
TOTALS		24394398.	341454290.	168923625.	2002254.	32771001.	51239.	5677715.	1087365045.

MINE NAME - ADJUST
MINE OPERATORS - ADJUST MNG.CO. R. M. GREENLAW COLLINS PACIFIC HOPE METALS CO, CHAS MCGOWAN

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1920	NS	325.	1129.	197.	16271.	16417.	48.	992.	17607.
1921	NS	229.	573.	72.	25874.	16211.	0.	0.	16613.
1922	NS	825.	309.	41.	20473.	13825.	75.	1550.	15497.
1923	NS	1951.	2310.	333.	52405.	33997.	131.	2708.	37038.
1924	NS	135.	373.	49.	5219.	3485.	13.	269.	3803.
1929	NL	1619.	483.	87.	5610.	2973.	26.	537.	4206.
1934	NS	805.	201.	17.	3189.	1530.	9.	315.	1926.
1935	NS	112.	38.	3.	727.	467.	2.	70.	599.
1936	NS	234.	100.	9.	2323.	1047.	10.	350.	1560.
1939	NGS	270.	0.	0.	526.	206.	7.	245.	451.
TOTALS		6505.	5516.	809.	132617.	90159.	321.	7037.	99298.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1920	NS	325.	0.	0.	0.	0.	0.	0.	17607.
1921	NS	229.	7267.	330.	0.	0.	0.	0.	16613.
1922	NS	825.	1394.	80.	0.	0.	0.	0.	15497.
1923	NS	1951.	0.	0.	0.	0.	0.	0.	37038.
1924	NS	135.	0.	0.	0.	0.	0.	0.	3803.
1929	NL	1619.	8900.	608.	0.	0.	0.	0.	4206.
1934	NS	805.	1649.	64.	0.	0.	0.	0.	1926.
1935	NS	112.	1432.	58.	0.	0.	0.	0.	599.
1936	NS	234.	3248.	153.	0.	0.	0.	0.	1560.
1939	NGS	270.	0.	0.	0.	0.	0.	0.	451.
TOTALS		6505.	23890.	1293.	0.	0.	0.	0.	99298.

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MINE NAME - BATTLER CREEK
MINE OPERATORS - C.O. POWERS

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1953	NL	3.	0.	0.	16.	14.	0.	0.	324.
TOTALS		3.	0.	0.	16.	14.	0.	0.	324.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1953	NL	3.	2300.	310.	0.	0.	0.	0.	324.
TOTALS		3.	2300.	310.	0.	0.	0.	0.	324.

GRAND TOTAL FOR RIVERSIDE MINING DISTRICT, BY ORE TYPE

YEARS OF REPORTED PRODUCTION
1906-1908,1911,1913-1918,1920,1922,1924,1926,1929,1934-1941,1948,1950,1955-1957

ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	TOTAL VALUE ALL METALS
NC	3931.	409613.	73494.	4600.	2745.	39.	821.	77072.
NG	892.	4382.	516.	633.	293.	300.	8136.	8945.
NS	963.	17100.	5301.	142.	126.	3.	62.	5438.
TOTALS	5786.	431095.	79311.	5375.	3163.	342.	9018.	91505.

ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	TOTAL VALUE ALL METALS
NC	3931.	313.	13.	0.	0.	0.	0.	77072.
NG	892.	0.	0.	0.	0.	0.	0.	8945.
NS	963.	0.	0.	0.	0.	0.	0.	5438.
TOTALS	5786.	313.	13.	0.	0.	0.	0.	91505.

MINE NAME - ADJUST
MINE OPERATORS - ADJUST MNG.CO. R. M. GREENLAW COLLINS PACIFIC HOPE METALS CO, CHAS MCGOWAN

MINE NAME - ADJUST
MINE OPERATORS - ADJUST MNG.CO. R. M. GREENLAW COLLINS PACIFIC HOPE METALS CO, CHAS MCGOWAN

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1920	NS	325.	1129.	197.	16271.	16417.	48.	992.	17607.
1921	NS	229.	573.	72.	25874.	16211.	0.	0.	16613.
1922	NS	825.	309.	41.	20473.	13825.	75.	1550.	15497.
1923	NS	1951.	2310.	333.	52405.	33997.	131.	2706.	37038.
1924	NS	135.	373.	49.	5219.	3485.	13.	269.	3803.
1929	NL	1619.	483.	87.	5610.	2973.	26.	537.	4206.
1934	NS	805.	201.	17.	3189.	1530.	9.	315.	1926.
1935	NS	112.	38.	3.	727.	467.	2.	70.	599.
1936	NS	234.	100.	9.	2323.	1047.	10.	350.	1560.
1939	NGS	270.	0.	0.	526.	206.	7.	245.	451.
TOTALS		6505.	5516.	809.	132617.	90159.	321.	7037.	99298.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1920	NS	325.	0.	0.	0.	0.	0.	0.	17607.
1921	NS	229.	7267.	330.	0.	0.	0.	0.	16613.
1922	NS	825.	1394.	80.	0.	0.	0.	0.	15497.
1923	NS	1951.	0.	0.	0.	0.	0.	0.	37038.
1924	NS	135.	0.	0.	0.	0.	0.	0.	3803.
1929	NL	1619.	8900.	606.	0.	0.	0.	0.	4206.
1934	NS	805.	1649.	64.	0.	0.	0.	0.	1926.
1935	NS	112.	1432.	58.	0.	0.	0.	0.	599.
1936	NS	234.	3248.	153.	0.	0.	0.	0.	1560.
1939	NGS	270.	0.	0.	0.	0.	0.	0.	451.
TOTALS		6505.	23890.	1293.	0.	0.	0.	0.	99298.

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MINE NAME - BATTLER CREEK
MINE OPERATORS - C.D. POWERS

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1953	NL	3.	0.	0.	16.	14.	0.	0.	324.
TOTALS		3.	0.	0.	16.	14.	0.	0.	324.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1953	NL	3.	2300.	310.	0.	0.	0.	0.	324.
TOTALS		3.	2300.	310.	0.	0.	0.	0.	324.

MINE NAME - BLUE BIRD
MINE OPERATORS - SANFORD+OREM

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1926	NS	464.	899.	124.	8702.	5405.	24.	496.	6025.
TOTALS		464.	899.	124.	8702.	5405.	24.	496.	6025.

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MINE NAME - COLUMBIA
MINE OPERATORS - JESUS S. LOPEZ

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1941	NG	4.	0.	0.	1.	0.	2.	70.	70.
TOTALS		4.	0.	0.	1.	0.	2.	70.	70.

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MINE NAME - HANNAH
MINE OPERATORS - W.HANNAH + PYRE

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1935	NS	1.	0.	0.	25.	16.	0.	0.	16.
TOTALS		1.	0.	0.	25.	16.	0.	0.	16.

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MINE NAME - HILLTOP CLAIM
MINE OPERATORS - FLOMINCO MORIN

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1942	NS	13.	0.	0.	198.	76.	3.	105.	131.
TOTALS		13.	0.	0.	198.	76.	3.	105.	131.

MINE NAME - HOOSIER GR
MINE OPERATORS - J H MILES CROZIER+CORDOZA JAMES VAPPOS F.D.SMITH,1930

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1913	NG	20.	602.	92.	41.	25.	25.	517.	633.
1914	NG	35.	380.	52.	11.	6.	27.	559.	616.
1930	NG	14.	0.	0.	7.	3.	8.	165.	158.
1934	NG	1.	0.	C.	1.	0.	2.	7C.	70.
1938	NG	13.	0.	C.	9.	4.	10.	350.	354.
TOTALS		83.	982.	144.	69.	38.	72.	166C.	1842.

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MINE NAME - INSEPERABLE
MINE OPERATORS - FILOMENS MARIA

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1935	NL	6.	2773.	240.	19.	12.	1.	35.	287.
TOTALS		6.	2773.	24C.	19.	12.	1.	35.	237.

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MINE NAME - JACK LEE CLAIM
MINE OPERATORS - JACK LEE Y.BRACHMONTE,192

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1922	NS	23.	62.	8.	403.	272.	4.	83.	354.
1923	NS	23.	0.	C.	424.	275.	1.	21.	296.
TOTALS		46.	62.	8.	827.	547.	5.	103.	650.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1922	NS	23.	24.	1.	0.	0.	0.	C.	354.
1923	NS	23.	0.	C.	0.	0.	0.	0.	296.
TOTALS		46.	24.	1.	0.	0.	0.	0.	650.

MINE NAME - LAWRENCE
MINE OPERATORS - A.B.COOK

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1922	NS	7.	0.	0.	328.	221.	2.	41.	263.
1923	NS	12.	12.	2.	259.	168.	0.	0.	170.
1924	NS	13.	55.	7.	220.	147.	1.	21.	175.
TOTALS		32.	67.	9.	807.	536.	3.	62.	607.

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MINE NAME - LEE WONG
MINE OPERATORS - J.RICHARDS

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1935	NC	8.	422.	36.	124.	80.	0.	0.	116.
TOTALS		8.	422.	36.	124.	80.	0.	0.	116.

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MINE NAME - LITTLE TREASURE
MINE OPERATORS - N.H.MELLER HENDERSON MURPHEY

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1917	NS	7.	0.	0.	397.	323.	1.	21.	344.
1921	NS	1.	0.	0.	35.	22.	0.	0.	22.
1921	NS	11.	49.	6.	330.	207.	0.	0.	213.
1922	NS	101.	55.	7.	3273.	2210.	6.	124.	2342.
TOTALS		120.	104.	13.	4035.	2762.	7.	145.	2920.

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MINE NAME - MARY PIPER CLAIMS
MINE OPERATORS - GRADY L.HERRING D.F.DELGADO,1931

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1931	NG	14.	82.	7.	40.	11.	5.	103.	121.
1959	NG	1.	0.	0.	0.	0.	1.	35.	35.
1963	NG	1.	0.	0.	0.	0.	1.	35.	35.
TOTALS		16.	82.	7.	40.	11.	7.	173.	191.

MINE NAME - QUARTZ LODE
MINE OPERATORS - MAGNET BROS.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1939	NG	5.	0.	0.	1.	0.	2.	70.	70.
TOTALS		5.	0.	0.	1.	0.	2.	70.	70.

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MINE NAME - REIDER + ERIE GR.
MINE OPERATORS - J. C. MANN

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1931	NG	4.	68.	6.	1.	0.	1.	21.	26.
TOTALS		4.	68.	6.	1.	0.	1.	21.	26.

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MINE NAME - SADDLE MTN GRP
MINE OPERATORS - SADDLE MTN. MG.C

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1902	NS	100.	0.	0.	1400.	730.	10.	207.	937.
1905	NC	10623.	394318.	61474.	3528.	2129.	91.	1881.	65435.
1906	NC	58090.	2409950.	464590.	19067.	12735.	0.	0.	477325.
1907	NC	40537.	1766945.	353460.	2441.	1592.	254.	5251.	360303.
TOTALS		109350.	4571213.	879524.	26436.	17187.	355.	7339.	904049.

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MINE NAME - SENATOR GRP.
MINE OPERATORS - ABE FERRA (+ C. FERRA, 1941) A. TRAFANOVICH, LEASEE, 1929

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1929	NC	131.	6288.	1139.	151.	80.	3.	62.	1231.
1940	NC	60.	5130.	579.	169.	59.	2.	70.	708.
1941	NC	35.	4000.	472.	113.	39.	1.	35.	546.
1942	NC	17.	1200.	141.	48.	18.	1.	35.	195.
1944	NC	49.	3200.	377.	90.	40.	1.	35.	452.
TOTALS		292.	19818.	2708.	571.	237.	8.	237.	3182.

MINE NAME - SILVER CROSS
MINE OPERATORS - PEDERSON+GARLAND + MINING

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1968	NS	15.	0.	0.	74.	158.	0.	0.	158.
TOTALS		15.	0.	0.	74.	158.	0.	0.	158.

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MINE NAME - SILVER THOM
MINE OPERATORS - R.S. FISHER

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1950	NS	10.	0.	0.	53.	39.	0.	0.	39.
TOTALS		10.	0.	0.	53.	39.	0.	0.	39.

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MINE NAME - TWO QUEENS
MINE OPERATORS - FRANK HUBBELL CENTRAL M+D

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1907	NC	4.	78.	16.	15.	10.	5.	103.	129.
1923	NG	56.	0.	0.	70.	45.	22.	455.	500.
1934	NG	201.	824.	69.	258.	124.	52.	1820.	2013.
TOTALS		261.	902.	85.	343.	179.	79.	2378.	2642.

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MINE NAME - UNKNOWN
MINE OPERATORS - CHRISTMAS M CO

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1921	NS	5.	17.	2.	95.	60.	0.	0.	62.
TOTALS		5.	17.	2.	95.	60.	0.	0.	62.

MINE NAME - UNKNOWN
MINE OPERATORS - R MUNGREY

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1920	NS	8.	20.	3.	300.	303.	1.	21.	327.
TOTALS		8.	20.	3.	300.	303.	1.	21.	327.

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MINE NAME - UNKNOWN
MINE OPERATORS - C.H.POTTER

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1927	NL	50.	25.	3.	53.	30.	0.	0.	980.
TOTALS		50.	25.	3.	53.	30.	0.	0.	980.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1927	NL	50.	14020.	947.	0.	0.	0.	0.	980.
TOTALS		50.	14020.	947.	0.	0.	0.	0.	980.

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MINE NAME - UNKNOWN
MINE OPERATORS - EMIL SEIDEL

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1960	NLZ	16.	100.	32.	49.	44.	14.	490.	1193.
TOTALS		16.	100.	32.	49.	44.	14.	490.	1193.

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	YEARLY VALUE ALL METALS
1960	NLZ	16.	26000.	304.	2500.	323.	0.	0.	1193.
TOTALS		16.	26000.	304.	2500.	323.	0.	0.	1193.

MINE NAME - UNKNOWN
MINE OPERATORS - D H SULLIVAN

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1926	NS	28.	813.	112.	565.	351.	2.	41.	504.
TOTALS		28.	813.	112.	565.	351.	2.	41.	504.

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MINE NAME - UNKNOWN
MINE OPERATORS - L T WOLFE

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1948	NS	2.	0.	0.	21.	16.	0.	0.	16.
TOTALS		2.	0.	0.	21.	16.	0.	0.	16.

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MINE NAME - UNKNOWN
MINE OPERATORS - S K WORTH

YEAR	ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1924	NG	9.	60.	8.	7.	5.	4.	83.	95.
TOTALS		9.	60.	8.	7.	5.	4.	83.	95.

GRAND TOTAL FOR SADDLE MTNS MINING DISTRICT, BY YEAR

YEAR	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	YEARLY VALUE ALL METALS
1902	100.	0.	0.	1400.	730.	10.	207.	937.
1905	10623.	394318.	61474.	3528.	2129.	91.	1891.	65435.
1906	58090.	2409950.	464590.	19067.	12735.	0.	0.	477325.
1907	40541.	1767023.	353475.	2456.	1602.	259.	5354.	360432.
1913	20.	602.	92.	41.	25.	25.	517.	633.
1914	35.	380.	52.	11.	6.	27.	558.	616.
1917	7.	0.	0.	397.	323.	1.	21.	344.
1920	333.	1149.	201.	16571.	16720.	49.	1013.	17934.
1921	246.	639.	80.	26334.	16499.	0.	0.	16909.
1922	956.	426.	57.	24477.	16529.	87.	1798.	18456.
1923	2042.	2322.	335.	53158.	34485.	154.	3183.	38004.
1924	157.	488.	64.	5446.	3637.	18.	372.	4073.
1926	492.	1712.	236.	9267.	5755.	26.	537.	6529.
1927	50.	25.	3.	53.	30.	0.	0.	930.
1929	1750.	6771.	1226.	5761.	3053.	29.	599.	5437.
1930	14.	0.	0.	7.	3.	8.	165.	158.
1931	18.	150.	12.	41.	12.	6.	124.	148.
1934	1007.	1025.	86.	3448.	1654.	63.	2205.	4009.
1935	127.	3233.	280.	895.	575.	3.	105.	1018.
1936	234.	100.	9.	2323.	1047.	10.	350.	1550.
1938	13.	0.	0.	9.	4.	10.	350.	354.
1939	275.	0.	0.	527.	206.	9.	315.	521.
1940	60.	5130.	579.	169.	59.	2.	70.	708.
1941	39.	4000.	472.	114.	40.	3.	105.	617.
1942	30.	1200.	141.	246.	94.	4.	140.	376.
1944	49.	3200.	377.	90.	40.	1.	35.	452.
1948	2.	0.	0.	21.	16.	0.	0.	16.
1950	10.	0.	0.	53.	39.	0.	0.	39.
1953	3.	0.	0.	16.	14.	0.	0.	324.
1959	1.	0.	0.	0.	0.	1.	35.	35.
1960	16.	100.	32.	49.	44.	14.	490.	1193.
1963	1.	0.	0.	0.	0.	1.	35.	35.
1968	15.	0.	0.	74.	158.	0.	0.	158.
TOTALS	117356.	4603943.	883874.	176049.	118264.	911.	20566.	1025882.

YEAR	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	TOTAL VALUE ALL METALS
1902	100.	0.	0.	0.	0.	0.	0.	937.
1905	10623.	0.	0.	0.	0.	0.	0.	65485.
1906	58090.	0.	0.	0.	0.	0.	0.	477325.
1907	40541.	0.	0.	0.	0.	0.	0.	360432.
1913	20.	0.	0.	0.	0.	0.	0.	633.
1914	35.	0.	0.	0.	0.	0.	0.	616.
1917	7.	0.	0.	0.	0.	0.	0.	344.
1920	333.	0.	0.	0.	0.	0.	0.	17934.
1921	246.	7267.	330.	0.	0.	0.	0.	16909.
1922	956.	1418.	81.	0.	0.	0.	0.	18456.
1923	2042.	0.	0.	0.	0.	0.	0.	38004.
1924	157.	0.	0.	0.	0.	0.	0.	4073.
1926	492.	0.	0.	0.	0.	0.	0.	6529.
1927	50.	14020.	947.	0.	0.	0.	0.	930.
1929	1750.	8900.	608.	0.	0.	0.	0.	5437.
1930	14.	0.	0.	0.	0.	0.	0.	158.
1931	18.	0.	0.	0.	0.	0.	0.	148.
1934	1007.	1649.	64.	0.	0.	0.	0.	4009.
1935	127.	1432.	58.	0.	0.	0.	0.	1018.
1936	234.	3248.	153.	0.	0.	0.	0.	1560.
1938	13.	0.	0.	0.	0.	0.	0.	354.
1939	275.	0.	0.	0.	0.	0.	0.	521.
1940	60.	0.	0.	0.	0.	0.	0.	708.
1941	39.	0.	0.	0.	0.	0.	0.	617.
1942	30.	0.	0.	0.	0.	0.	0.	376.
1944	49.	0.	0.	0.	0.	0.	0.	452.
1948	2.	0.	0.	0.	0.	0.	0.	16.
1950	10.	0.	0.	0.	0.	0.	0.	39.
1953	3.	2300.	310.	0.	0.	0.	0.	324.
1959	1.	0.	0.	0.	0.	0.	0.	35.
1960	16.	26000.	304.	2500.	323.	0.	0.	1193.
1963	1.	0.	0.	0.	0.	0.	0.	35.
1968	15.	0.	0.	0.	0.	0.	0.	158.
TOTALS	117356.	66234.	2856.	2500.	323.	0.	0.	1025832.

COUNTY: PINAL MINING DISTRICT: SADDLE MTNS

GRAND TOTAL FOR SADDLE MTNS MINING DISTRICT, BY ORE TYPE

GRAND TOTAL FOR SADDLE MTNS MINING DISTRICT, BY ORE TYPE

YEARS OF REPORTED PRODUCTION
1902,1905-1907,1913-1914,1917,1920-1924,1926-1927,1929-1931,1934-1936,1938-1942,1944,1948,1950,1953,
1959-1960,1963,1968

ORE TYPE	ORE TREATED (SHORT TONS)	COPPER (POUNDS)	COPPER (DOLLARS)	SILVER (OUNCES)	SILVER (DOLLARS)	GOLD (OUNCES)	GOLD (DOLLARS)	TOTAL VALUE ALL METALS
NC	109554.	4591531.	882284.	25746.	16783.	358.	7472.	906539.
NGS	270.	0.	0.	526.	206.	7.	245.	451.
NG	378.	2016.	233.	447.	224.	162.	4352.	4809.
NLZ	16.	100.	32.	49.	44.	14.	490.	1193.
NL	1678.	3281.	331.	5698.	3029.	27.	572.	5797.
NS	5460.	7015.	994.	143583.	97979.	343.	7434.	107093.
TOTALS	117356.	4603943.	883874.	176049.	118264.	911.	20566.	1025882.

ORE TYPE	ORE TREATED (SHORT TONS)	LEAD (POUNDS)	LEAD (DOLLARS)	ZINC (POUNDS)	ZINC (DOLLARS)	MOLYBDENUM (POUNDS)	MOLYBDENUM (DOLLARS)	TOTAL VALUE ALL METALS
NC	109554.	0.	0.	0.	0.	0.	0.	906539.
NGS	270.	0.	0.	0.	0.	0.	0.	451.
NG	378.	0.	0.	2500.	323.	0.	0.	4809.
NLZ	16.	26000.	304.	0.	0.	0.	0.	1193.
NL	1678.	25220.	1865.	0.	0.	0.	0.	5797.
NS	5460.	15014.	687.	0.	0.	0.	0.	107093.
TOTALS	117356.	66234.	2856.	2500.	323.	0.	0.	1025882.

