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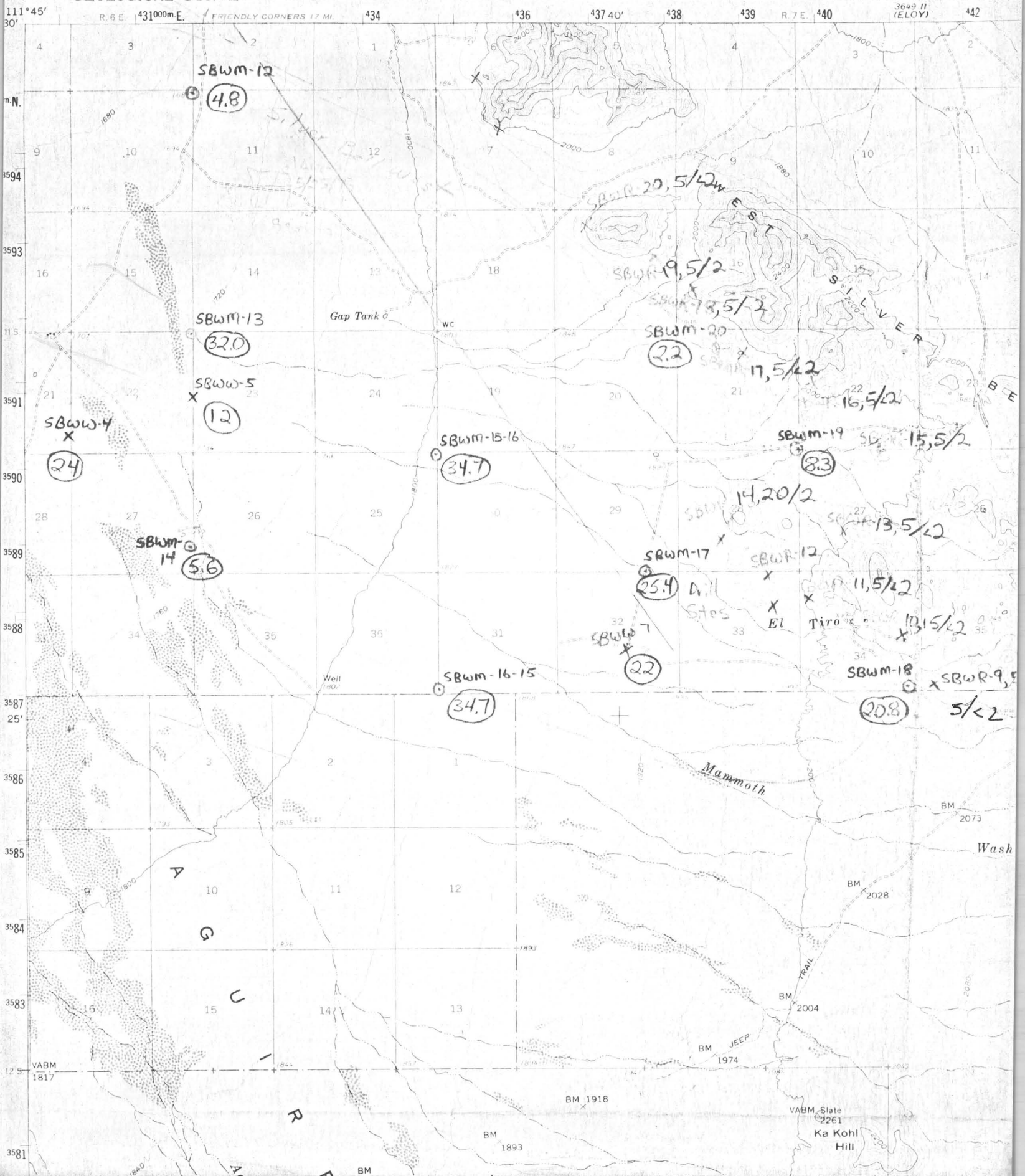
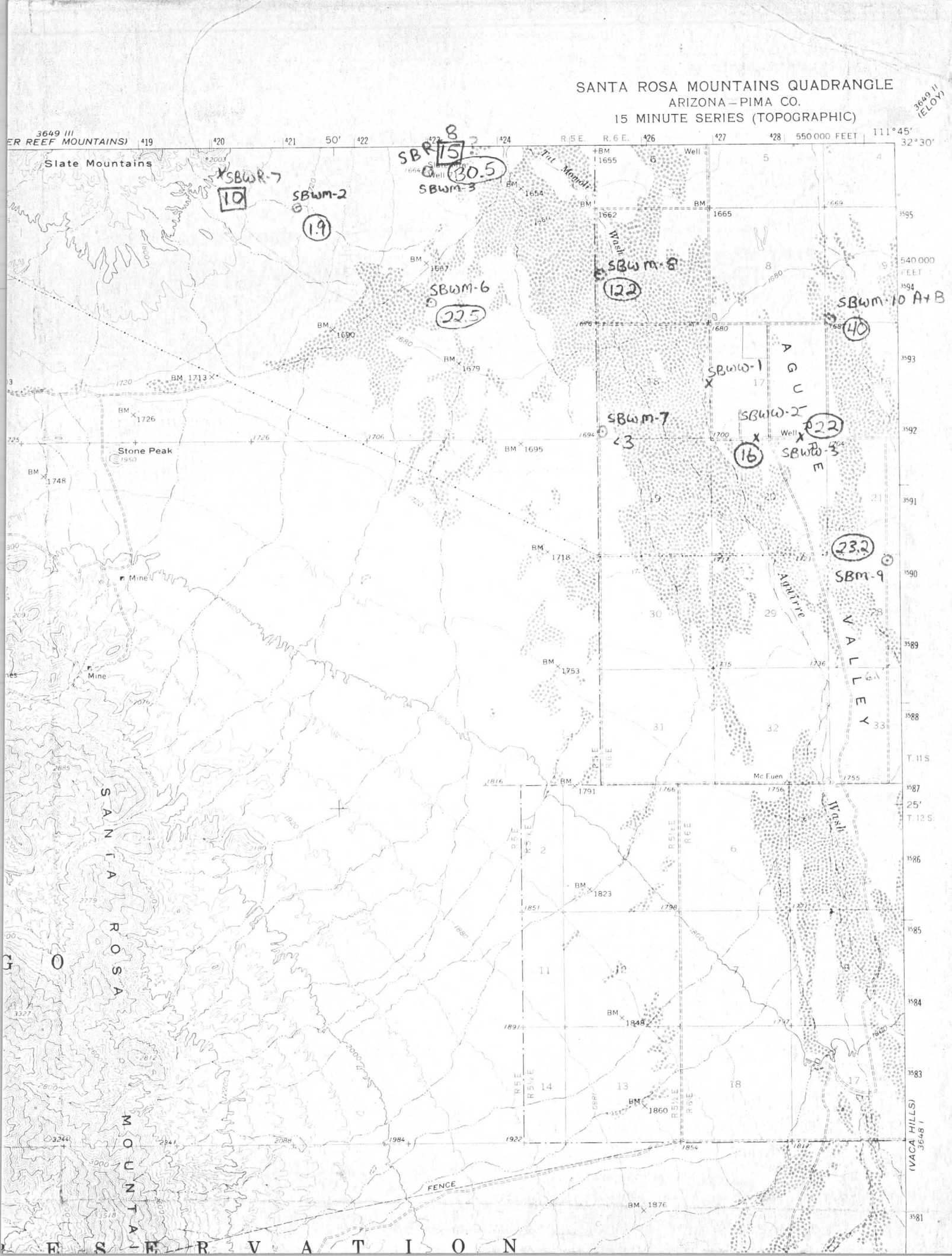