IGNEOUS INTRUSIONS AND ASSOCIATED MINERALIZATION IN THE SADDLE MOUNTAIN MINING DISTRICT PINAL COUNTY, ARIZONA

by

Larry Frank Barrett

A thesis submitted to the faculty of the
University of Utah in partial fulfillment of the requirements
for the degree of

Master of Science

Department of Geological and Geophysical Sciences

University of Utah

June 1972

ACKNOWLEDGEMENTS

WILLIAMSON CANYON VOLCANICS

78

DATA SHEET FOR CHEMICAL AND AGE DATA

FOR IGNEOUS COMPLEXES

LOCATION: *Williamson Canyon Volcanics, SE Arizona* PINAL COUNTY

LOCATION COORDINATES:

K_{55} : 2.65] ~2.8 — CA-AC fields
$K_{57.5}$: 3.15
K_{60} : 3.75

KCa: – CA-AC [most in CA] fields.
KMg: ~57.0 AC
Fe: weakly rich
Al: 0.665 – 0.950

PEACOCK INDEX:
Metaluminous, alkali-calcic or calc-alkalic, weakly iron-rich.

ROCKS INVOLVED:

AGE DATA: 80 – 74 m.y. [TOMBSTONE ASSEMBLAGE – Mojave Metaluminous]

COMMENTS:

Rocks related to Williamson Canyon volcanics have three dates ranging from 80-74 m.y. Volcanics are intruded by probable 72-70 m.y. calcalkaline intrusions.

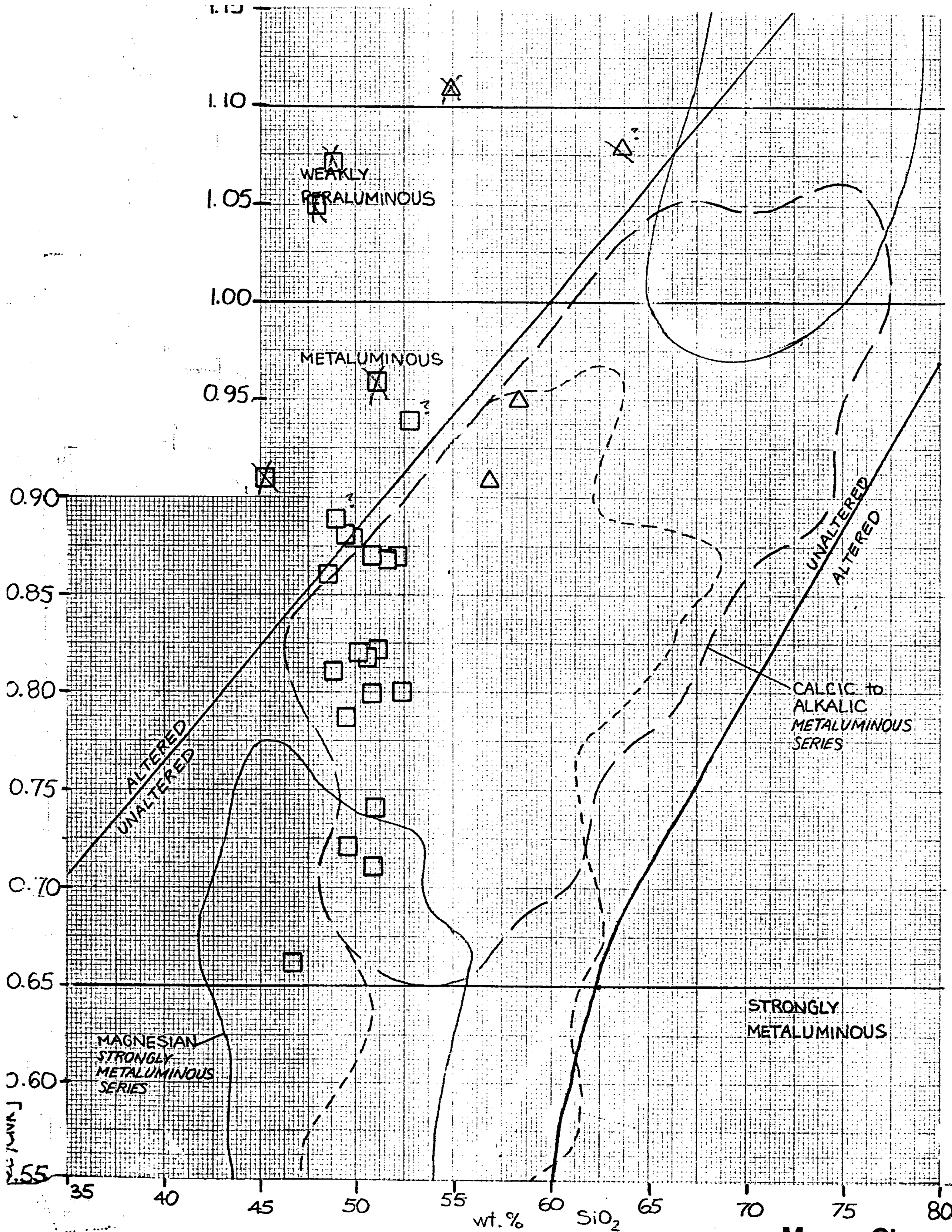
REFERENCES FOR CHEMICAL DATA:

Koski (1978); Keith, Nielsen, Barrett, Rehrig, unpub. data

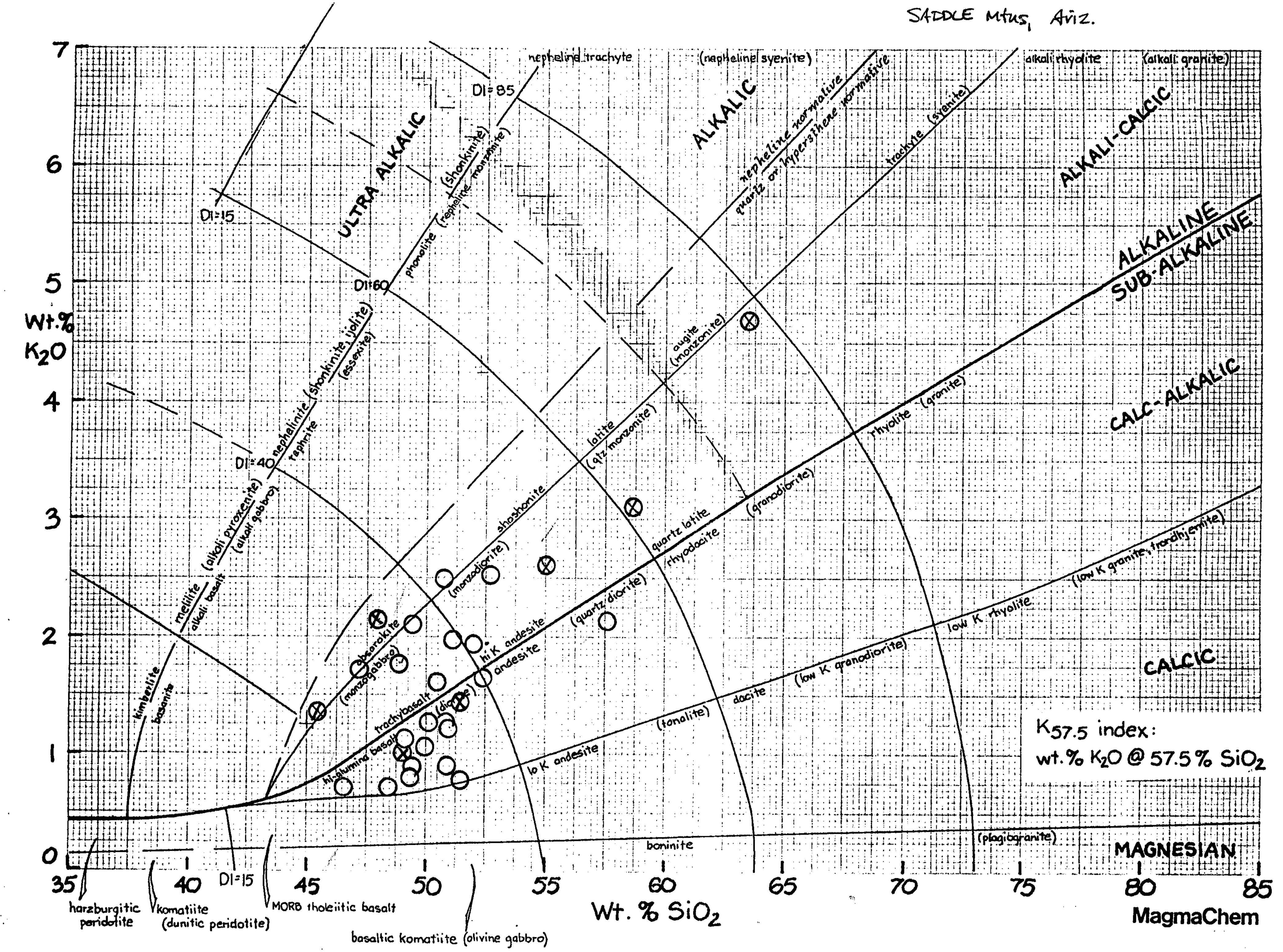
REFERENCES FOR AGE DATA:

Koski (1978); Keith and Damon unpub. data

SADDLE Mtn, Ariz



SADDLE Mtns, Ariz.



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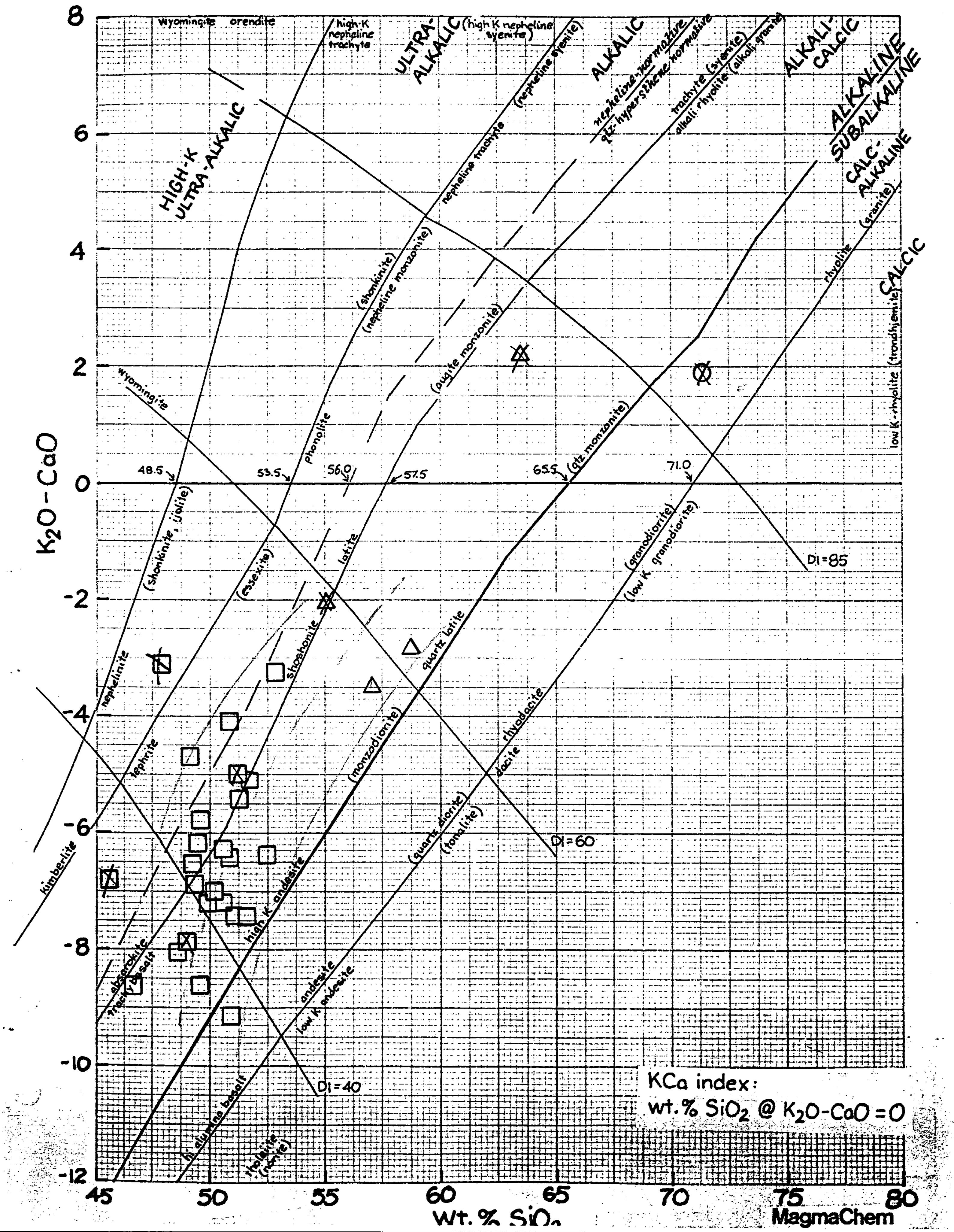

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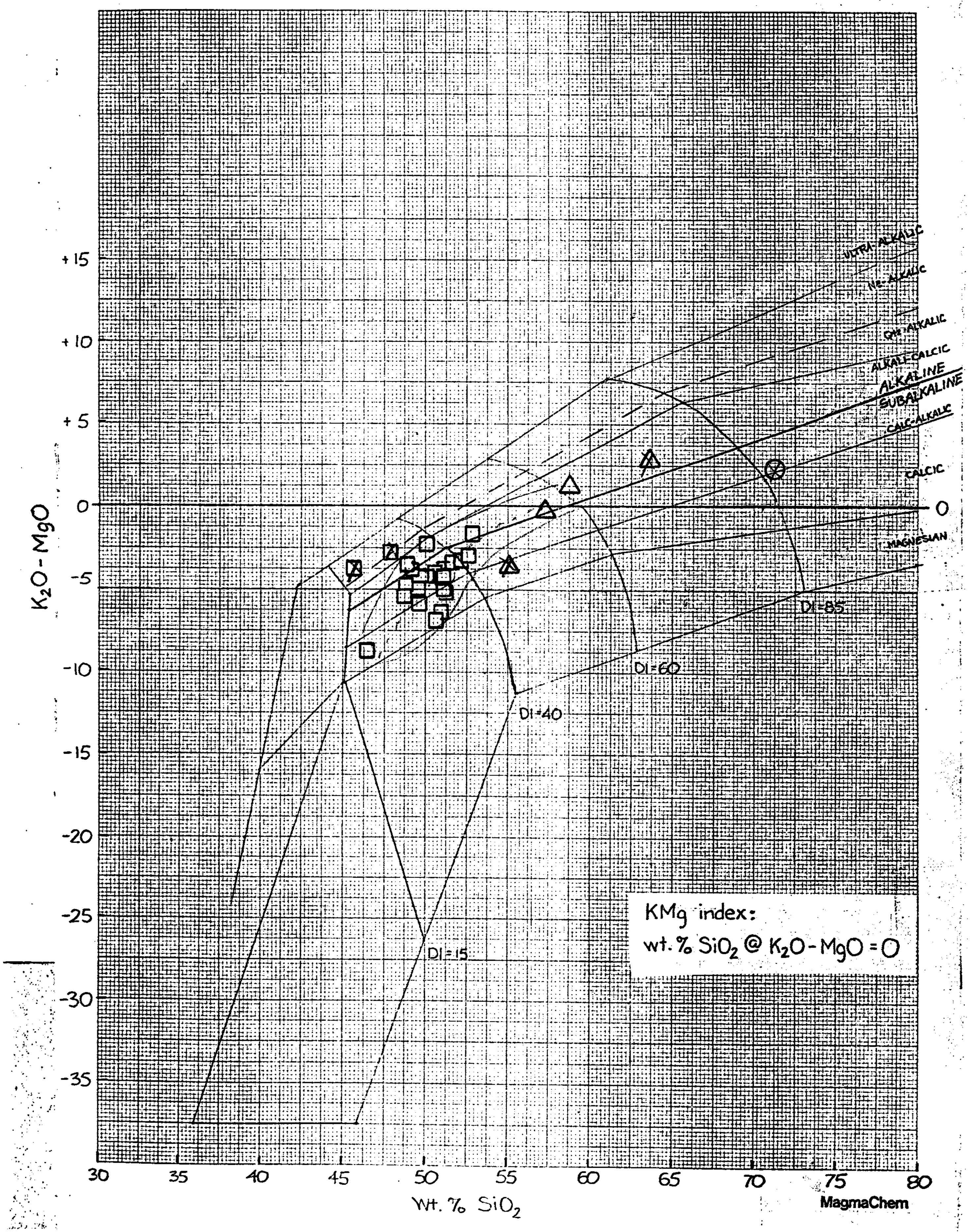
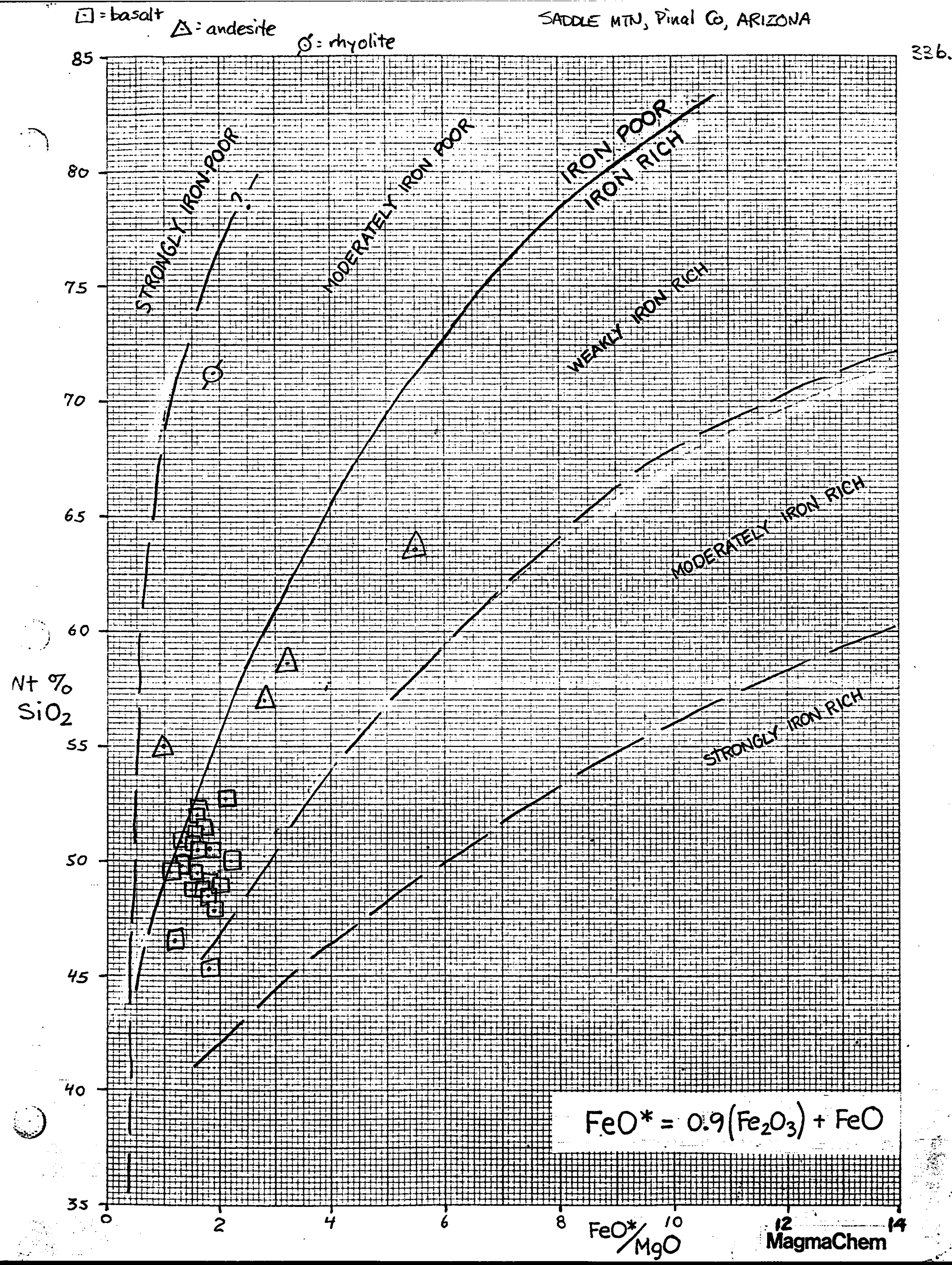
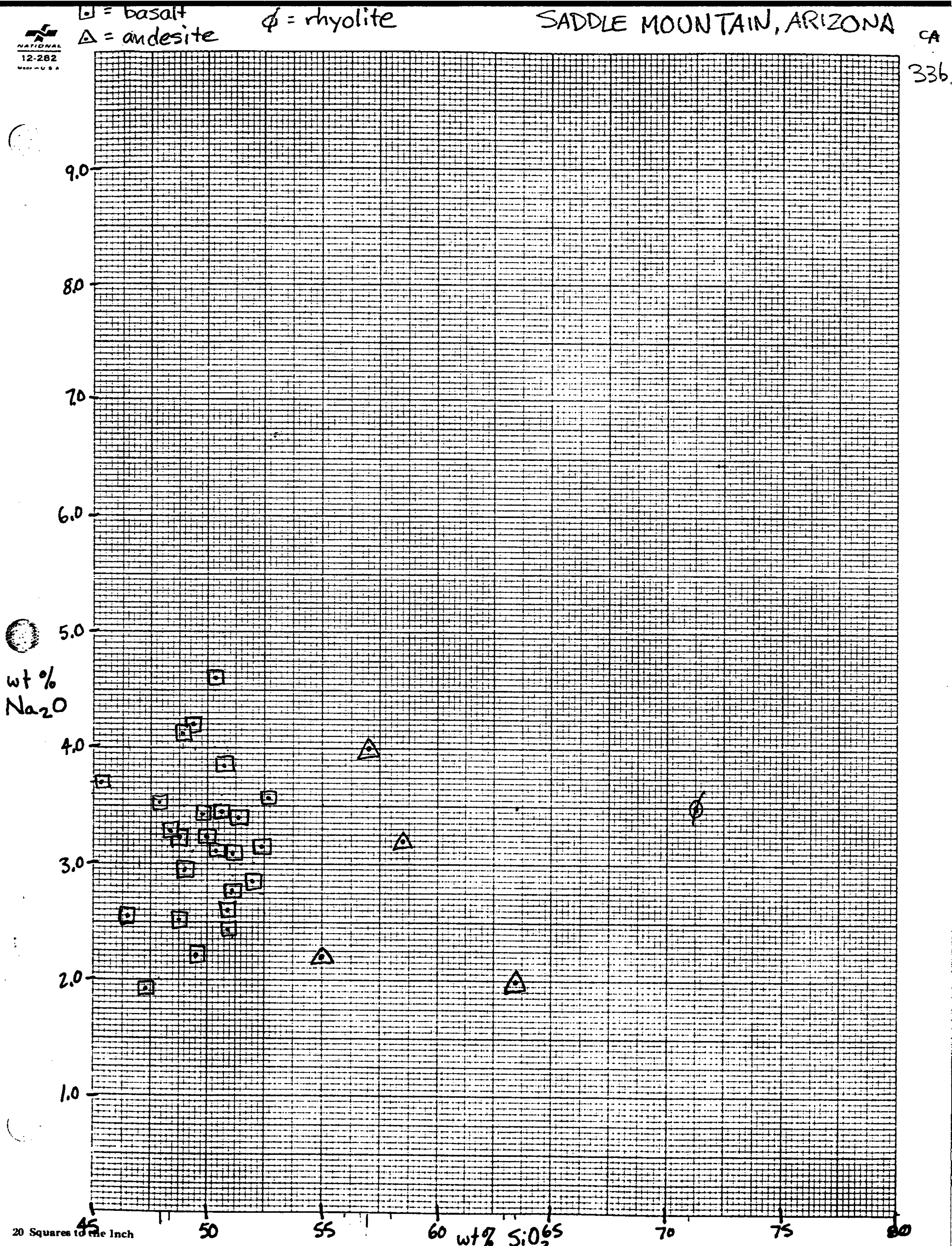
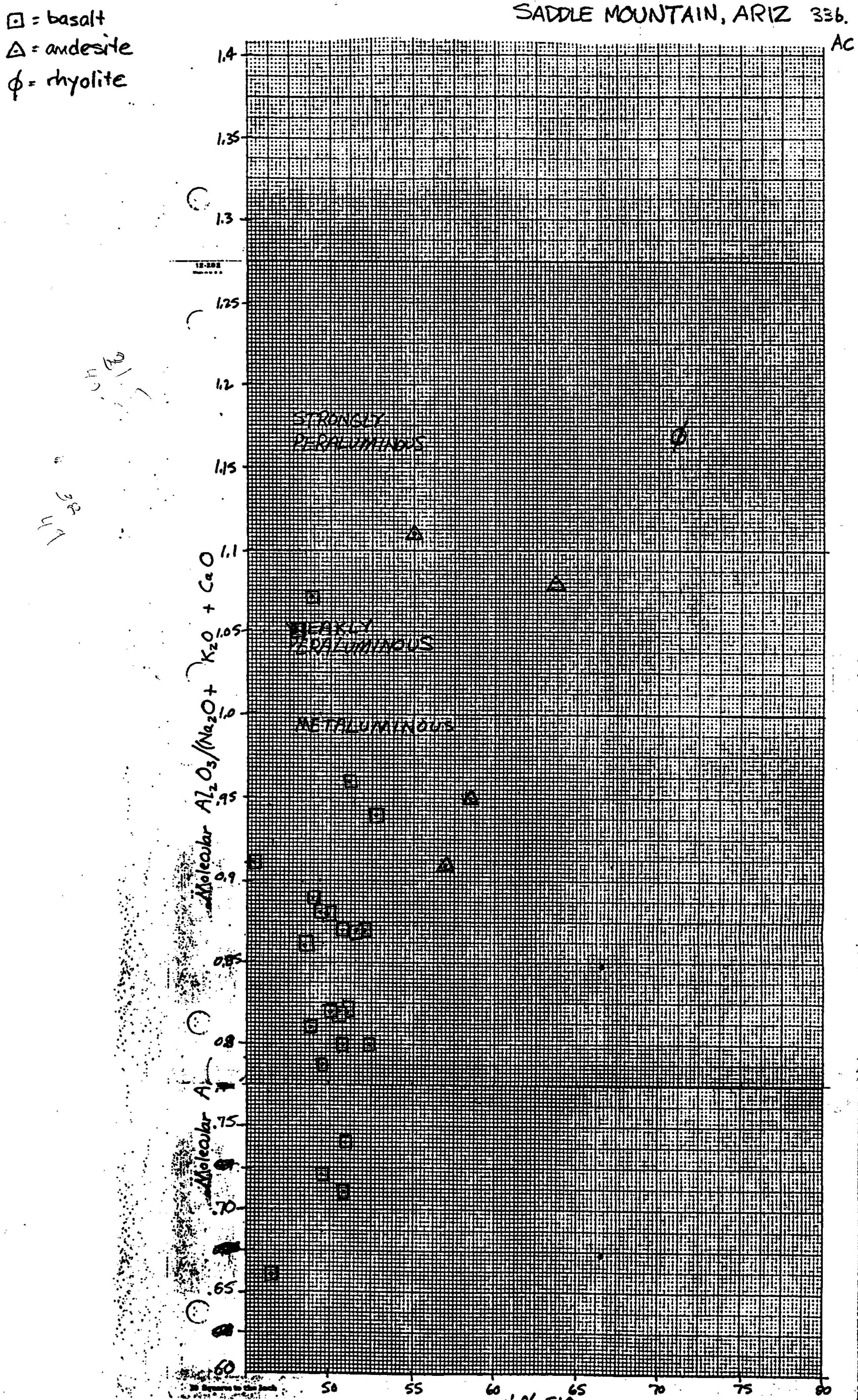


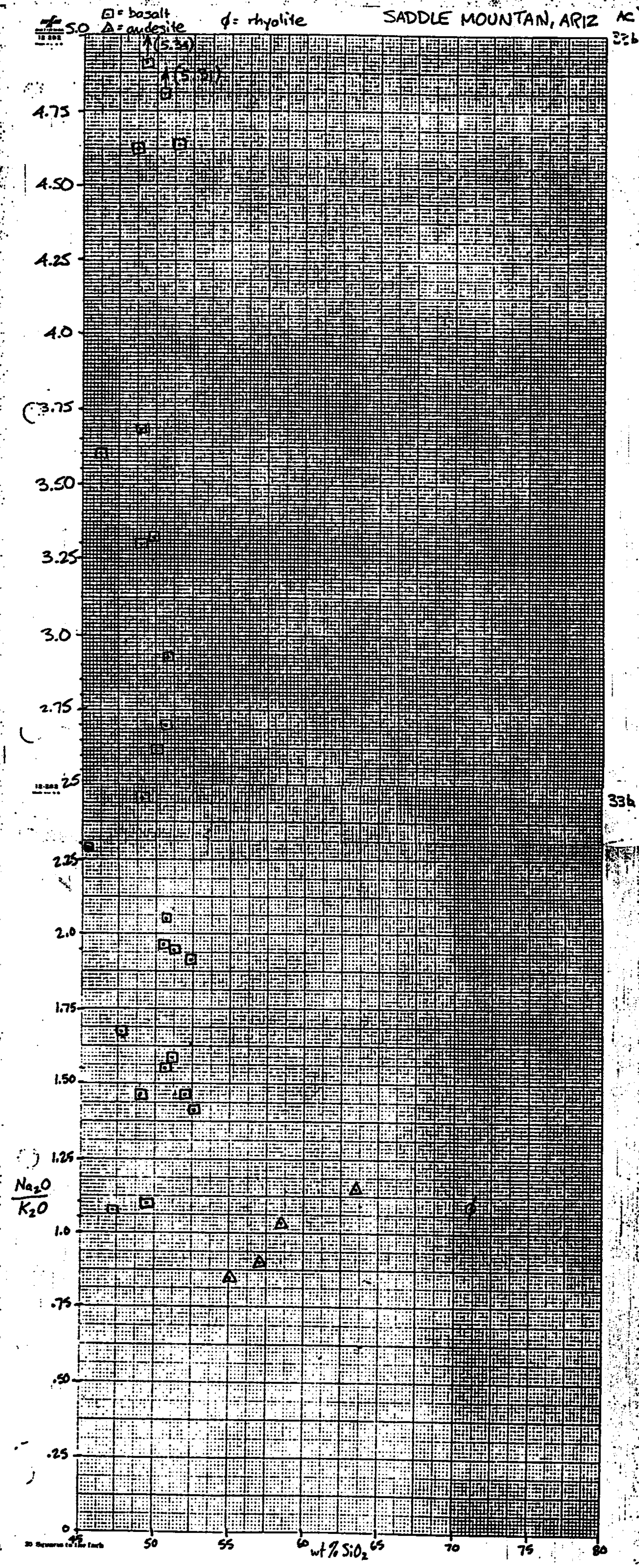


⊡ = basalt
△ = andesite
⊘ = rhyolite
SADDLE MTN, Pinal Co, ARIZONA
STRONGLY IRON-POOR
MODERATELY IRON POOR
IRON POOR
IRON RICH
WEAKLY IRON RICH
MODERATELY IRON RICH
STRONGLY IRON RICH
Wt % SiO2
85
80
75
70
65
60
55
50
45
40
35
0
2
4
6
8
10
12
14
FeO*/MgO
FeO* = 0.9(Fe2O3) + FeO
MagmaChem


⊡ = basalt
△ = andesite
ϕ = rhyolite
SADDLE MOUNTAIN, ARIZONA
CA
336
NATIONAL
12-282
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
wt %
Na_2O
45
50
55
60
65
70
75
80
wt% SiO_2
20 Squares to the Inch

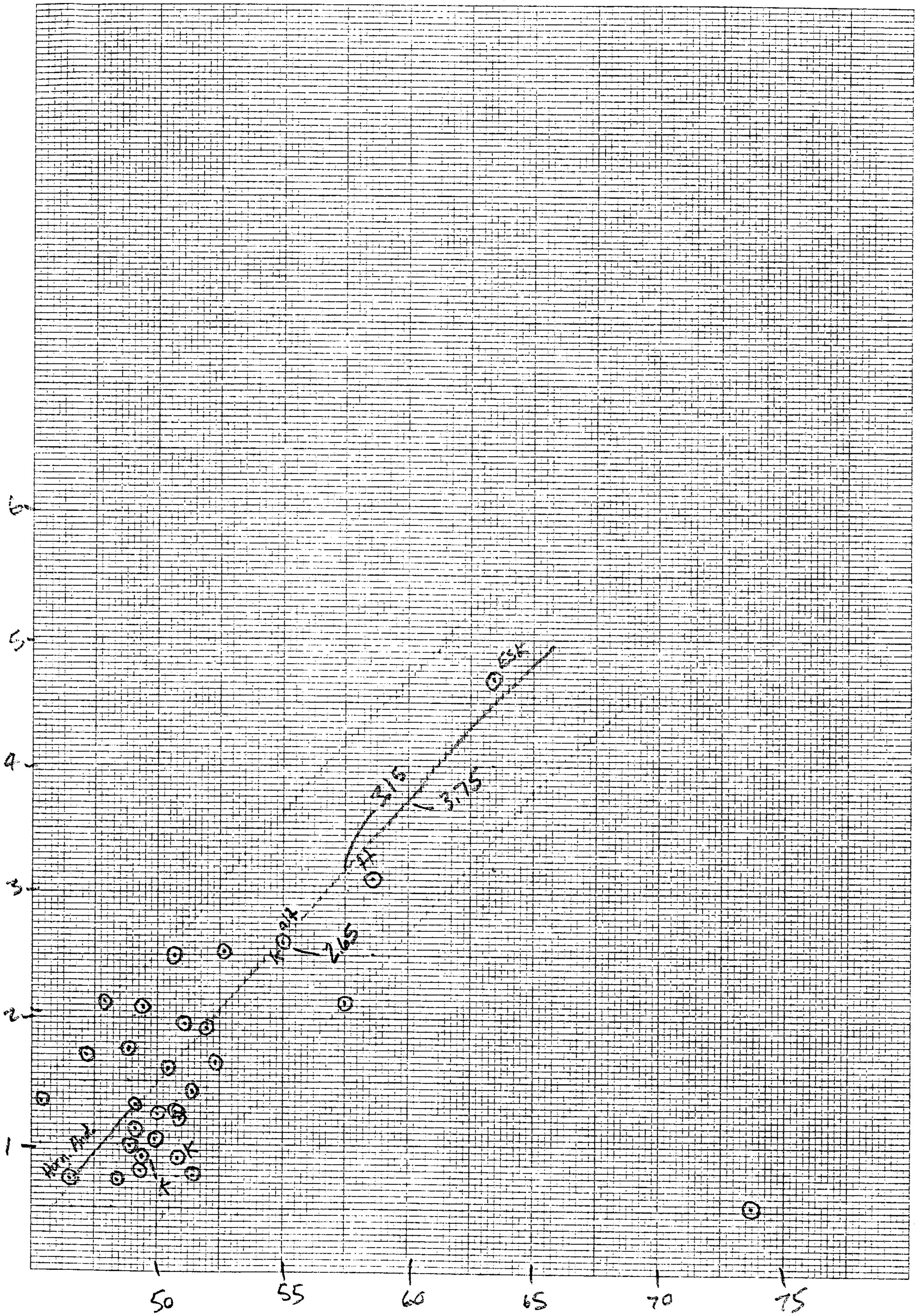


⊡ = basalt
△ = andesite
ϕ = rhyolite
AC
STRONGLY PERALUMINOUS
WEAKLY PERALUMINOUS
METALUMINOUS
Molecular $Al_2O_3/(Na_2O+K_2O+CaO)$
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1.0
.95
0.9
0.85
0.8
.75
.70
.65
.60
50
55
60
65
70
75
80



□ = basalt
Δ = andesite
ϕ = rhyolite
SADDLE MOUNTAIN, ARIZ
(5.34)
(5.31)
5.0
4.75
4.50
4.25
4.0
3.75
3.50
3.25
3.0
2.75
2.5
2.25
2.0
1.75
1.50
1.25
1.0
.75
.50
.25
0
$\frac{Na_2O}{K_2O}$
45
50
55
60
65
70
75
80
wt % SiO_2
33b

SADDLE MOUNTAIN,



L. Clayton

Kennecott Exploration, Inc.

Exploration Services Department

Geochemical Research and Laboratory Division

March 11, 1975

MEMO TO: John C. Wilson

FROM: Lloyd A. Clark

SUBJECT: Chemical Classification of the Williamson Canyon Volcanics, Pinal Co., Arizona by Larry B. Clayton

In this phase of the 1974 Andesite Research, it was hoped to define the eruptive center of the volcanic edifice, and to establish relations between volcanic differentiation, genesis of the Laramide stocks and dikes, and the O'Carroll Canyon sulfide system. However, the several thousands of feet of volcanic rocks are all basalts and are undifferentiated. Probably the original volcanic pile was several times thicker and more laterally extensive. It now is apparent that erosion has removed that part of the volcanic pile necessary to accomplish the research objectives.

Lloyd

Lloyd A. Clark

LAC/db
Attachment

cc: R. C. Babcock
N. A. Gambell
R. L. Nielsen
G. D. Van Voorhis

CHEMICAL CLASSIFICATION OF THE
WILLIAMSON CANYON VOLCANICS, PINAL CO., ARIZONA

by
L. B. Clayton

February, 1975

SUMMARY

A six-mile traverse was completed starting at the Gila River and continuing east along the border between T. 4 S. and T. 5 S. into Reed Basin (R. 16 E. and R. 17 E.). Fresh rock chip samples were collected approximately every fifty feet in composite samples over intervals of 500 to 2,000 feet. The traverse crossed the entire north limb of the Deer Creek Syncline and continued down the plunge of the Syncline to the east. This represents a volcanic section in excess of 3,000 feet. At least 85% of the section sampled was pyroclastic in origin. Fragment size varied from lapilli to breccia blocks, usually subangular. Only two flow units were observed in the pile.

Whole rock chemistry, heavy liquid separations, X-ray diffraction and thin section studies indicate that the volcanic pile was derived from a subalkaline magma. The rocks can further be classified as calc-alkaline based on high alumina content and location on an AFM diagram. Plagioclase, the common phenocryst mineral, also supports the calc-alkaline classification. However, the common lithologic variation normally observed in calc-alkaline volcanics (basalt-andesite-dacite-rhyolite) is not developed. All samples collected are basalts, which suggest that the majority of the volcanic pile has been eroded away.

INTRODUCTION

The Williamson Canyon volcanic pile was studied to determine if the source volcano could be located and genetically related to the O'Carroll sulfide system or any other system, or if the volcanic pile is early Cretaceous in age simply acting as a host to mineralization.

The normal volcanic differentiation sequence of basic to intermediate to felsic flows and pyroclastic is an easily mappable feature which can be verified geochemically. From these data an eruptive center can be predicted. The volcanic differentiation is usually followed by emplacement of stocks and plugs in and around the eruptive center, and if located, may provide areas with high mineral exploration potential. The late stage magmatic activity is often expressed as a dike swarm along a major structural trend similar to that at O'Carroll Canyon.

A total of nineteen rock chip composite samples were collected. These are combined with other data on volcanic rocks available from drill hole OC-1 and Hansen ddh (Fig. 2). The samples represent a volcanic section in excess of 3,000 feet across the north limb to the axis and down the plunge of the Deer Creek Syncline (Fig. 1). Every attempt was made to omit obviously mineralized material from the samples. Samples were collected as far as possible from dikes and mineralized fissures. Approximately one fragment (3-5 cm) of rock was collected every 50 feet after chipping away the weathered surface. Two to four pounds of sample were collected for each composite (Fig. 2).

Whole rock wet chemical analyses, spectrographic (semi-quantitative) analyses (for possibly anomalous metals), thin sections and X-ray diffraction work were performed on the samples (see Appendix).

DISCUSSION

Field observation indicated that 85% of the rocks collected are pyroclastic in origin. Fragments range in size from lapilli to breccia blocks usually subangular. Only two flow units were observed in the pile. One occurs at the base of the pile (Sample 1) and is a dense, black aphanitic unit, several hundred feet thick. The second flow unit is amygdaloidal, also several hundred feet thick (Samples 6 & 7), and lays conformably upon interbedded sediments within the volcanic pile at the head of Little Gold Gulch. Mineralization was observed in the pyroclastic rocks above the amygdaloidal flow (Samples 8, 9, and 10).

Classification based on chemical composition indicates that the bulk of the volcanic rocks falls in the subalkaline field (Figure 3a) and can be further classified as calc-alkaline based on the AFM diagram ($A=K_2O+Na_2O$, $F=FeO + 0.8998\,Fe_2O_3$, $M=MgO$) (Fig. 4a). The calc-alkaline classification is further supported by the high alumina content which is the most prominent chemical difference between more basic volcanic rocks. "The calc-alkaline basalts and andesites are generally high alumina types containing 16 to 20% Al_2O_3, whereas their tholeiitic counterparts have only 12-16%" (Irvine and Baragar, 1971). The average for the Williamson Canyon pyroclastics is 18.13% Al_2O_3. Further classification, based on silica content (average pyroclastic 50.55% SiO_2) and CaO - K_2O - Na_2O ratio (Fig. 4b), indicate that the rocks are basalts. The weakly mineralized samples at the head of Little Gold Gulch (Samples 8, 9, and 10) show increases in SiO_2, K_2O, and possibly Na_2O relative to the unaltered samples.