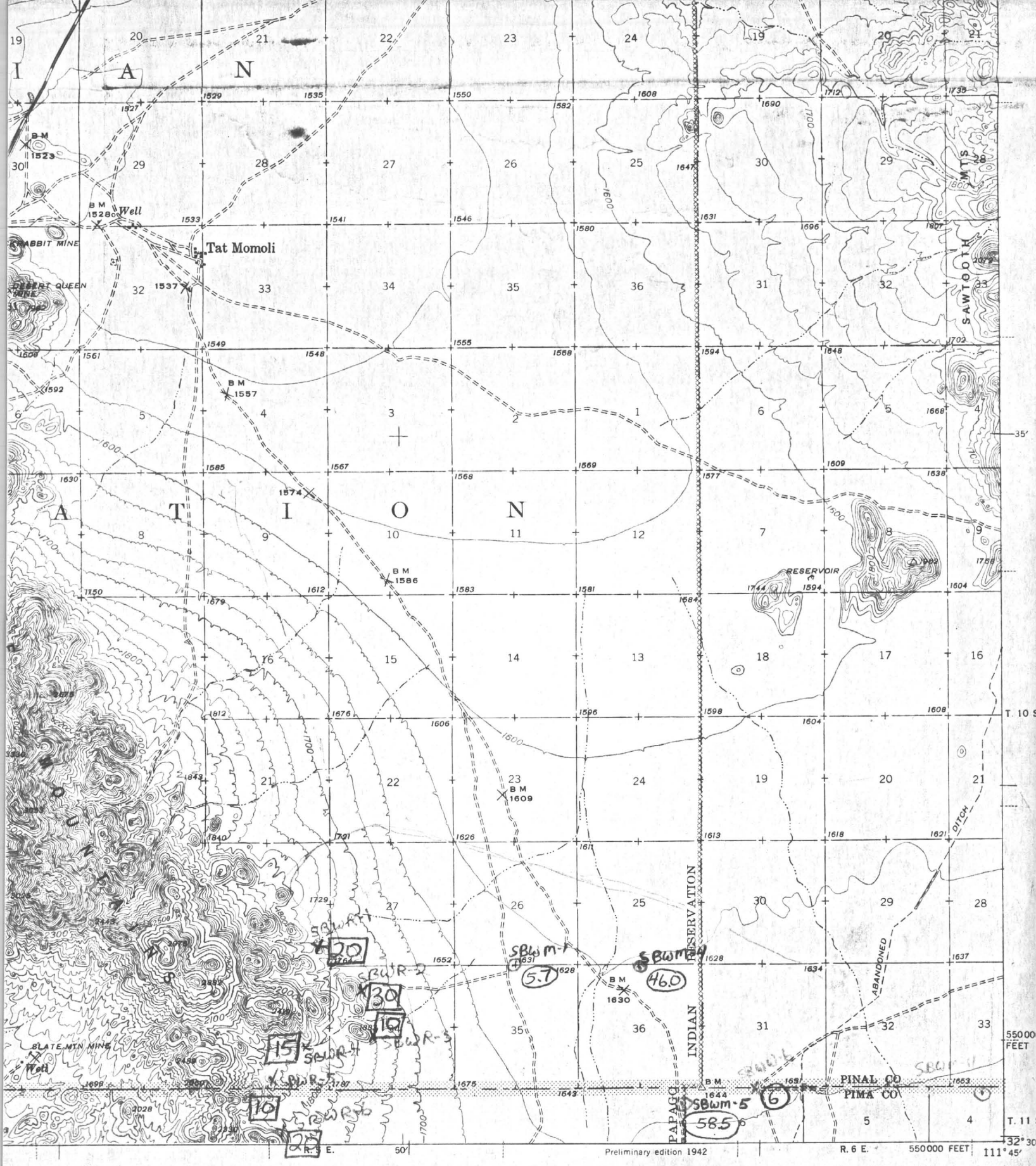
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS