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Brief examination of thin sections in most cases confirms the pyroclastic texture of the samples. However, some samples that were obviously pyroclastic in outcrop appear to be flows in section because of large fragment size. Fresh plagioclase is present in Samples 1, 6, 12, and 13. In the remaining sections plagioclase shows varying degrees of clay alteration, presumably as a result of weathering or possible low grade metamorphism. Chlorite occurs in most samples as a result of alteration or weathering the mafic minerals. Little quartz was detected in thin section; however, X-ray diffraction indicates the presence of quartz in most samples.

Heavy liquid separations (> 2.8 gm/cc) were made and X-rayed on eight of the nineteen samples (see Appendix). Results indicate the presence of chlorite in most of the samples. Magnetite was detected in all the samples and pyrite was present in Sample 18 along with trace amounts of epidote, chlorite, and hematite. Pyroxene (augite) is present in most of the samples taken at and above the amygdoloidal flow with amphiboles present throughout most of the samples (both X-ray and thin section). Olivine was not detected in any of the X-ray or thin section work.

Reference

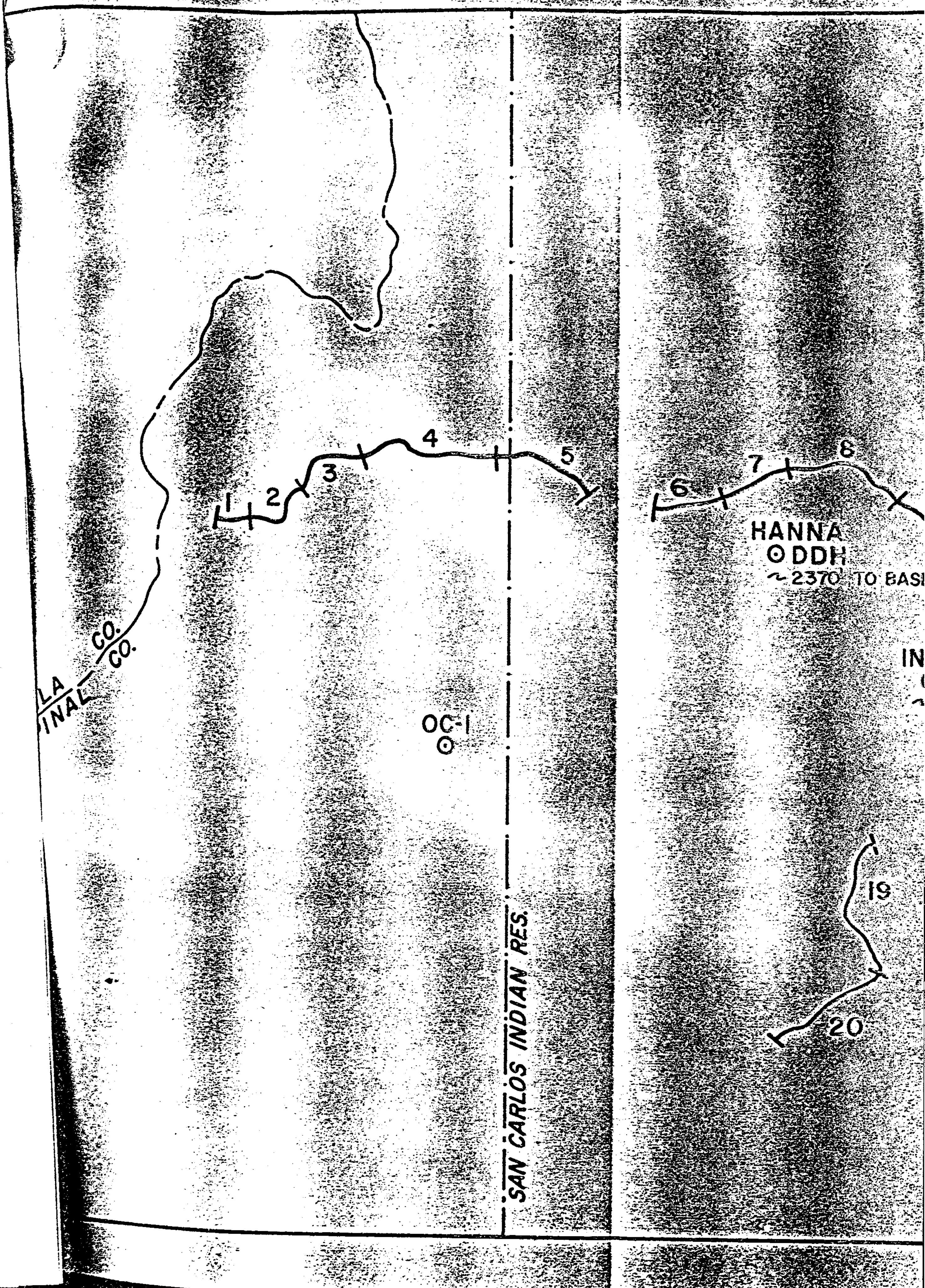
Irvine, T.N. and Baragar, W.R.A., 1971, A guide to chemical classification of common volcanic rocks: Canadian Jour. Earth Science, v. 8, p. 523-548.

Larry B. Clayton

LBC:vcl
Attachments

APPENDIX - Wet Chemical, Spectrographic and X-ray Analysis of Williamson Canyon Volcanics

D.I.	Sample	SiO2	Al2O3	Fe2O3	FeO	MgO	CaO	Na2O	K2O	S ppm	H2O+	CO2	Cu ppm	Zn ppm	Pb ppm	Cd ppm	As ppm	Ag ppm	Sb ppm	Te ppm	Bi ppm	Ni ppm	Mo ppm	Pd ppm	Pt ppm	Au ppm	TiO2	P2O5	MnO	BaO ppm	SrO ppm	X-RAY ID OF MINERAL IN > 2.8 gm/cc FRACTION
		WET CHEMICAL ANALYSIS													SPECTROGRAPHIC ANALYSIS																	
33.5	OCA-1	48.4	19.2	6.12	4.97	5.96	8.73	3.27	.708	95	2.67	.75	63	118	5	< 1	< 200	< 1	< 200	< 200	< 2	31	10	< 10	< 20	< 4	.8	<.1	.1	169 / 190	550	Plag., Mte., Amphibole, Chl.
44.9	OCA-2	50.4	19.4	5.42	4.20	5.12	8.02	4.61	.868	98	3.04	.97	53	104	7	< 1	< 200	< 1	< 200	< 200	< 2	20	10	< 10	< 20	< 4	.65	<.1	.1	240 / 270	675	NA
36.45	OCA-3	51.4	18.9	5.26	4.24	5.34	8.17	3.45	.747	174	2.37	.61	59	91	7	< 1	< 200	< 1	< 200	< 200	< 2	34	7	< 10	< 20	< 4	.7	<.1	.11	205 / 230	725	Plag., Qtz., Amphibole, Mte., Chl., Calcite, Kaolinite?
45.07	OCA-4	48.9	19.1	7.13	2.46	4.52	7.64	4.12	1.12	63	3.36	1.67	70	77	6	< 1	< 200	< 1	< 200	< 200	< 2	26	11	< 10	< 20	< 4	.65	<.1	.085	329 / 370	850	NA
44.5	OCA-5	49.3	18.1	5.95	2.89	5.08	6.98	4.23	.792	54	4.08	1.38	111	85	11	"	"	"	"	"	"	48	9	"	"	"	.7	"	.1	218 / 245	1000	NA
33.35	OCA-6	50.9	15.7	4.06	4.98	6.81	8.62	2.43	1.21	427	2.90	.32	126	89	6	"	"	"	"	"	"	100	9	"	"	"	.7	.3	.1	343 / 385	700	Plag., Amphibole, Mte., Chl., Kaolinite?, Pyroxene?
36	OCA-7	49.4	14.7	4.78	5.07	8.08	7.82	2.31	2.09	182	3.79	.39	32	175	10	"	"	"	"	"	"	150	8	"	"	"	.65	.33	.15	418 / 470	500	NA
50.5	OCA-8	50.7	18.5	4.92	3.84	4.89	6.54	3.86	2.49	483	3.51	.78	77	102	5	"	"	"	"	"	"	38	10	"	"	"	.6	.27	.095	294 / 330	725	NA
48.95	OCA-9	52.7	18.2	5.72	3.53	4.17	5.78	3.58	2.52	198	2.95	1.70	35	138	7	"	"	"	"	"	"	30	7	"	"	"	.6	.3	.1	374 / 420	620	Plag., Qtz., Amphibole, Chl., Mte., Augite, Calcite
59.05	OCA-10	57.0	17.7	5.56	1.60	2.35	5.57	4.00	2.12	102	3.06	1.33	46	95	7	"	"	"	"	"	"	13	6	"	"	"	.65	.36	.09	436 / 490	950	Plag., Qtz., Chl., Magnetite, Hematite
42.15	OCA-11	52.3	17.4	7.38	1.11	4.79	7.93	3.15	1.65	37	2.58	.34	99	90	7	"	"	"	"	"	"	50	10	"	"	"	.7	.15	.1	400 / 450	700	Plag., Mte., Augite, Chlorite?
40	OCA-12	50.7	17.0	7.79	1.60	5.68	7.68	3.45	1.26	58	4.10	.22	109	90	6	"	"	"	"	"	"	60	11	"	"	"	.7	.15	.11	329 / 370	725	NA
40.9	OCA-13	50.0	19.1	6.23	2.10	3.49	8.20	3.24	1.24	79	4.54	.54	53	78	7	"	"	"	"	"	"	20	12	"	"	"	.85	<.1	.095	551 / 620	950	NA
41.35	OCA-15	52.0	17.1	7.92	1.18	5.31	6.96	2.85	1.91	52	3.58	<.2	103	92	6	"	"	"	"	"	"	54	9	"	"	"	.65	"	.09	436 / 490	600	Plag., Mte., Augite, Chl?, Montmorillonite
37.75	OCA-16	48.8	18.4	5.60	2.16	4.30	8.84	3.24	.982	52	3.58	2.35	96	80	5	"	"	"	"	"	"	30	10	"	"	"	.7	"	.09	249 / 280	700	NA
41.5	OCA-17	51.1	17.3	6.42	1.85	4.91	6.38	2.77	1.42	71	4.56	2.76	85	89	8	"	"	"	"	"	"	60	11	"	"	"	.7	"	.095	378 / 425	750	NA
39.8	✓OCA-18	50.8	19.9	4.07	2.98	4.83	7.99	3.31	1.27	1665	2.44	.76	70	132	6	"	"	"	"	"	"	34	9	"	"	"	.6	"	.095	312 / 350	750	Plag., Qtz., Amphibole, Chl., Mte., Hematite, Pyrite?, Epidote
40.5	OCA-19	51.1	17.1	7.96	1.29	5.71	7.39	3.09	1.95	102	3.02	.48	86	96	7	"	"	"	"	"	"	98	9	"	"	"	.7	.17	.085	512 / 575	700	NA
39	OCA-20	50.4	16.9	7.36	2.02	5.58	7.87	3.11	1.59	52	4.02	<.2	69	90	5	"	"	"	"	"	"	78	9	"	"	"	.7	<.1	.08	423 / 475	800	Plag., Qtz., Mte., Augite
47.5	T-4592 Hanson DDH	47.9	18.9	3.35	6.34	4.88	5.21	3.55	2.13	1320	3.82	2.78	19	NA																	NA	NA
34.4	T-5527 OC-1-260'-270'	48.8	19.3	4.73	5.20	6.48	6.43	2.55	1.75	58	4.20	1.21	< 10	122	5	"	"	"	"	"	"	30	11	"	"	"	.85	.1	.065	467 / 525	1000	NA
35.5	T-5580 OC-1-811'-822'	49.1	19.0	4.50	4.94	5.12	8.14	2.90	1.31	6938	3.03	1.38	175	68	4	"	"	"	"	"	"	27	12	"	"	"	.72	<.1	.06	289 / 325	1000	NA
38.5	T-5583 OC-1-865'-873'	49.8	19.3	1.04	5.84	5.25	8.25	3.42	1.03	3425	2.08	.37	118	68	7	"	"	"	"	"	"	40	16	"	"	"	.85	<.1	.065	140 / 270	1000	NA
37.1	T-5309 OC-1-110'-1120'	45.3	19.7	4.65	5.19	5.14	8.18	3.07	1.34	6142	3.18	1.28	185	64	7	"	"	"	"	"	"	26	15	"	"	"	.85	.13	.06	423 / 475	1000	NA



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HANNA
DDH
~2370' TO BAS
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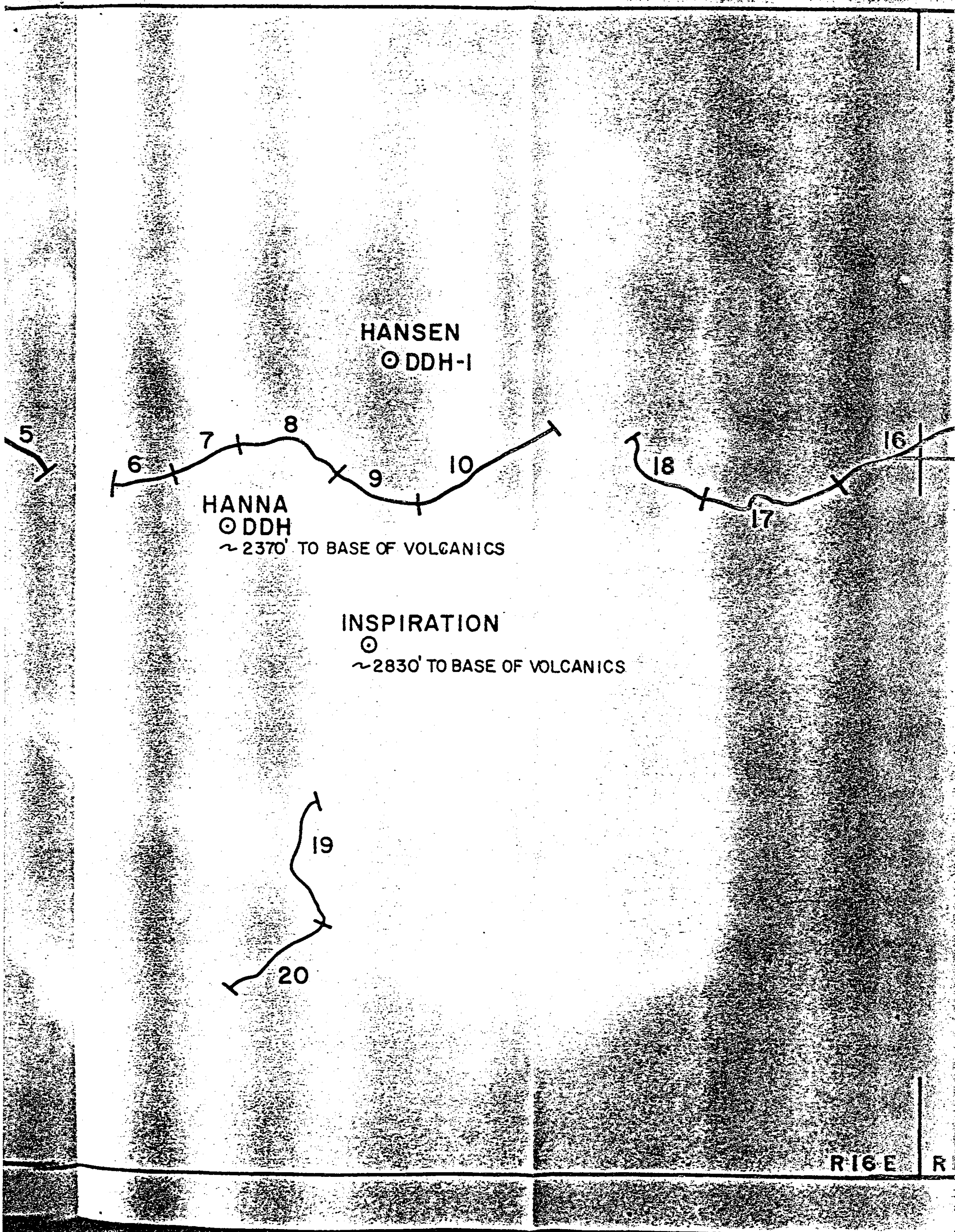

HANSEN
DDH-1
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HANNA
DDH
~2370' TO BASE OF VOLCANICS
INSPIRATION
~2830' TO BASE OF VOLCANICS
19
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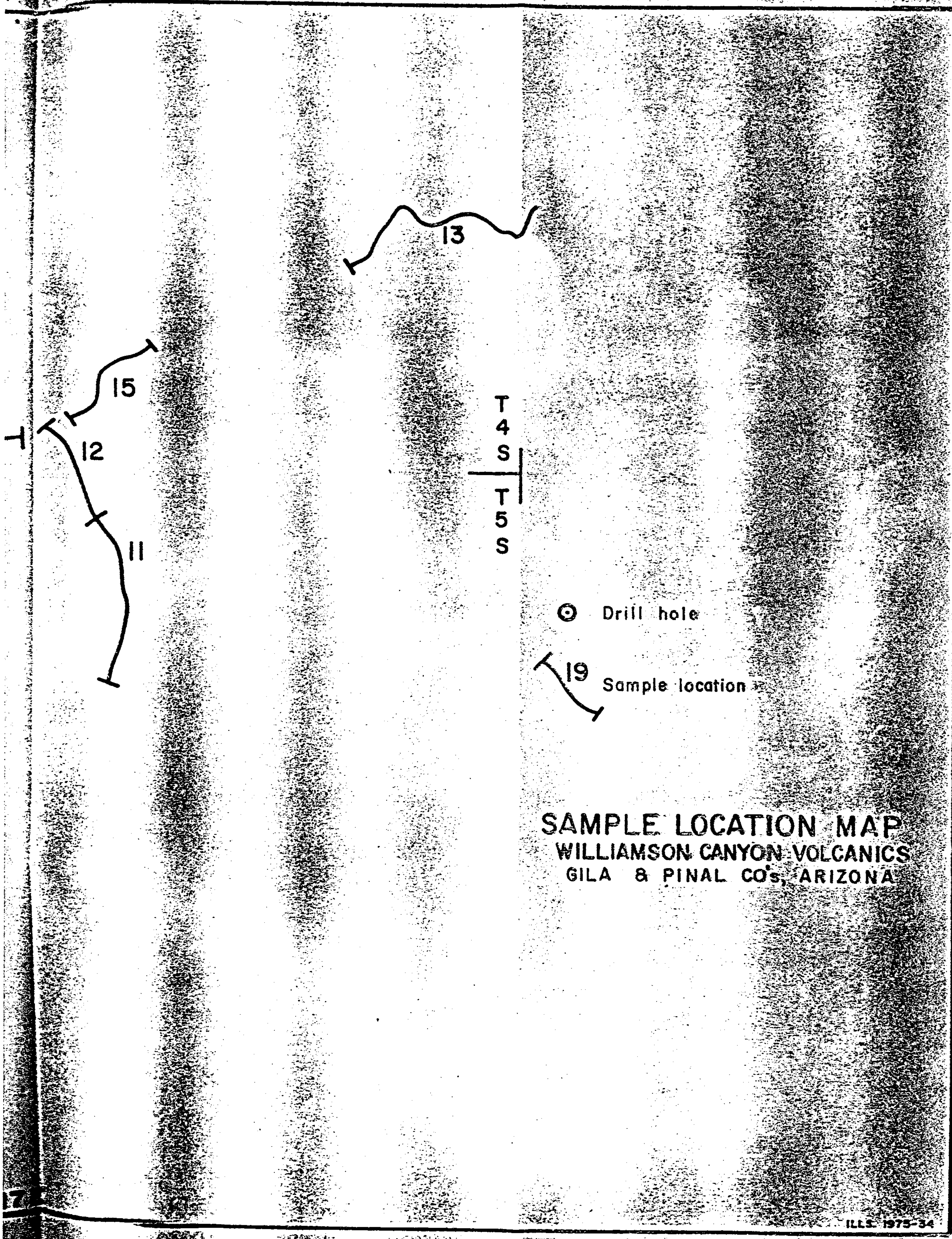
R16E
R

FIGURE-2


13
15
12
11
T 4 S
T 5 S
Drill hole
19 Sample location
SAMPLE LOCATION MAP
WILLIAMSON CANYON VOLCANICS
GILA & PINAL CO's, ARIZONA
ILLS. 1975-34

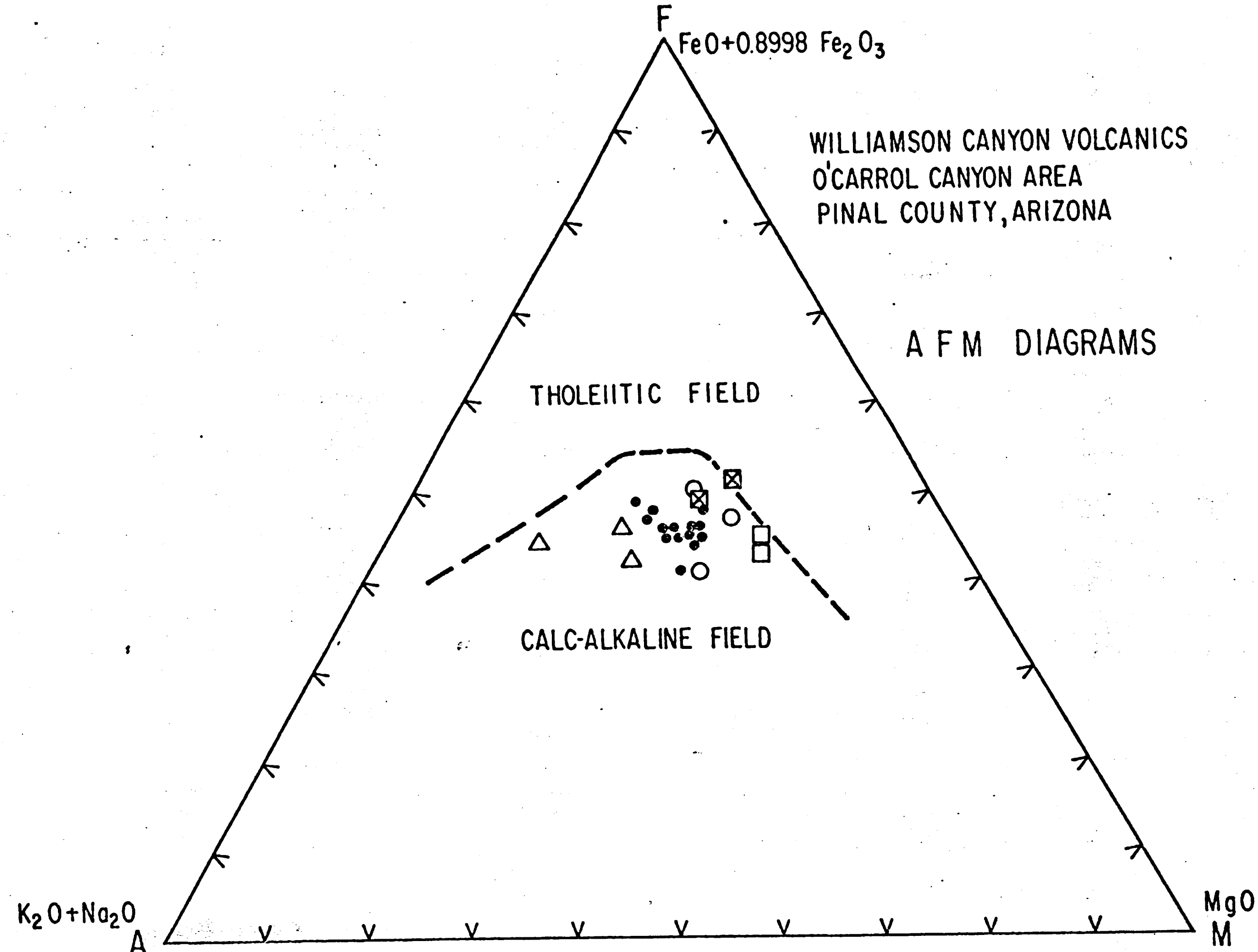


FIGURE-4A

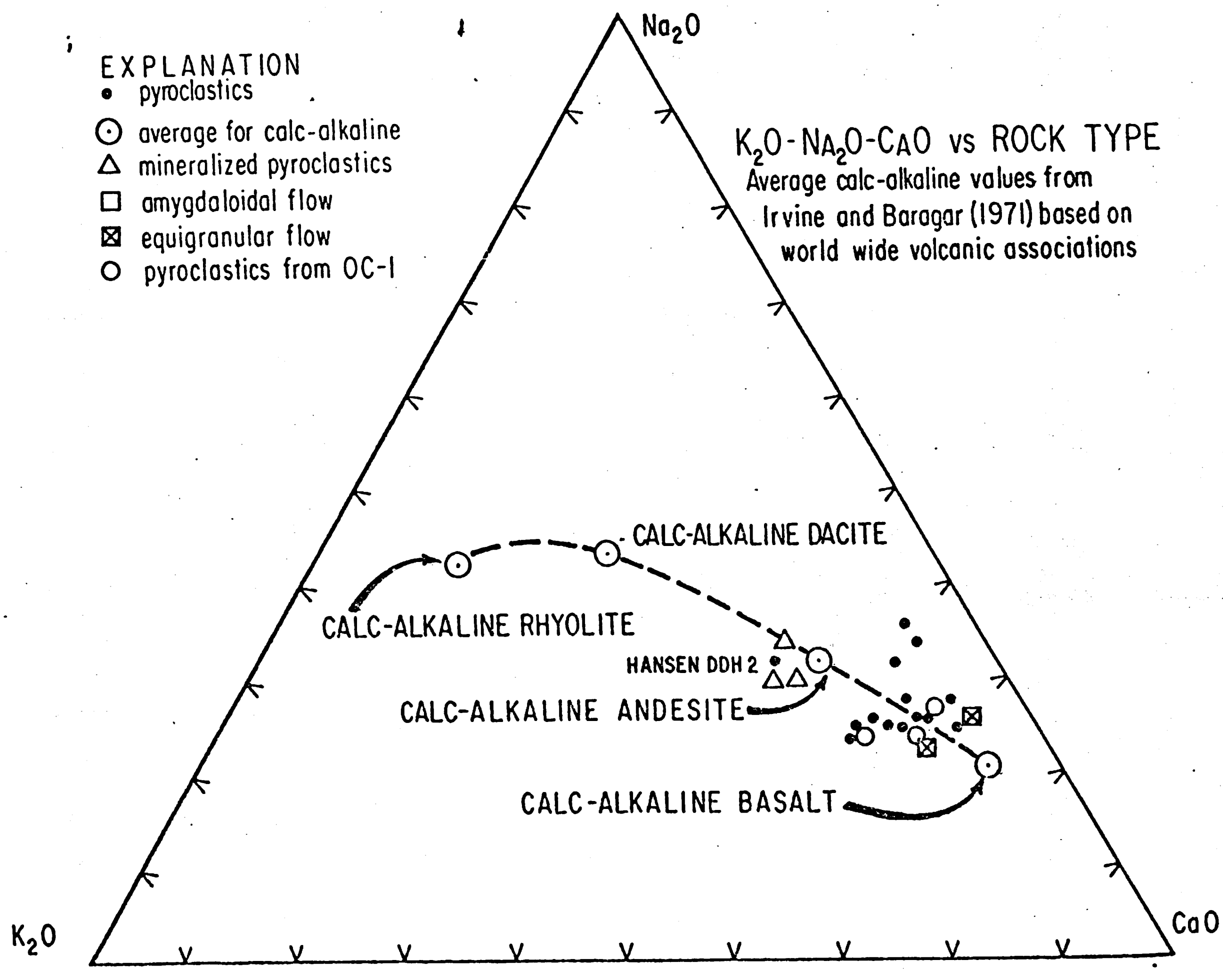
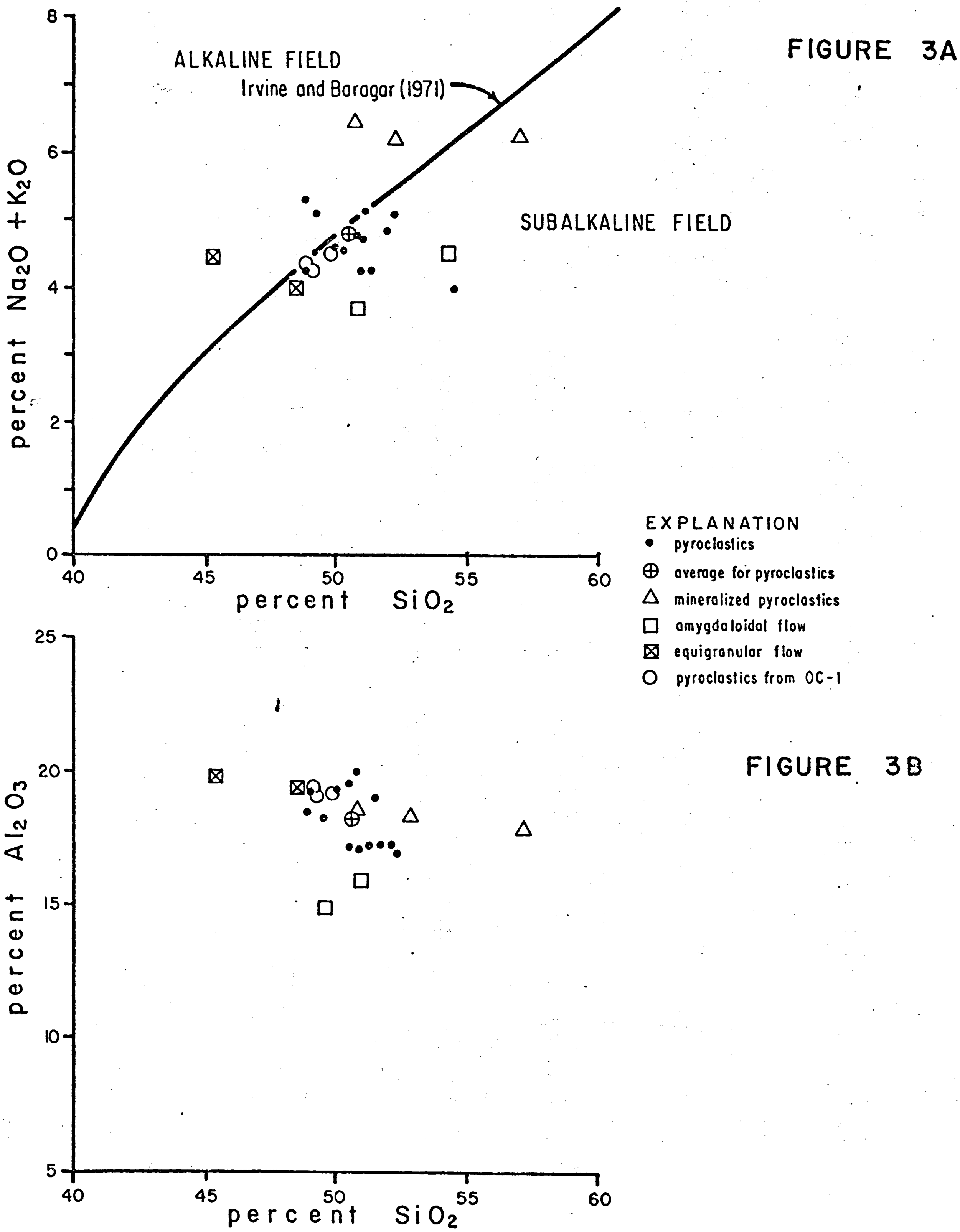


FIGURE - 4B



SILICA VARIATION DIAGRAMS

WILLIAMSON CANYON VOLCANICS

O'CARROL CANYON AREA, PINAL COUNTY, ARIZONA

L. CLAYTON Mar., 1975

	WET CHEMICAL ANALYSIS													SPECTROGRAPHIC ANALYSIS																	X-RAY ID OF MINERAL IN > 2.8 gm/cc FRACTION
	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	S ppm	H_2O^+	CO_2	Cu ppm	Zn ppm	Pb ppm	Cd ppm	As ppm	Ag ppm	Sb ppm	Te ppm	Bi ppm	Ni ppm	Mo ppm	Pd ppm	Pt ppm	Au ppm	TiO_2	P_2O_5	MnO	BaO ppm	SrO ppm	
OCA- 1	48.4	19.2	6.12	4.97	5.96	8.73	3.27	.708	95	2.67	.75	63	118	5	< 1	< 200	< 1	< 200	< 200	< 2	31	10	< 10	< 20	< 4	.8	<.1	.1	190	550	Plag., Mte., Amphibole, Chl.
OCA- 2	50.4	19.4	5.42	4.20	5.12	8.02	4.61	.868	98	3.04	.97	53	104	7	< 1	< 200	< 1	< 200	< 200	< 2	20	10	< 10	< 20	< 4	.65	<.1	.1	270	675	NA
OCA- 3	51.4	18.9	5.26	4.24	5.34	8.17	3.45	.747	174	2.37	.61	59	91	7	< 1	< 200	< 1	< 200	< 200	< 2	34	7	< 10	< 20	< 4	.7	<.1	.11	230	725	Plag., Qtz., Amphibole, Mte., Chl., Calcite, Kaolinite?
OCA- 4	48.9	19.1	7.13	2.46	4.52	7.64	4.12	1.12	63	3.36	1.67	70	77	6	< 1	< 200	< 1	< 200	< 200	< 2	26	11	< 10	< 20	< 4	.65	<.1	.085	370	850	NA
OCA- 5	49.3	18.1	5.95	2.89	5.08	6.88	4.23	.792	54	4.08	1.38	111	85	11	"	"	"	"	"	"	48	9	"	"	"	.7	"	.1	245	1000	NA
OCA- 6	50.9	15.7	4.06	4.98	6.81	8.62	2.43	1.21	427	2.90	.32	126	89	6	"	"	"	"	"	"	100	9	"	"	"	.7	.3	.1	385	700	Plag., Amphibole, Mte., Chl., Kaolinite?, Pyroxene?
OCA- 7	49.4	14.7	4.78	5.07	8.08	7.82	2.31	2.09	182	3.79	.39	32	175	10	"	"	"	"	"	"	150	8	"	"	"	.65	.33	.15	470	500	NA
OCA- 8	50.7	18.5	4.92	3.84	4.89	6.54	3.86	2.49	483	3.51	.78	77	102	5	"	"	"	"	"	"	38	10	"	"	"	.6	.27	.095	330	725	NA
OCA- 9	52.7	18.2	5.72	3.53	4.17	5.78	3.58	2.52	198	2.95	1.70	35	138	7	"	"	"	"	"	"	30	7	"	"	"	.6	.3	.1	420	620	Plag., Qtz., Amphibole, Chl., Mte., Augite, Calcite
OCA-10	57.0	17.7	5.56	1.60	2.35	5.57	4.00	2.12	102	3.06	1.33	46	95	7	"	"	"	"	"	"	13	6	"	"	"	.65	.36	.09	490	950	Plag., Qtz., Chl., Magnetite, Hematite
OCA-11	52.3	17.4	7.38	1.11	4.79	7.98	3.15	1.65	37	2.58	.34	99	90	7	"	"	"	"	"	"	50	10	"	"	"	.7	.15	.1	450	700	Plag., Mte., Augite, Chlorite?
OCA-12	50.7	17.0	7.79	1.60	5.68	7.68	3.45	1.26	58	4.10	.22	109	90	6	"	"	"	"	"	"	60	11	"	"	"	.7	.15	.11	370	725	NA
OCA-13	50.0	19.1	6.23	2.10	3.49	8.20	3.24	1.24	79	4.54	.54	53	78	7	"	"	"	"	"	"	20	12	"	"	"	.85	<.1	.095	620	950	NA
OCA-15	52.0	17.1	7.92	1.18	5.31	6.96	2.85	1.91	52	3.58	<.2	103	92	6	"	"	"	"	"	"	54	9	"	"	"	.65	"	.09	490	600	Plag., Mte., Augite, Chl?, Montmorillonite
OCA-16	48.8	18.4	5.60	2.16	4.30	8.84	3.24	.982	52	3.58	2.35	96	80	5	"	"	"	"	"	"	30	10	"	"	"	.7	"	.09	280	700	NA
OCA-17	51.1	17.3	6.42	1.85	4.91	6.38	2.77	1.42	71	4.56	2.76	85	89	8	"	"	"	"	"	"	60	11	"	"	"	.7	"	.095	425	750	NA
OCA-18	50.8	19.9	4.07	2.98	4.83	7.99	3.31	1.27	1665	2.44	.76	70	132	6	"	"	"	"	"	"	34	9	"	"	"	.6	"	.095	350	750	Plag., Qtz., Amphibole, Chl., Mte., Hematite, Pyrite?, Epidote
OCA-19	51.1	17.1	7.96	1.29	5.71	7.39	3.09	1.95	102	3.02	.48	86	96	7	"	"	"	"	"	"	98	9	"	"	"	.7	.17	.085	575	700	NA
OCA-20	50.4	16.9	7.36	2.02	5.58	7.87	3.11	1.59	52	4.02	<.2	69	90	5	"	"	"	"	"	"	78	9	"	"	"	.7	<.1	.08	475	800	Plag., Qtz., Mte., Augite
T-4592 Hanson DDH	47.9	18.9	3.35	6.34	4.88	5.21	3.55	2.13	1320	3.82	2.78	19	NA																	NA	NA
T-5527 DC-1-260'-270'	48.8	19.3	4.73	5.20	6.48	6.43	2.55	1.75	58	4.20	1.21	< 10	122	5	"	"	"	"	"	"	30	11	"	"	"	.85	.1	.065	525	1000	NA
T-5580 OC-1-811'-822'	49.1	19.0	4.50	4.94	5.12	8.14	2.90	1.31	6938	3.03	1.38	175	68	4	"	"	"	"	"	"	27	12	"	"	"	.72	<.1	.06	325	1000	NA
T-5585 OC-1-865'-875'	49.8	19.3	1.04	5.84	5.25	8.25	3.42	1.03	2425	2.08	.37	118	68	7	"	"	"	"	"	"	40	15	"	"	"	.85	<.1	.065	270	1000	NA
T-5309 OC-1-110'-1120'	45.3	19.7	4.65	5.19	5.14	8.18	3.07	1.34	6142	3.18	1.28	185	64	7	"	"	"	"	"	"	26	15	"	"	"	.85	.13	.06	475	1000	NA

LAB. REPORT NO. ______

BONDAR-CLEGG & COMPANY LTD.

130 Pemberton Ave., North Vancouver, B.C., Canada V7P 2R5 Phone (604) 985-0681 Telex 04-352667

SAMPLE SHIPMENT NOTICE

Please analyze by
Assay (% ore grade) ☐ prepared ☐ samples
Geochemical (ppm, trace level) ☐ unprepared ☐

Comments C.F.M. 88-576 49301-49342 -20HN - Please analyse these uncrushed samples for Au+33 using neutron activation. Do Not Crush these -20 mesh samples as the anomolous samples require S.E.M. evaluation of gold grain morphology. after Cooling. Send unused samples to C.F.M. When Cool.

Type of Samples	No. of Samples	Sample Numbers (Series)	Elements to be Analyzed
	42	49301-49342	Au+33

Total No. Samples ______ Date Shipped June 13/88 Prepaid ☒ Collect ☐

No. Parcels in Shipment ______

PLEASE CHECK ✓ BELOW

REJECTS (COARSE OVERSIZE)

Return Immediately ☐
Store 90 Days - Then Return C.O.D. ☐
Store 90 Days - Then Discard ☐
After 90 Days - Rejects Stored to Year End (.35¢ Sample) ☐

PULPS

Return Immediately ☐
Store to Year End - Then Return C.O.D. ☐
Store to Year End - Then Discard ☐

Results and Invoices To Be Sent To

Westmont Mining Inc. ☒ Results
2341 South Friebus ☒ Invoices
Suite 12
Tucson, AZ ☐ Results
85713 ☐ Invoices
Attn: H. Dummett

C. F. MINERALS RESEARCH LTD. ☒ Results
263 LAKE AVENUE ☐ Invoices
KELOWNA, B.C. V1Y 5W6

Samples submitted by C. F. MINERALS RESEARCH LTD. 263 LAKE AVENUE KELOWNA, B.C. V1Y 5W6

Shipment number ______

Client project number ______

Purchase order number ______

AB. REPORT NO. ____________

BONDAR-CLEGG & COMPANY LTD.

130 Pemberton Ave., North Vancouver, B.C., Canada V7P 2R5 Phone (604) 985-0681 Telex 04-352667

SAMPLE SHIPMENT NOTICE

Please analyze by
Assay (% ore grade) ☐ prepared ☐ samples
Geochemical (ppm, trace level) ☐ unprepared ☐

Comments C. F.M. 88-576 49301 - 49342 - 20HN (-0.5gm) - Please geochem analyse these pre-crushed samples for Cu - Ag using AA methods.