SANTA ROSA MOUNTAINS QUADRANGLE
ARIZONA—PIMA CO.
15 MINUTE SERIES (TOPOGRAPHIC)
3649 III
(ER REEF MOUNTAINS)
3649 II
(ELOY)
111°45'
32°30'
550 000 FEET
540 000 FEET
Slate Mountains
SBWR-7
10
SBWM-2
1.9
SBR 15
8
30.5
SBWM-3
Trail Monolith
SBWM-8
122
SBWM-6
22.5
SBWM-10 A+B
40
SBWW-1
SBWW-2
22
16
SBWW-3
SBWM-7
<3
Stone Peak
Mine
Mine
SBM-9
23.2
Aguirre
Wash
Mc Fuen
Wash
SANTA ROSA MOUNTAINS
FENCE
(VACA HILLS)
3648 I
T. 11 S.
T. 12 S.
R 5 E.
R. 6 E.
R5E
R6E
BM 1713
BM 1726
BM 1748
BM 1690
BM 1679
BM 1667
BM 1655
BM 1654
BM 1662
BM 1665
BM 1695
BM 1718
BM 1753
BM 1791
BM 1823
BM 1848
BM 1860
BM 1876
Well
Tank
AGUAJE
VALLEY



Scale $\frac{1}{62500}$

1 2 3 4 Miles

2000 3000 4000 5000 6000 7000 Yards

6000 9000 12000 15000 18000 Feet

1 2 3 4 5 Kilometers

Contour interval 25 feet

Datum is mean sea level

To join Casa Grande Map, use dotted projection corners

ROUTES USUALLY TRAVELED

HARD IMPERVIOUS SURFACES

OTHER SURFACE IMPROVEMENTS

U. S. ROUTE STATE ROUTE

1942

Polyconic projection. 1927 North American datum
5000 yard grid based on U S. zone system, F
10000 foot grid based on Arizona (Central) rectangular coordinate system

SILVER REEF MOUNTAINS, ARIZ.