Type of Samples	No. of Samples	Sample Numbers (Series)	Elements to be Analyzed
	42	49301 - 49342	Cu - Ag

Total No. Samples ____________ Date Shipped June 13/88 Prepaid ☒ Collect ☐

No. Parcels in Shipment ____________

PLEASE CHECK ✓ BELOW

REJECTS
(COARSE OVERSIZE)

Return Immediately ☐
Store 90 Days - Then Return C.O.D. ☐
Store 90 Days - Then Discard ☐
After 90 Days - Rejects Stored to Year End (.35¢ Sample) ☐

Results and Invoices To Be Sent To

Westmont Mining Inc. ☒ Results
2341 South Friebus ☒ Invoices
Suite 12
Tucson, AZ ☐ Results
85713
Attn: H. Dummett ☐ Invoices

C. F. MINERALS RESEARCH LTD.
263 LAKE AVENUE
KELOWNA, B.C. V1Y 5W6
☒ Results
☐ Invoices

PULPS

Return Immediately ☐
Store to Year End - Then Return C.O.D. ☐
Store to Year End - Then Discard ☐

Samples submitted by C. F. MINERALS RESEARCH LTD.
263 LAKE AVENUE
KELOWNA, B.C. V1Y 5W6

Shipment number ____________

Client project number ____________

Purchase order number ____________

C.F.MINERAL RESEARCH LTD.
263 LAKE AVENUE
KELOWNA, BRITISH COLUMBIA
CANADA V1Y 5W6

TEL(604)763-1815
(604)860-8525

WESTMONT
PROJECT:
H. DUMMETT
13/06/88

C.F.M. 88-576

SAMPLE NUMBER	ORIGINAL WEIGHT (KG)	FRACTION	WEIGHT (GMS)
49301	9.000		
49301		-20HM	73.91
49301		-20HP	185.98
49301		-20HN	81.65
49302	9.200		
49302		-20HM	91.03
49302		-20HP	156.23
49302		-20HN	152.15
49303	10.800		
49303		-20HM	81.57
49303		-20HP	196.30
49303		-20HN	102.58
49304	8.300		
49304		-20HM	22.52
49304		-20HP	149.28
49304		-20HN	6.64
49305	6.700		
49305		-20HM	26.84
49305		-20HP	134.56
49305		-20HN	53.46
49306	8.000		
49306		-20HM	17.29
49306		-20HP	74.36
49306		-20HN	3.47
49307	7.900		
49307		-20HM	9.27
49307		-20HP	46.62
49307		-20HN	3.27
49308	7.500		
49308		-20HM	14.22
49308		-20HP	53.88
49308		-20HN	5.10

WESTMONT

C.F.M. 88-576

H. DUMMETT
13/06/88

SAMPLE NUMBER	ORIGINAL WEIGHT (KG)	FRACTION	WEIGHT (GMS)
49309	6.500		
49309		-20HM	9.49
49309		-20HP	21.49
49309		-20HN	3.77
49310	11.600		
49310		-20HM	10.95
49310		-20HP	36.88
49310		-20HN	5.59
49311	8.100		
49311		-20HM	1.81
49311		-20HP	32.40
49311		-20HN	4.16
49312	7.600		
49312		-20HM	3.20
49312		-20HP	19.92
49312		-20HN	2.26
49313	7.400		
49313		-20HM	38.79
49313		-20HP	60.92
49313		-20HN	13.59
49314	7.100		
49314		-20HM	427.54
49314		-20HP	508.40
49314		-20HN	84.89
49315	9.000		
49315		-20HM	763.66
49315		-20HP	605.50
49315		-20HN	172.74
49316	10.600		
49316		-20HM	2182.55
49316		-20HP	651.17
49316		-20HN	32.35

WESTMONT C.F.M. 88-576

H. DUMMETT
13/06/88

SAMPLE NUMBER	ORIGINAL WEIGHT (KG)	FRACTION	WEIGHT (GMS)
49317	10.800		
49317		-20HM	782.67
49317		-20HP	864.80
49317		-20HN	98.76
49318	7.500		
49318		-20HM	8.93
49318		-20HP	43.69
49318		-20HN	17.29
49319	7.100		
49319		-20HM	9.87
49319		-20HP	32.89
49319		-20HN	2.59
49320	9.400		
49320		-20HM	521.52
49320		-20HP	418.67
49320		-20HN	62.91
49321	9.300		
49321		-20HM	124.90
49321		-20HP	215.03
49321		-20HN	22.61
49322	9.500		
49322		-20HM	746.06
49322		-20HP	488.27
49322		-20HN	87.86
49323	6.600		
49323		-20HM	7.81
49323		-20HP	17.04
49323		-20HN	2.07
49324	7.600		
49324		-20HM	23.75
49324		-20HP	27.56
49324		-20HN	18.35

WESTMONT C.F.M. 88-576

H. DUMMETT
13/06/88

SAMPLE NUMBER	ORIGINAL WEIGHT (KG)	FRACTION	WEIGHT (GMS)
49325	8.200		
49325		-20HM	155.25
49325		-20HP	488.24
49325		-20HN	11.11
49326	8.100		
49326		-20HM	8.46
49326		-20HP	9.93
49326		-20HN	1.38
49327	8.000		
49327		-20HM	9.63
49327		-20HP	10.61
49327		-20HN	2.03
49328	9.000		
49328		-20HM	1.35
49328		-20HP	18.63
49328		-20HN	2.05
49329	8.200		
49329		-20HM	3.00
49329		-20HP	13.00
49329		-20HN	4.30
49330	8.100		
49330		-20HM	6.69
49330		-20HP	21.72
49330		-20HN	3.02
49331	8.200		
49331		-20HM	2.24
49331		-20HP	14.21
49331		-20HN	1.72
49332	6.500		
49332		-20HM	0.16
49332		-20HP	188.20
49332		-20HN	56.96

WESTMONT C.F.M. 88-576

H. DUMMETT
13/06/88

SAMPLE NUMBER	ORIGINAL WEIGHT (KG)	FRACTION	WEIGHT (GMS)
49333	6.700		
49333		-20HM	27.67
49333		-20HP	95.70
49333		-20HN	16.01
49334	7.700		
49334		-20HM	51.33
49334		-20HP	254.12
49334		-20HN	33.45
49335	6.200		
49335		-20HM	2.13
49335		-20HP	17.53
49335		-20HN	3.77
49336	8.100		
49336		-20HM	49.11
49336		-20HP	148.44
49336		-20HN	95.69
49337	6.200		
49337		-20HM	58.11
49337		-20HP	227.01
49337		-20HN	24.35
49338	5.600		
49338		-20HM	23.80
49338		-20HP	157.29
49338		-20HN	18.09
49339	6.600		
49339		-20HM	139.58
49339		-20HP	271.46
49339		-20HN	66.23
49340	9.500		
49340		-20HM	148.13
49340		-20HP	205.88
49340		-20HN	30.60

WESTMONT C.F.M. 88-576

H. DUMMETT
13/06/88

SAMPLE NUMBER	ORIGINAL WEIGHT (KG)	FRACTION	WEIGHT (GMS)
49341	10.000		
49341		-20HM	104.09
49341		-20HP	401.45
49341		-20HN	66.92
49342	7.600		
49342		-20HM	69.82
49342		-20HP	186.78
49342		-20HN	21.39

ALL SAMPLES HAVE BEEN UV LIGHT EXAMINED-NO SCHEELITE GRAINS WERE FOUND.

Little Gold Gulch Area

Figure 2 - LGG Geochemical Sampling Results

Normalized log ratios

Vein/dump - (ppm)

Sample	Cu	Pb	Zn	Ag	Au	Mo	Cu	Mo	Pb	Zn	Ag	Au
[illegible]1001	1400	40	160	6.8	.71	4	9.45	10.23	7.80	8.41	9.07	8.05
2	1450	130	165	7.8	1.0	2	9.65	9.88	8.46	8.57	9.31	8.34
3	1000	190	245	18.0	3.50	6	9.06	10.22	8.30	8.41	9.36	8.57
5	210	90	120	5.4	8.20	-	8.91	9.75	8.52	8.65	9.38	9.62
6	175	950	4300	12.0	.15	4	8.22	9.78	8.99	9.83	9.10	7.15
7	1600	2600	3700	350	.67	2	8.57	8.67	8.79	8.95	10.54	7.17
8	445	5400	6600	50.0	1.20	2	8.37	9.06	9.58	9.71	9.54	7.79
14	350	6600	18500	72.0	6.0	2	8.00	8.78	9.36	10.04	9.41	8.24
15	395	50	1150	24.0	.13	410	6.98	12.01	6.08	7.44	7.77	5.49
16	120	3600	3100	350.	1.3	4	7.42	8.98	8.93	8.86	10.50	7.45
25	205	4500	2900	51.0	.95	6	8.04	9.67	9.49	9.26	9.57	7.71
26	345	10500	2700	140.0	.56	24	7.83	9.94	9.41	8.74	9.57	7.04
36	380	4400	12500	39.0	.18	8	8.12	9.58	9.25	9.87	9.19	6.79
41	520	12500	3500	350.	.19	4	7.98	8.89	9.46	8.83	10.23	6.53
42	190	105	305	8.8	.04	4	8.55	10.43	8.29	8.77	9.28	6.86
43	235	1500	950	140.0	.53	22	7.79	10.12	8.61	8.40	9.75	7.14
44	295	12500	470	350.	.15	8	7.72	9.22	9.46	7.93	10.22	6.43
45	255	1860	1650	54.0	.54	8	8.18	9.94	9.08	9.03	9.66	7.49
46	1060	5600	1150	130.0	7.65	55	8.15	10.41	8.89	8.18	9.31	8.00
47	(13800)	360	480	9.3	.22	3	10.46	9.28	9.29	8.42	8.72	7.07
49	240	5400	1300	83.0	3.19	8	8.01	9.71	9.47	8.77	9.74	8.14
50	610	11600	2900	62.0	1.95	4	8.39	9.27	9.92	9.11	9.51	7.89
51	310	7000	5500	83.0	.55	8	8.03	9.58	9.50	9.37	9.60	7.28
56	116	500	1300	120.0	1.45	3	7.84	9.33	8.48	8.92	10.37	7.93
57	52	950	7000	41.0	.64	13	7.32	10.03	8.59	9.59	9.29	7.41
58	320	4600	9000	170.0	7.35	3	7.97	8.98	9.18	9.55	9.98	8.34
61	76	2040	880	27.0	1.63	5	7.84	9.93	9.36	9.94	9.52	8.18
					(n = 27)	$\bar{x}$	8.25	8.58	8.91	8.93	9.14	
						σ	0.72	0.80	0.74	0.69	0.70	
						$\bar{x}+2\sigma$	9.69	10.18	10.39	10.31	10.54	
$\bar{X}$=969/475		3910	5360	102.0	1.87							
s=2601/443		4016	8041	115.12	2.48							

Silicified-brecciated zones

Cu	Pb	Zn	Ag	Au	Mo
110	-	15	-	-	12
45	-	25	-	-	4
60	-	20	-	-	18
100	185	40	.2	-	20
115	30	15	2.6	.07	44 (mass.jar.)
65	40	55	.2	-	14
120	-	65	.2	.02	6
$\bar{X}$=88	37	34	.46	.02	
s=30	67	20	.95	.02	

SADDLE MTN.
PLUTONIC SUITE

SADDLE MTN.

15

DATA SHEET FOR CHEMICAL AND AGE DATA

FOR IGNEOUS COMPLEXES

LOCATION: SADDLE MOUNTAIN, PINAL COUNTY ARIZONA

LOCATION COORDINATES:

Fe^{+3}/Fe^{+2} : 1.69 (oxidized)

KCa : 68.5 CA

KMg : 63.0 CA

Fe: poor

Al: 0.930 - 1.015 (mostly metalum.)

K_{55} : 1.00

$K_{57.5}$: 1.5 | 1.30 CA

K_{60} : 1.6 | 1.55

PEACOCK INDEX:
Affinity: metaluminous to weakly peraluminous, calc-alkalic, iron-poor.

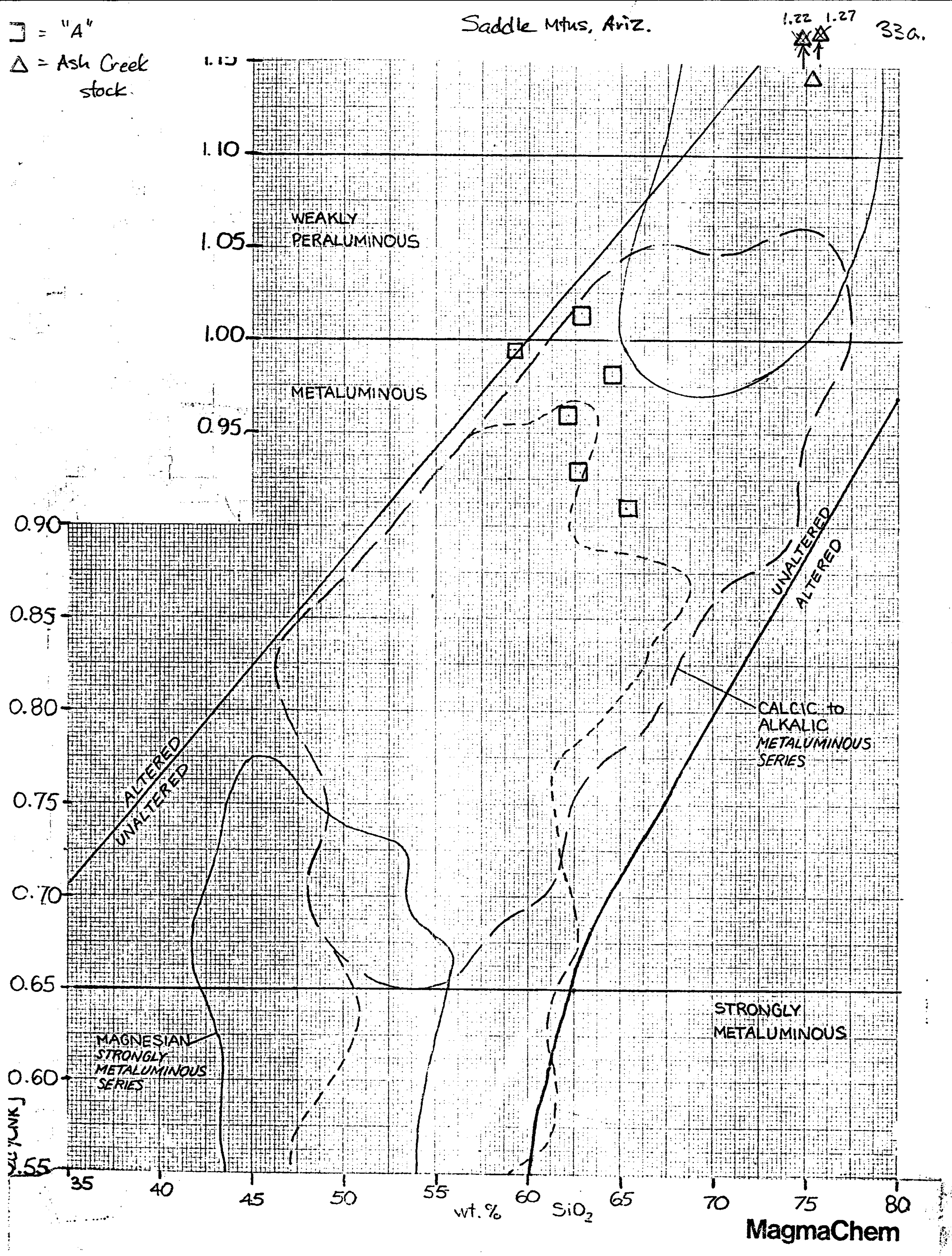
ROCKS INVOLVED: microdiorite dikes (~70 m.y.?), Ash Creek stock (62 m.y.)
Various dikes (62 - 70 m.y.) also 55048

AGE DATA: 70 - 61 m.y.

COMMENTS:
MORENCI Assemblage

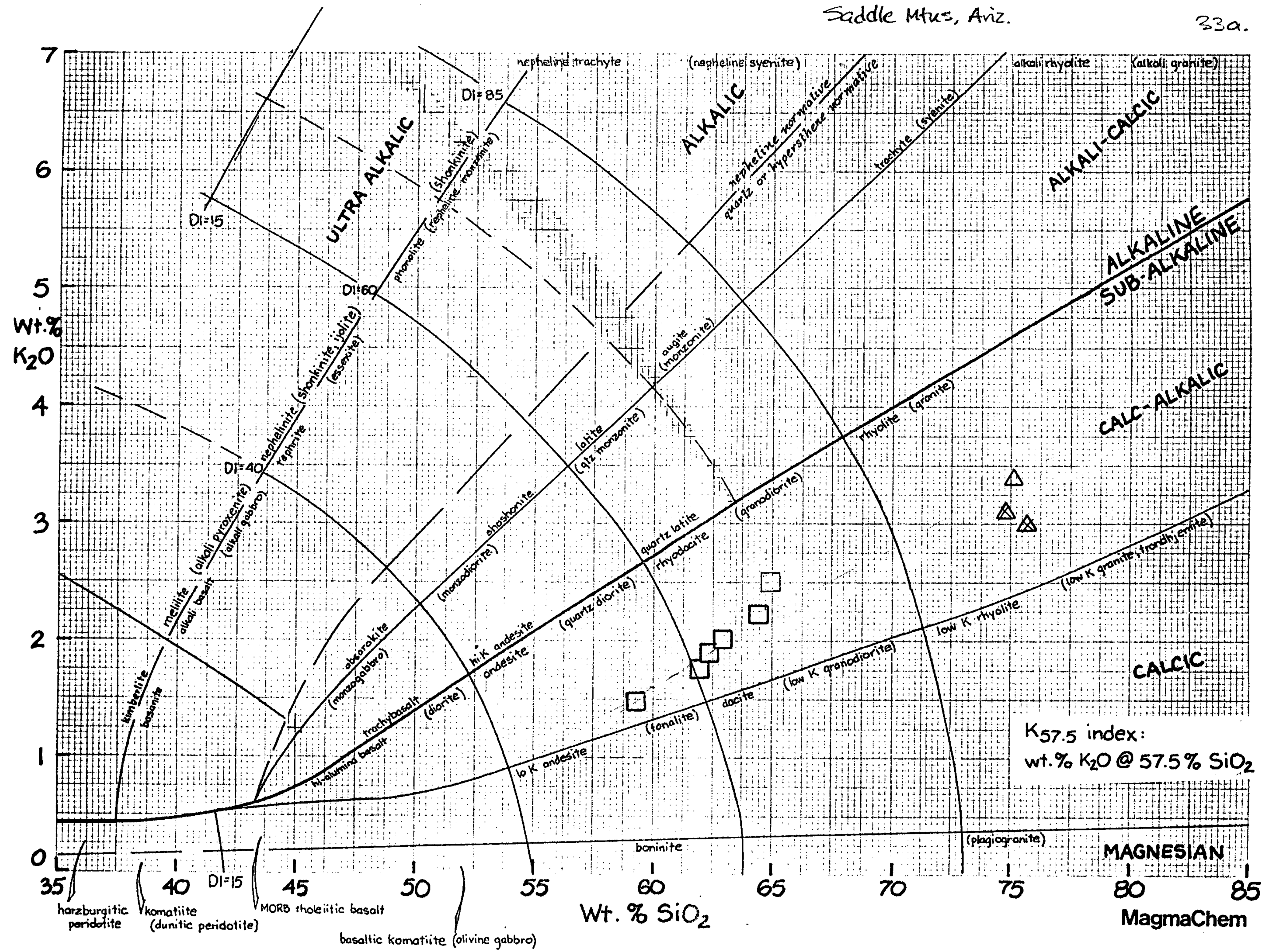
REFERENCES FOR CHEMICAL DATA: Keith, Rehrig, Barrett, Clayton (unpub. data).

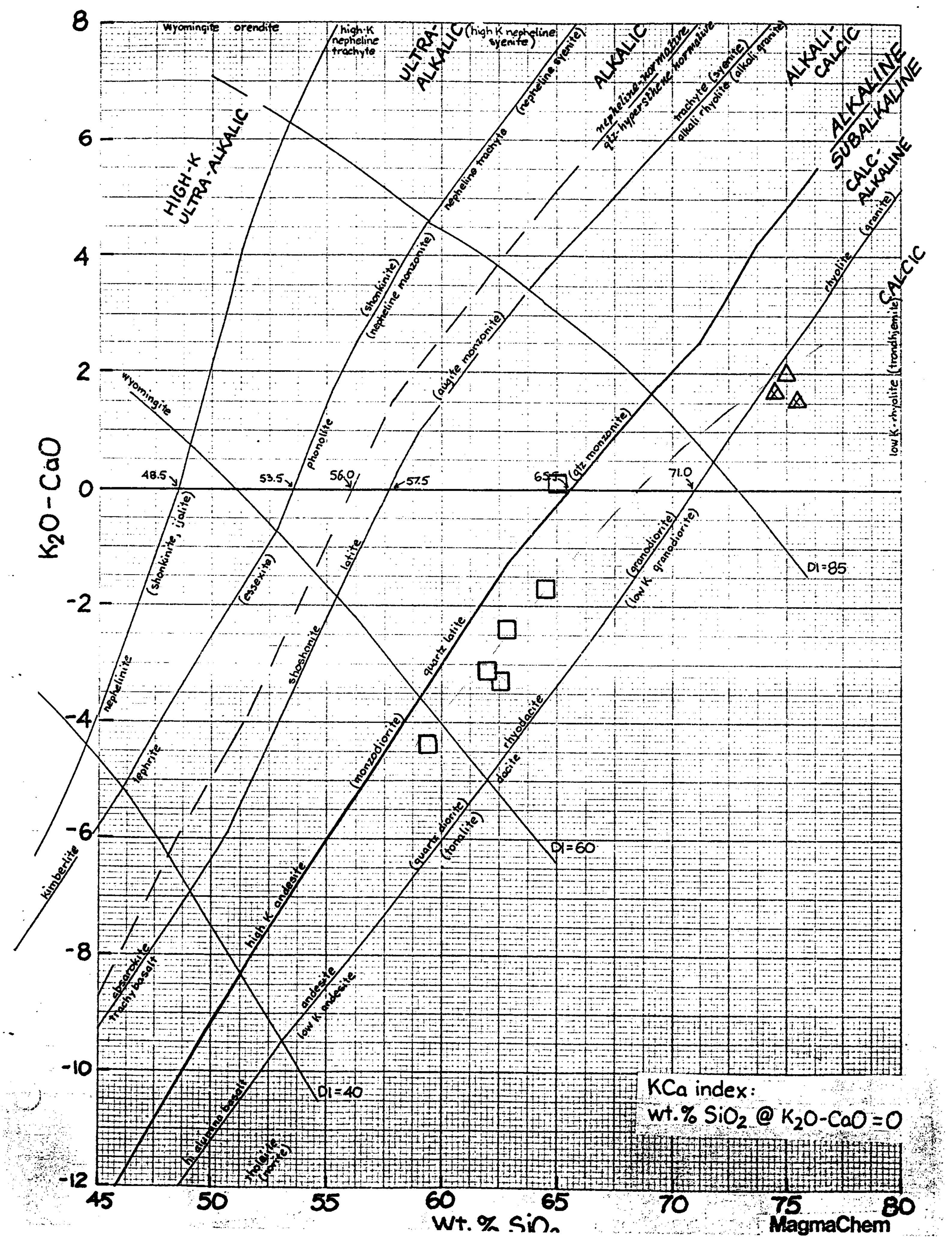
REFERENCES FOR AGE DATA: Keith and Damon (unpub. data).



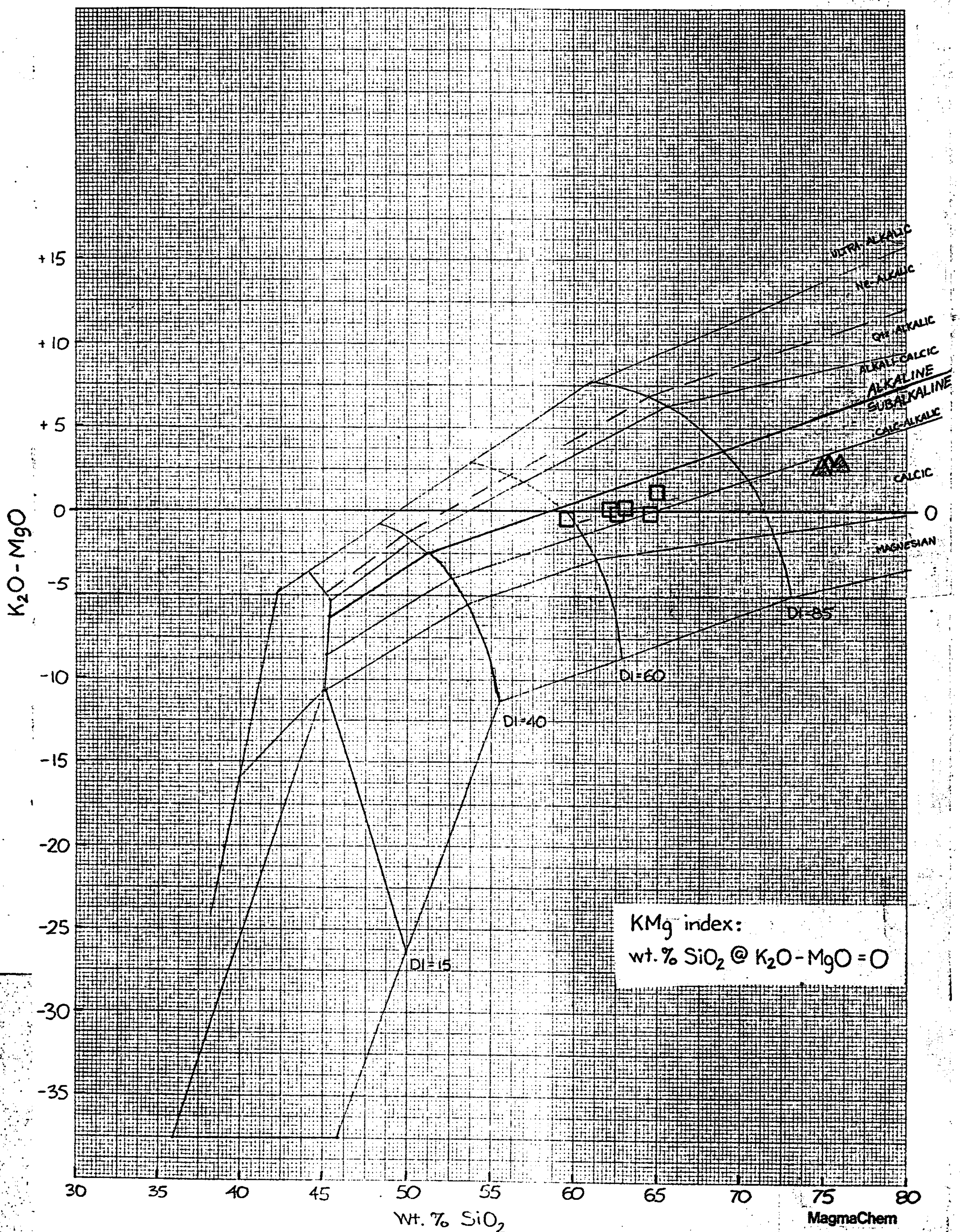
□ = "A"
△ = Ash Creek stock
Saddle Mtns, Ariz.
33a.
1.22
1.27
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
WEAKLY PERALUMINOUS
METALUMINOUS
ALTERED
UNALTERED
UNALTERED
ALTERED
CALCIC to ALKALIC METALUMINOUS SERIES
MAGNESIAN STRONGLY METALUMINOUS SERIES
STRONGLY METALUMINOUS
35
40
45
50
55
60
65
70
75
80
wt.% SiO_2
MagmaChem

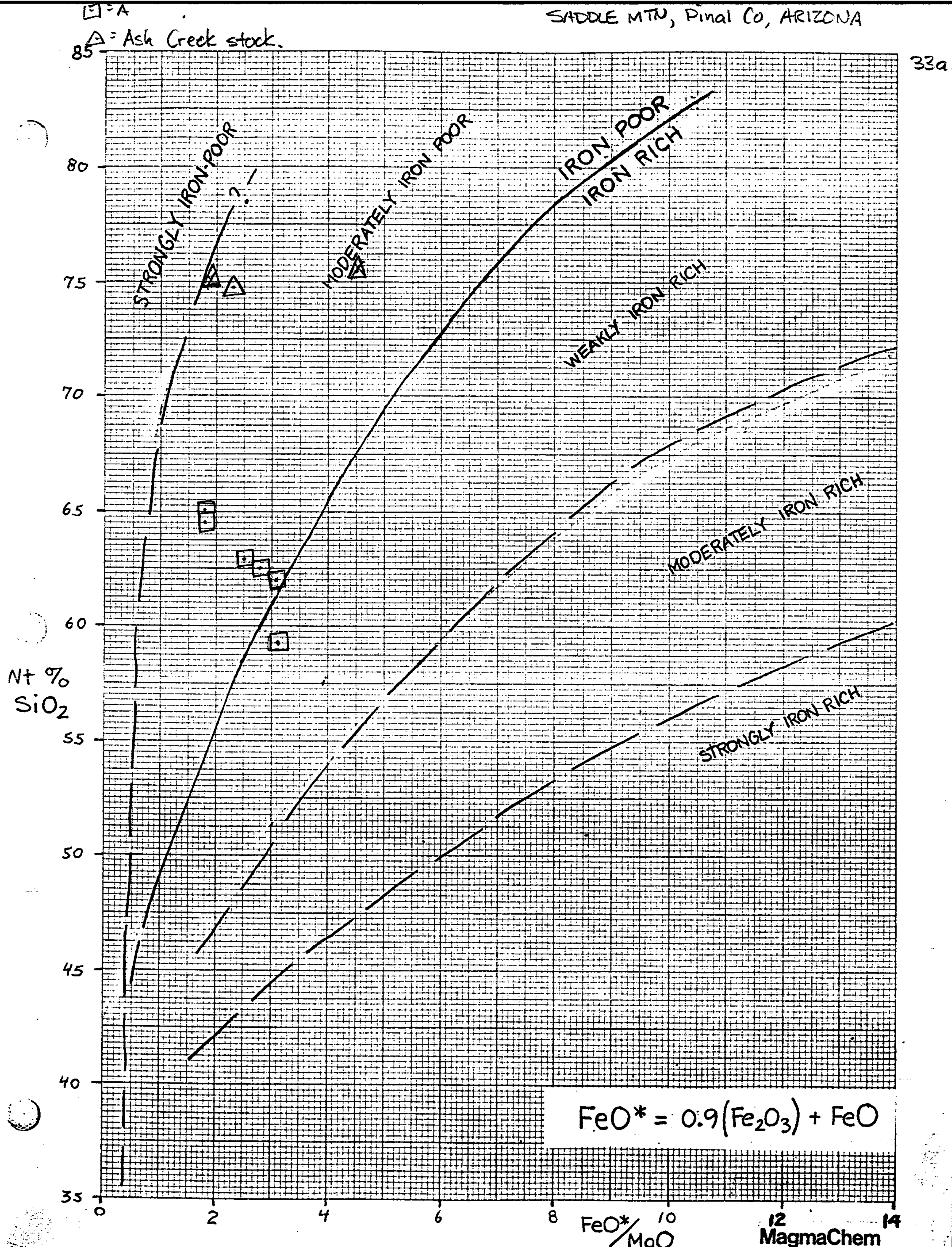
Saddle Mtns, Ariz.




K2O - CaO
Wt. % SiO2
HIGH-K ULTRA-ALKALIC
ULTRA-ALKALIC
ALKALIC
ALKALI-CALCIC
ALKALINE
SUBALKALINE
CALC-ALKALINE
CALCIC
wyomingite orendite
high-K nepheline trachyte
(high K nepheline syenite)
nepheline trachyte (nepheline syenite)
nepheline-normative
qtz-hypersthene normative
trachyte (syenite)
alkali rhyolite (alkali granite)
rhyolite (granite)
low K rhyolite (trondhjemite)
wyomingite
phonolite
(shonkinite) (nepheline monzonite)
(augite monzonite)
latite
(qtz monzonite)
(granodiorite)
(low K granodiorite)
(shonkinite, ijolite)
(essexite)
shoshonite
quartz latite
rhyodacite
dacite
nephelinite
tephrite
(monzodiorite)
(quartz diorite)
(tonalite)
kimberlite
absarokite
trachybasalt
high K andesite
andesite
low K andesite
hi alumina basalt
tholeiite (norite)
48.5
53.5
56.0
57.5
65.5
71.0
DI=85
DI=60
DI=40
KCa index:
wt.% SiO2 @ K2O-CaO = 0
MagmaChem

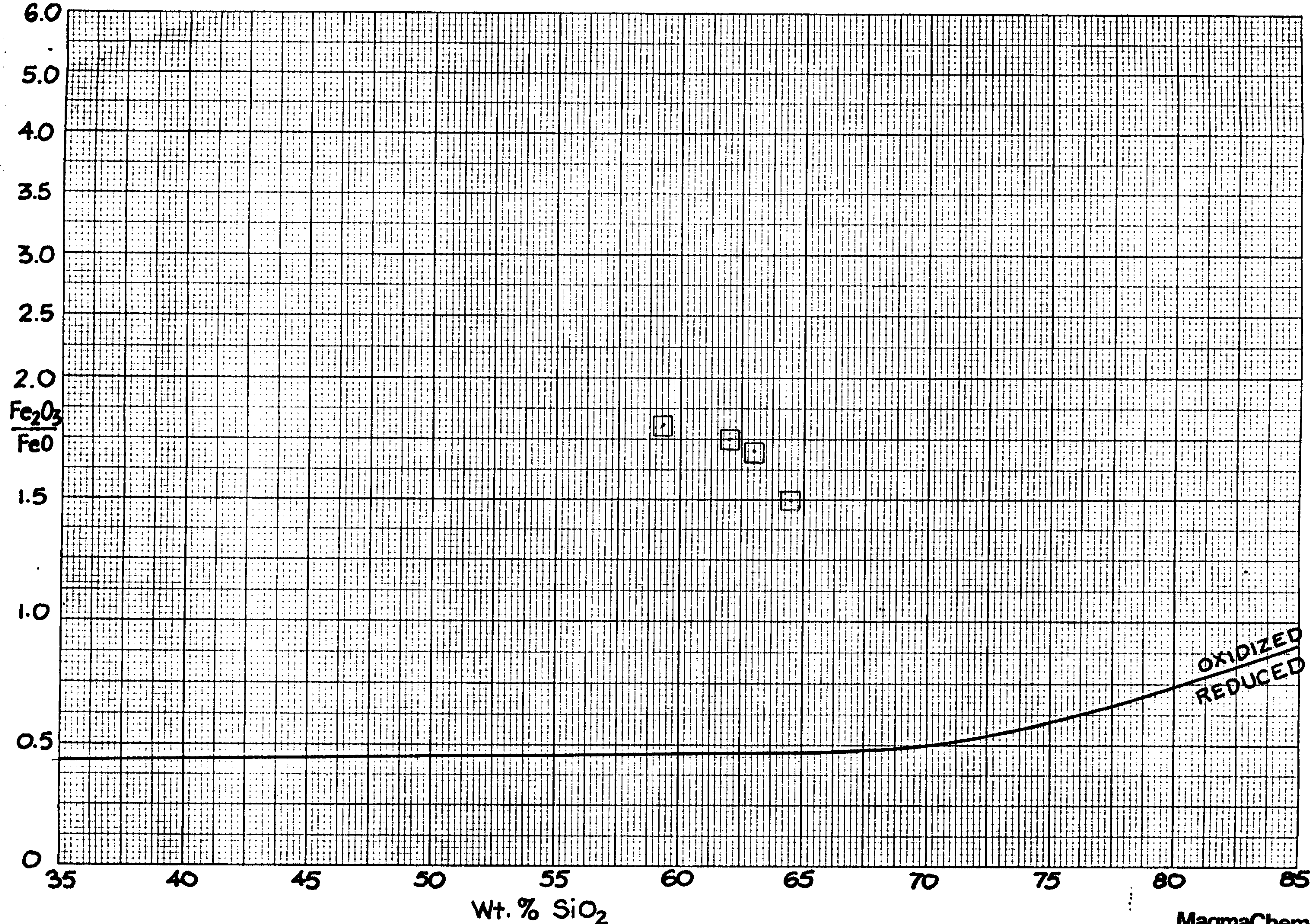
Saddle Mtns, Ariz



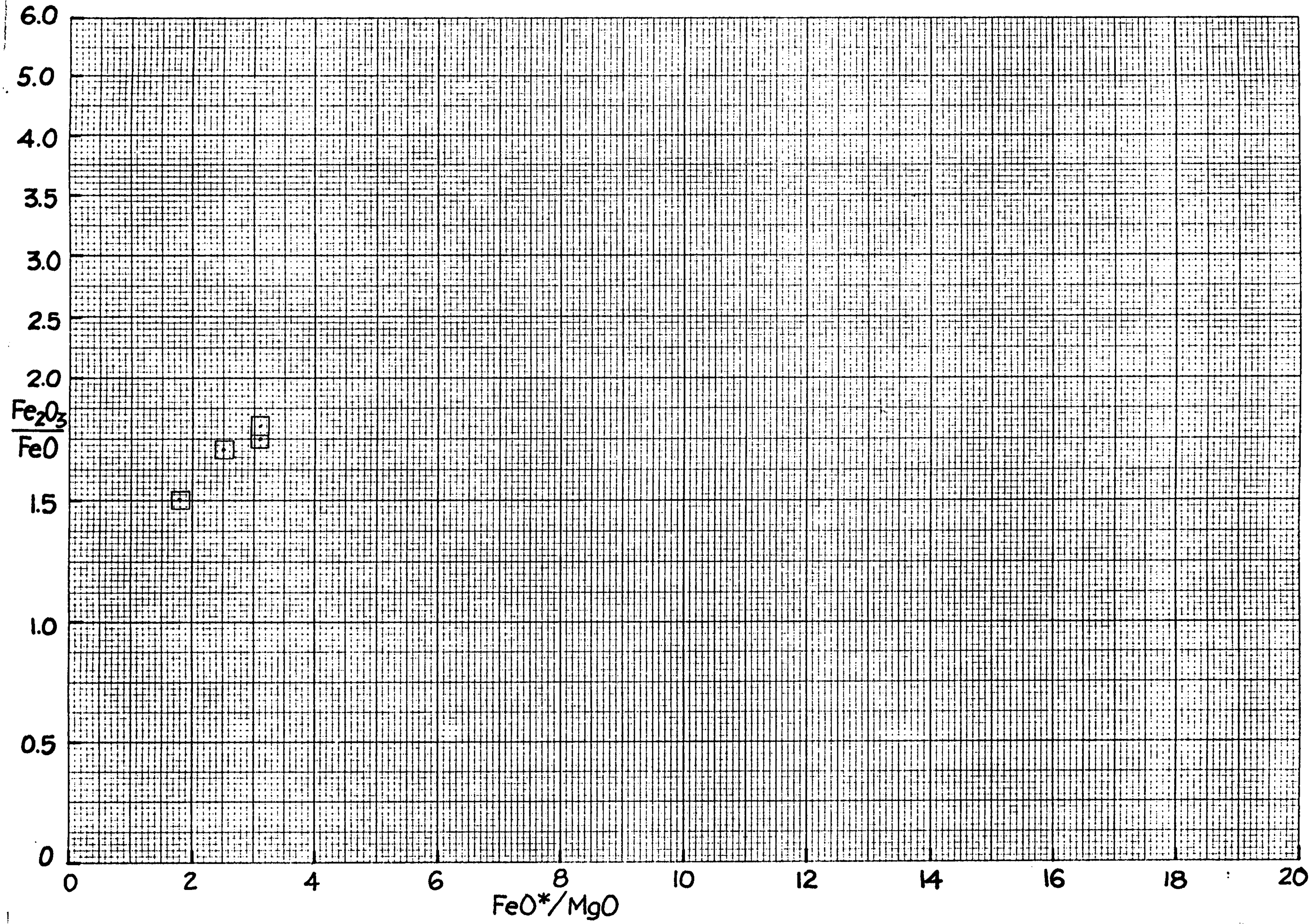


⊡ = A
△ = Ash Creek stock.
SADDLE MTN, Pinal Co, ARIZONA
33a
STRONGLY IRON-POOR
MODERATELY IRON POOR
IRON POOR
IRON RICH
WEAKLY IRON RICH
MODERATELY IRON RICH
STRONGLY IRON RICH
Wt %
SiO2
85
80
75
70
65
60
55
50
45
40
35
0
2
4
6
8
10
12
14
FeO*/MgO
MagmaChem
FeO* = 0.9(Fe2O3) + FeO

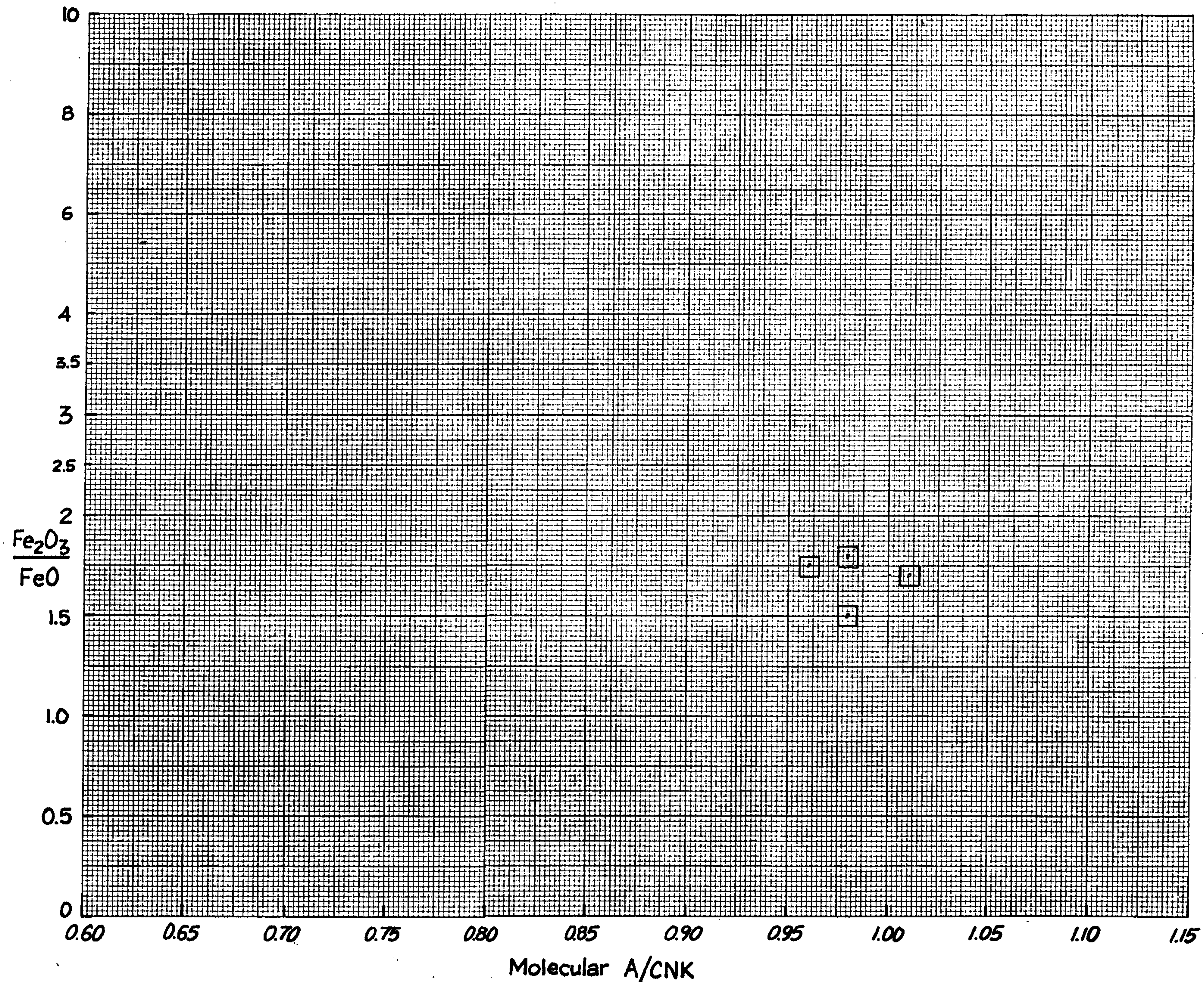
Saddle Mtn Plutonic Suite.