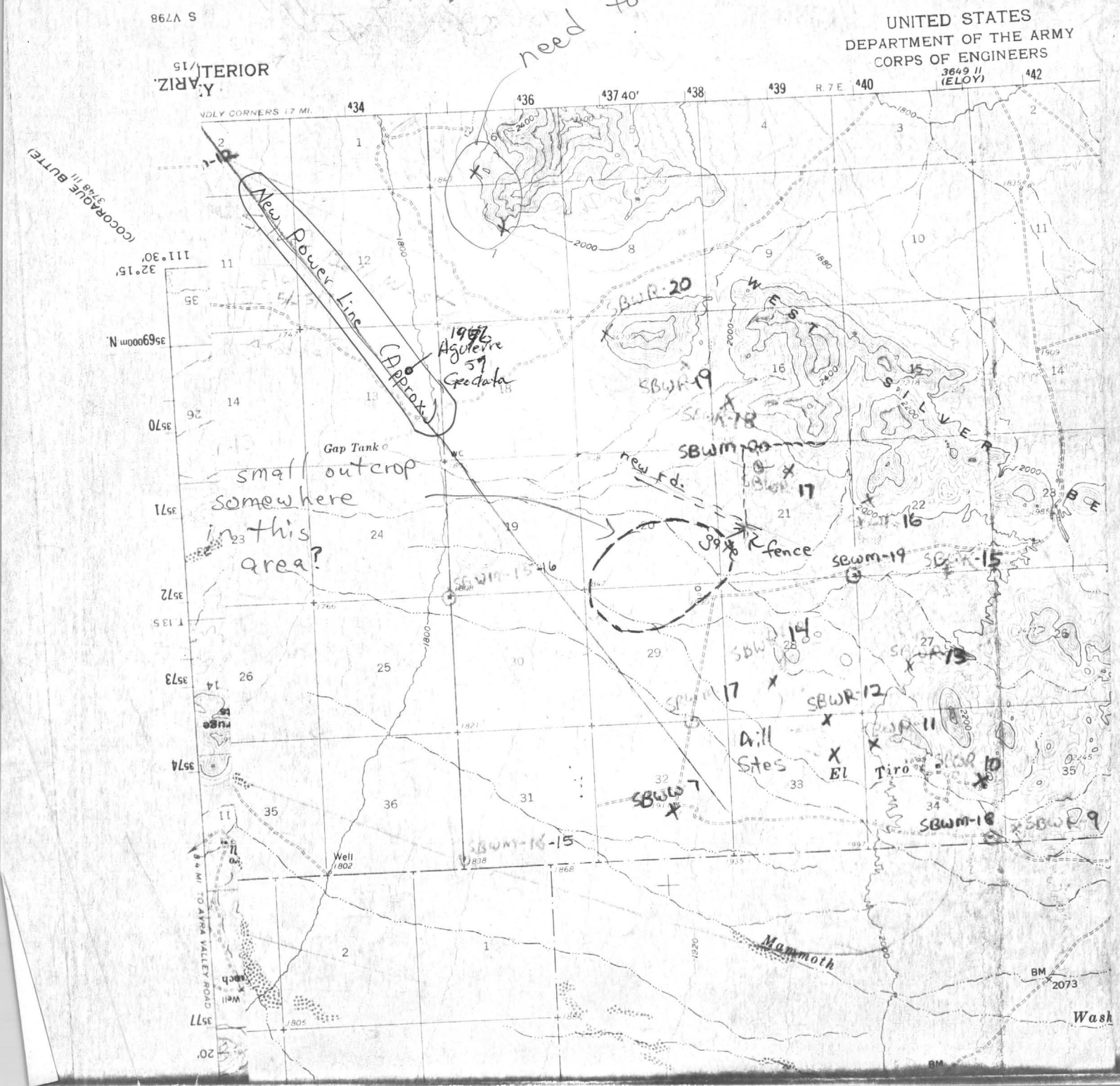
N3230—W11145/15

Best Way to get in is fm North though Friendly Corner to Sunland Gin Rd. Take Sun. Gin Rd South till you cross the New Power Line.