Saddle Mtn. plutonic suite



Saddle Mtn Plutonic Suite



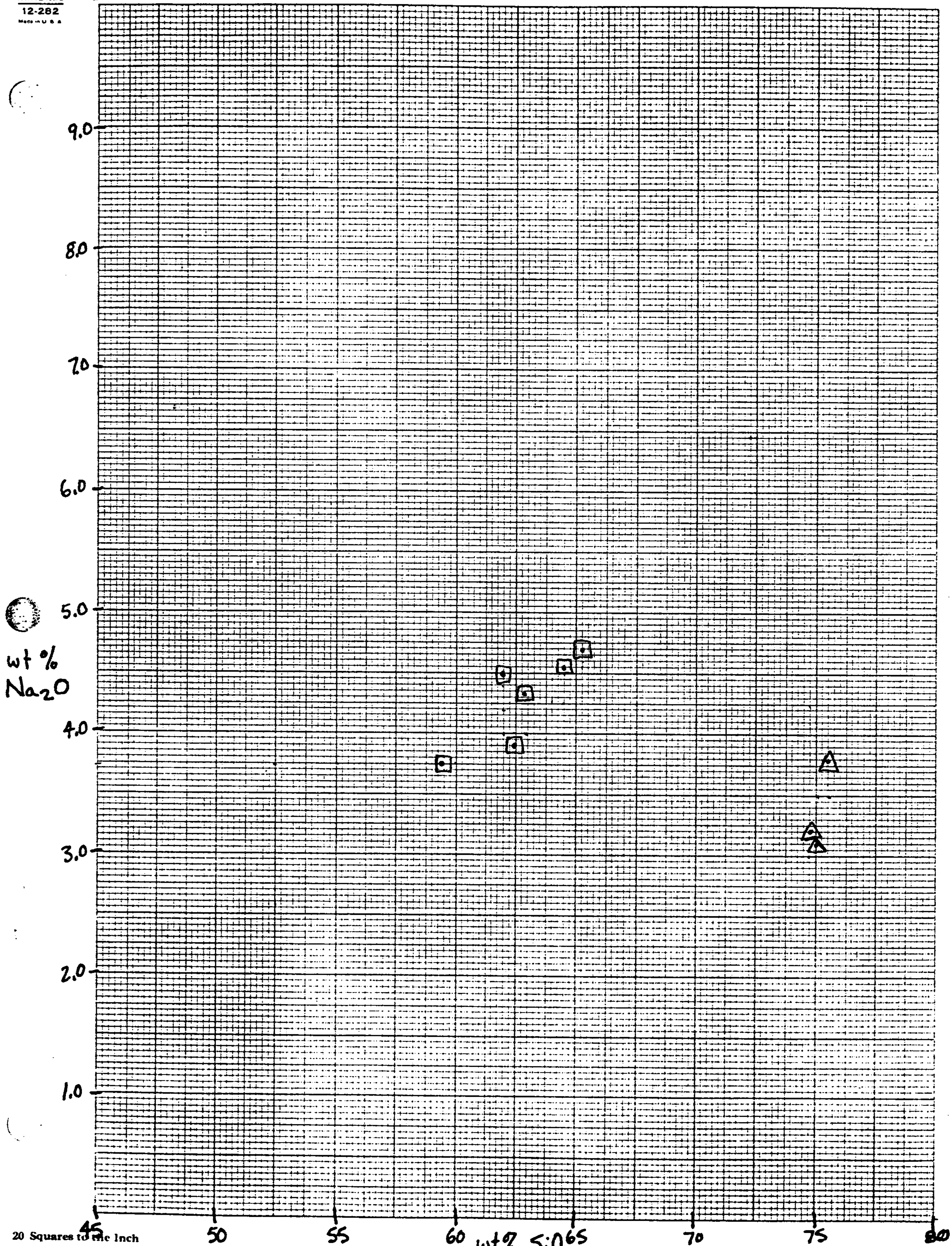
SADDLE MOUNTAIN, ARIZ

33a

CA

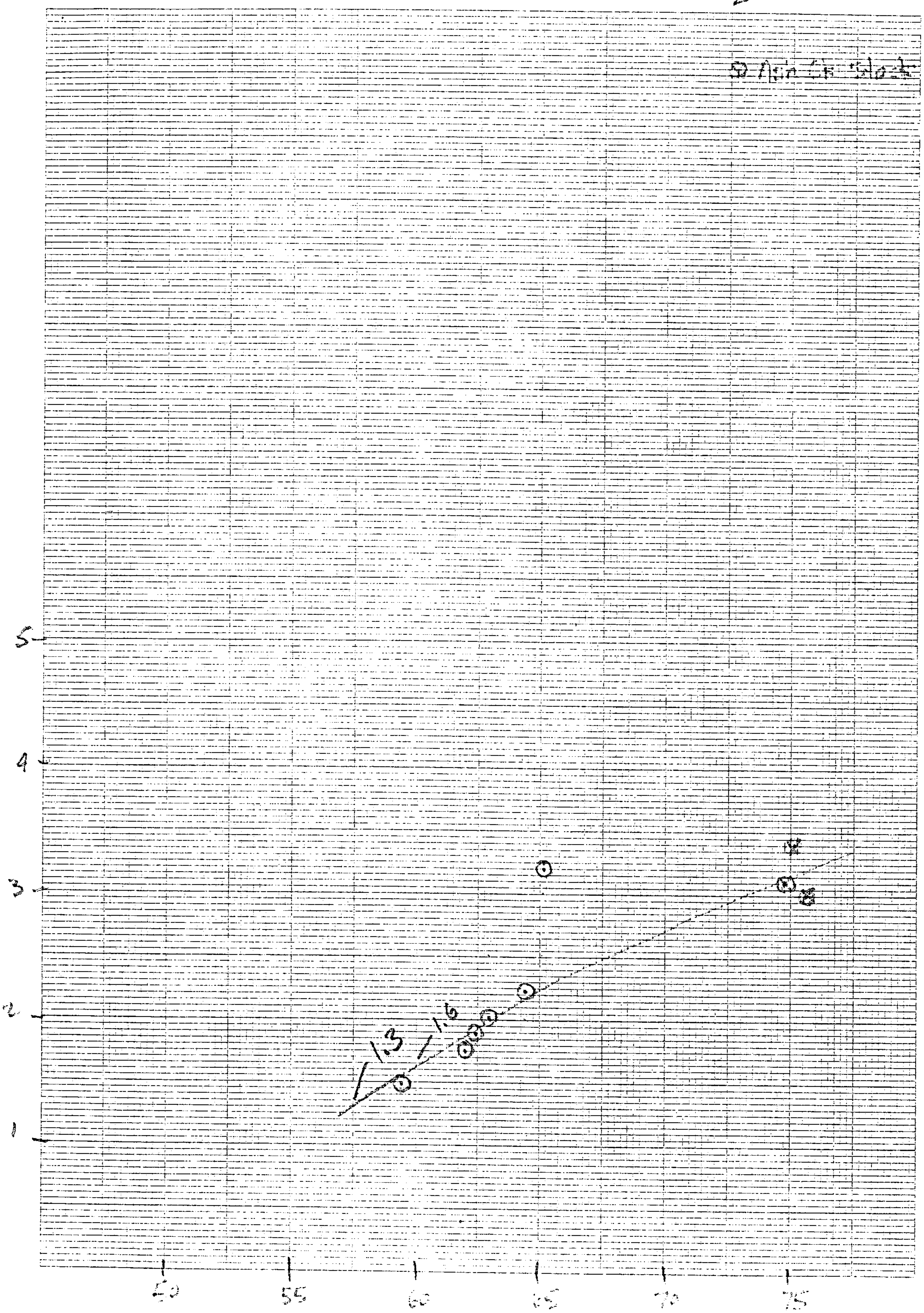
[·] = A)

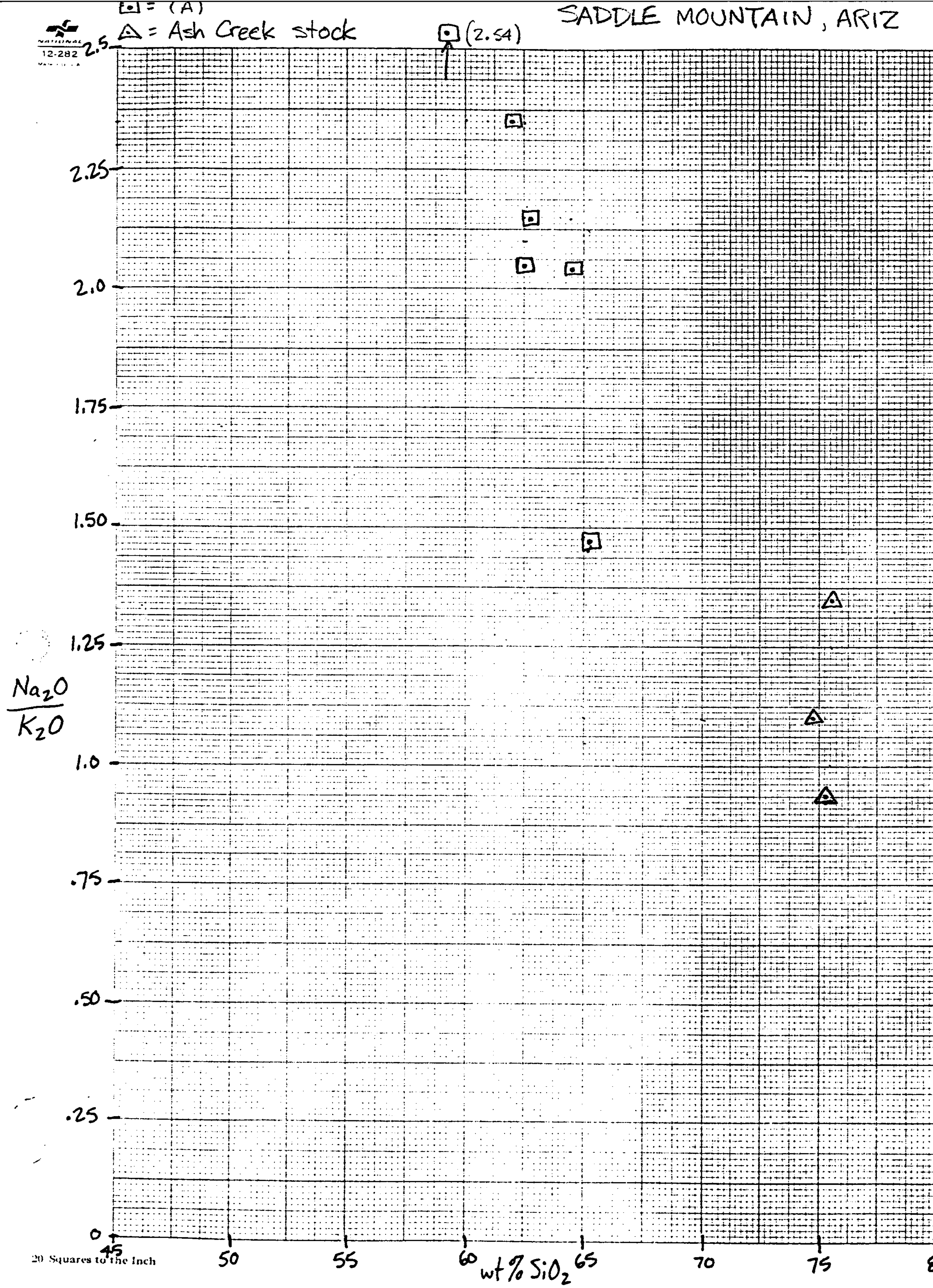
△ = Ash Creek stock



20 Squares to the Inch

SADDLE MOUNTAIN





33a.
CA

20 Squares to the Inch

SADDLE MOUNTAIN

	A →						B →		
Sample	T-4600	T-4599	SAM-2	T-3054	T-4594	SAM-3	AC-3	AC-2	AC-3
SiO_2	59.3	62.0	62.48	62.9	64.4	65.02	74.76	75.08	75.60
Al_2O_3	18.4	17.2	17.0	17.9	17.0	15.7	14.4	13.4	13.0
Fe_2O_3	4.22	3.3	6.2	2.72	2.67	4.0	.94	.96	.99
FeO	2.33	1.89		1.59	1.79				
MnO			.07			.05	.03	.02	.02
MgO	1.95	1.57	2.0	1.62	2.33	2.0	.37	.45	.2
CaO	5.84	4.87	5.2	4.42	3.93	3.1	1.4	1.4	1.4
Na_2O	3.74	4.14	3.9	4.32	4.54	4.7	3.4	3.2	3.8
K_2O	1.47	1.76	1.9	2.01	2.23	3.2	3.1	3.4	3.0
P_2O_5									
TiO_2	0.6	0.5	.59		0.50	.52	.14	.13	.12
CO_2	.39	.56		.56	<.2				
H_2O^+	2.27	1.55	.39	2.05	1.83	.51	1.0	1.1	.45
H_2O^-			1.88						
Totals	99.91	98.84	99.73	100.09	100.72	98.8	99.54	99.14	98.58
Rb						16.9		57.9	
Sr						490		342	
$^{87}Sr/^{86}Sr$						.7045		.7066	
A/CNK	0.98	0.96	0.93	1.01	0.98	0.91	1.22	1.14	1.05
Na_2O/K_2O	2.54	2.35	2.05	2.15	2.04	1.47	1.10	0.94	1.27
K_2O - MgO	-0.48	0.19	-0.10	0.39	-0.10	1.20	2.73	2.95	2.80
K_2O - CaO	-4.37	-3.11	-3.30	-2.41	-1.70	0.10	1.70	2.00	1.60
FeO*/MgO	3.1	3.1	2.8	2.5	1.8	1.8	2.3	1.9	4.5
F/F	1.81	1.75		1.71	1.49				

SOCIETY OF MINING ENGINEERS OF AIME

CALLER NO. D, LITTLETON, COLORADO 80127

PREPRINT NUMBER

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GEOLOGY OF THE FORTITUDE GOLD-SILVER DEPOSIT, COPPER CANYON, LANDER COUNTY, NEVADA

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Battle Mountain Gold Company
Battle Mountain, Nevada

[redacted] SME Annual Meeting
[redacted]

Abstract. The Fortitude gold-silver deposit is related to a "wallrock" copper porphyry system developed within Middle Pennsylvanian to Permian Antler Sequence rocks adjacent to a Middle-Tertiary altered granodiorite intrusive stock at Copper Canyon. Gold-silver ores of the Fortitude deposit occur with disseminated and massive sulfide replacement mineralization of skarn-like or calc-silicated limy horizons of the Antler Sequence contact meta-sedimentary rocks. A major, north-trending, steeply westward dipping normal fault was important as a conduit for hydrothermal fluids responsible for the metallization in the Fortitude area. Gold-silver mineralization is best developed near a marble front where retrograde chloritization and destruction of prograde calc-silicate mineral phases is most prevalent. Fluid-inclusion studies performed on the Copper Canyon system indicate a wide variation in fluid chemistry during several hydrosilicate stages that ranged in temperature from 500°C to 220°C.

Introduction

The Fortitude deposit is located in the Battle Mountain mining district, which is in the central Great Basin region of the Basin and Range province in the western United States. The deposit is at Copper Canyon in the southernmost portion of the district, approximately 19 km southwest of the town of Battle Mountain, Lander County, Nevada (see Fig. 1).

Mining activity within the Battle Mountain district began in 1866 (Roberts and Arnold, 1965). Base and precious metals were mined by underground methods intermittently up to 1955. Placer gold was first discovered at Copper Canyon in 1912. Moderate-scale dredging of alluvial gravel at the mouth of Copper Canyon was conducted by the Natomas Company from 1944 to 1955 (Johnson, 1973). Large-scale open-pit mining of copper ore was initiated in 1967 by Duval Corporation (Sayers, Tippett, and Fields, 1968). As copper prices decreased and precious-metals prices increased in the mid-1970's, Duval Corporation's exploration efforts shifted to precious metals at Copper Canyon. These exploration efforts resulted in the discovery of the Tomboy-Minnie deposits, and shortly afterward the Northeast Extension deposit at Copper Canyon (Blake, Wotruba, and Theodore, 1984; see Fig. 2). The Fortitude deposit was discovered in late 1980, after Duval Corporation had already proceeded with precious-metals production at Copper Canyon.

Conversion of the existing plant facilities at Copper Canyon to a precious-metals recovery system was completed in 1978 (Jackson, 1982), and production from the Tomboy-Minnie deposits began in early 1979. Precious-metals production moved to the Northeast Extension deposit at Copper Canyon in 1982. In December of 1984, after three years of preproduction stripping and mining of the Upper Fortitude ore zone, production from the higher-grade Lower Fortitude ore zone began. Currently, under a new corporate name of Battle Mountain Gold Company, the Fortitude deposit provides ore for continued precious-metals production at Copper Canyon.

Recorded metal production from the Battle Mountain mining district prior to 1967 included 4666 kg (150 000 oz) of gold, 65 317 kg (2.1 million oz) of silver, 13 600 t (15 000 st) of

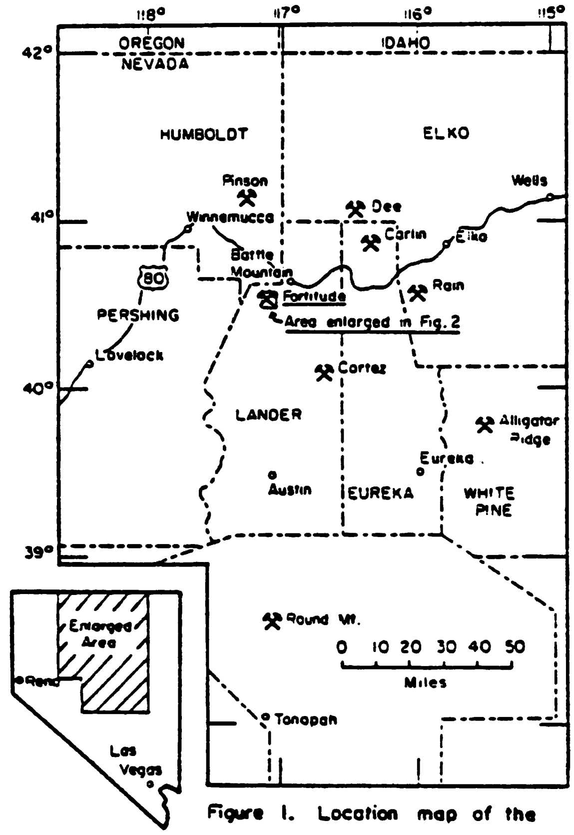

Figure 1. Location map of the Fortitude deposit.

copper, 4500 t (5000 st) of lead, and 13 600 t (15 000 st) of zinc (Roberts and Arnold, 1965). At the time of Duval's 1967 start-up of production, ore reserves at Copper Canyon included 12.6 Mt (13.9 million st) in the East ore body and another 3.6 Mt (4.0 million st) in the West ore body, both with average grades of 0.79% copper, 16.1 g/t (0.47 oz/st) silver and .86 g/t (0.025 oz/st) gold (Blake and others, 1984). The Tomboy-Minnie deposits collectively contained 3.5 Mt (3.9 million st) of ore grading 3.09 g/t (0.09 oz/st) gold and 9.60 g/t (0.28 oz/st) silver. The Northeast Extension reserves were identified as 1.4 Mt (1.5 million st) of ore with an average grade of 2.91 g/t (0.085 oz/st) gold and 5.1 g/t (0.15 oz/st) silver. Initial total reserve estimates for the Fortitude deposit were 14.5 Mt (16 million st) grading 5.14 g/t (0.150 oz/st) gold and 29.8 g/t (0.87 oz/st) silver (Jackson, 1982). Therefore, prior to large-scale mining, the Copper Canyon area contained a minimum of 102 642 kg (3.3 million oz) of gold and 541 201 kg (17.4 million oz) of silver as minable reserves.

The Fortitude deposit reserves as of January 1, 1985 were 10 605 000 t (11.69 million st) grading 5.28 g/t (0.154 oz/st) gold and 28.49 g/t (0.83 oz/st) silver. Currently, the Battle Mountain Gold Company is producing 6800 kg (220 000 oz) of gold per year and significant amounts of silver, processing approximately 2720 to 3175 t (3000 to 3500 st) per day. Extraction of gold and silver is by the carbon-in-pulp, cyanide-leach method (Anderson and Todd, 1984).