↑ past Silver Bell Estates

You might do OK getting in fm. the south also if you could catch the power line, but I didn't try it.

need to be sampled



800
.20
160.00

90 hig Cash
116.84 to special Acc Repairs expenses
160 TO Transfer to tax fund.
276.84

90 Cash
276.84 To Splaces
366.84

943.06 - 366.84
= 576.22

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

VACA HILLS QUADRANGLE
ARIZONA–PIMA CO.
15 MINUTE SERIES (TOPOGRAPHIC)

3549 III (SILVER REEF MOUNTAINS)

3749 II (RED ROCK)

3649 II (ELOY)

111°45' 32°30'

111°30' 32°30'

R. 6 E. R. 7 E. R. 8 E.

431 000m E. 620 000 FEET

3595 000m N. 540 000 FEET

T. 11 S. T. 12 S. T. 13 S.

25' 20'

32°15' 111°45'

32°15' 111°30'

460 000 FEET 560 000 FEET

FRIENDLY CORNERS 17 MI.

RED ROCK 12 MI.

22 MI. TO ARIZ. 84 & 93 TUCSON 38 MI.

17 MI. TO ARIZ. 86

3.6 MI. TO AVRA VALLEY ROAD

SIL NAKYA 7.5 MI.

(SILVER BELL PEAK) 3748 IV

(SAN VICENTE) 3648 II

(COMOBABI) 3648 III

(COCORAQUE BUTTE) 3748 III

Malpais Hill
Gap Tank
WC
Filkd Drill Site
DH 4209
MW 35
El Tiro
Well 1802
Mammoth Wash
Silver Bell Cem
Water
Tin House Well
Silverbell
Jesuit Hill
Quartzite Peak
Kurtz Shaft
Daisy Shaft
El Tiro Pit
Union Hill
Mammoth Incline
Confidence Peak
Cem
North Butte
Copper Butte
Wild Hog Mtn
Oxide Pit
Silver Bell
Ka Kohl Hill
Koht Kohl Hill
Tank 125
House
Romero Ranch
Well
Romero Well
Skoksonak
Graves
Roskruge Mts
Cerro Negro
Queens Well
Twin Peaks
Tank 113
Well (Dry)
Quinlin (Site)
Tank 80
Aguirre Wash
Vopuli Wash
Silver Bell Road
Old Railroad Grade
Private Road
Trail
Jeep Trail
Light-duty
Unimproved dirt

BM 2075 BM 2111 BM 2105 BM 2119 BM 2168 BM 2354 BM 2281 BM 2519 BM 2268 BM 2342 BM 2231 BM 2181 BM 2513 BM 2120 BM 2518 Cem BM 2073 BM 2028 BM 2467 BM 2004 BM 1974 BM 2437 BM 2413 VABM 1817 BM 1918 VABM Slate 2261 BM 1893 BM 1871 BM 1869 BM 1871 BM 1859 BM 2371 BM 2426 BM 2425 BM 2353 BM 2245 BM 2173 BM 2184 BM 2097 BM 2069 BM 2192 VABM 4195

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1958. Advance field check 1959

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 12, shown in blue

Land lines unsurveyed in T. 13 S.–R. 6 E. and in parts of
T. 12 S.–Rs. 6, 7 and 8 E.

UTM GRID AND 1959 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:62500

1 0 1 2 3 4 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

ARIZONA
QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

VACA HILLS, ARIZ.
N3215—W11130/15

1959

AMS 3648 I—SERIES V798

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1965

GRAVITY SURVEY
SILVER BELL WEST PROJECT
PINAL & PIMA COUNTIES, ARIZONA

FOR

PILLAR, LOWELL & ASSOCIATES

mining
geophysical surveys inc

GRAVITY SURVEY

SILVER BELL WEST PROJECT

PINAL & PIMA COUNTIES, ARIZONA

FOR

PILLAR, LOWELL & ASSOCIATES

PROJECT 0724

mining
geophysical surveys inc

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SUMMARY	1
INTRODUCTION	1
INTERPRETATION	2
SURVEY PROCEDURE	3

ACCOMPANYING THIS REPORT:

2 PLAN MAPS

6 PROFILES

1 COMPUTER LISTING OF DATA

DISTRIBUTION:

ORIGINAL & 2 COPIES: John Kinnison, Tucson

mining geophysical surveys inc

GRAVITY SURVEY
SILVER BELL WEST PROJECT
PINAL & PIMA COUNTIES, ARIZONA
FOR
PILLAR, LOWELL & ASSOCIATES

SUMMARY:

A gravity survey conducted in the titled area indicates that the major part of the area of interest occurs over a deep alluvial basin. We estimate that 5000' to 10,000' of alluvial fill occur in this basin.

A narrow zone of shallow bedrock occurs southwest of exposed pre-mineral rocks in the West Silver Bell Mountains. Large areas of shallow bedrock may occur between the Slate and Sawtooth Mountains and east of the Santa Rosa Mountains.

INTRODUCTION:

A gravity survey was conducted in the titled area during the period May 2 - May 13, 1977 under the direction of Scott P. Rogers, geologist. The interpretation and report are by Robert E. West and W. Gordon Wieduwilt, geophysicists for Mining Geophysical Surveys, Inc. Approximately 390 gravity stations were observed.

Rocks exposed in the survey area include Precambrian granites and Cretaceous andesites in the West Silver Bell Mountains; Tertiary volcanics and intrusives and Quaternary basalts in the

Sawtooth Mountains; Precambrian schists, granites, and sedimentary rocks, Paleozoic sedimentary rocks, and Cretaceous volcanic and sedimentary rocks in the Slate Mountains; Laramide intrusives, schists, and granites in the Santa Rosa Mountains; and Quaternary alluvium in Aguirre Valley.

The purpose of the survey was to delineate areas where shallow bedrock occurs in an alluvial covered region that lies between the West Silver Bell and the Slate Mountains.

INTERPRETATION:

Bouguer anomalies decrease from about -75 mgal on exposed bedrock in the mountain ranges to -98 mgal in Aguirre Valley. This decrease is caused by large thicknesses of low density alluvium in Aguirre Valley. We estimate that 5000' to 10,000' of low density fill may occur in Aguirre Valley if the density contrast between alluvium and bedrock is 0.4 to 0.2 gm/cm^3.

The pattern formed by the Bouguer anomaly contour map suggests that northwest and east-northeast trending normal faults have dropped bedrock down in Aguirre Valley. The location of these faults is shown on the interpretation map. These locations were determined from Bouguer anomaly profiles A'A' through FF'.

The northwest trending fault that separates deep alluvium to the southwest from shallow bedrock to the northeast in the West Silver Bell Mountains is well located by this survey. We

are less confident about the position of the other faults shown on the interpretation map. Additional gravity lines run perpendicular to the strike of these faults would help to establish their location more accurately.

SURVEY PROCEDURE:

A LaCoste and Romberg, Inc. model G geodetic gravity meter (#325) was used for the survey. This meter has a reading accuracy of 0.01 mgal and a drift rate of less than 1 mgal/month.

The gravity survey was tied to the Toltec, Arizona base station of the Arizona Gravity Base Station Network, and the Mining Geophysical Surveys, Inc. base station. The Toltec and MGS bases have observed gravities of 979393.579 $\pm$.014 mgal and 979251.706 $\pm$.021 mgal, respectively.

Latitude, longitude, and elevation were obtained for each station from 15' U.S. Geological Survey topographic maps. Contour intervals for these maps vary from 25' to 40'. Both the Silver Reef Mountains and Eloy quadrangles were surveyed using plane tables and elevations picked from these maps may be less accurate than elevations picked from the Vaca Hills and Santa Rosa Mountains maps. Scatter in the Bouguer anomaly profiles indicate that elevation errors are usually less than $\pm$15'.

The gravity data were reduced by computer using standard gravity corrections. Linear drift corrections were applied to the field data after tide corrections had been applied. Latitude,

free-air, and Bouguer corrections were made on the observed gravities. A density of 2.67 gm/cm^3 was used for the Bouguer correction. Terrain corrections were not applied to the data.

On May 12, 1977 a 3 mgal tare occurred between gravity measurements at stations 18 and 19 on Line 10. The data collected prior to the tare was saved by tying station 18 to the Toltec base station.

Respectfully submitted,

R. E. West /mw

Robert E. West
Geophysicist

W. Gordon Wieduwilt
Geophysicist

Registered Professional Engineer (Geophysical)
CERTIFICATE NO.
8842
W. GORDON
WIEDUWILT
DATE SIGNED 5/27/77
Arizona U. S. A.

May 27, 1977

Tucson, Arizona

0724
PROFILE CC'
LINES 1, 2, 3, & 4

SIMPLE BOUGUER ANOMALY (MGAL)

-75
-80
-85
-90
-95

LINE 1

LINE 2 & 3

LINE 4

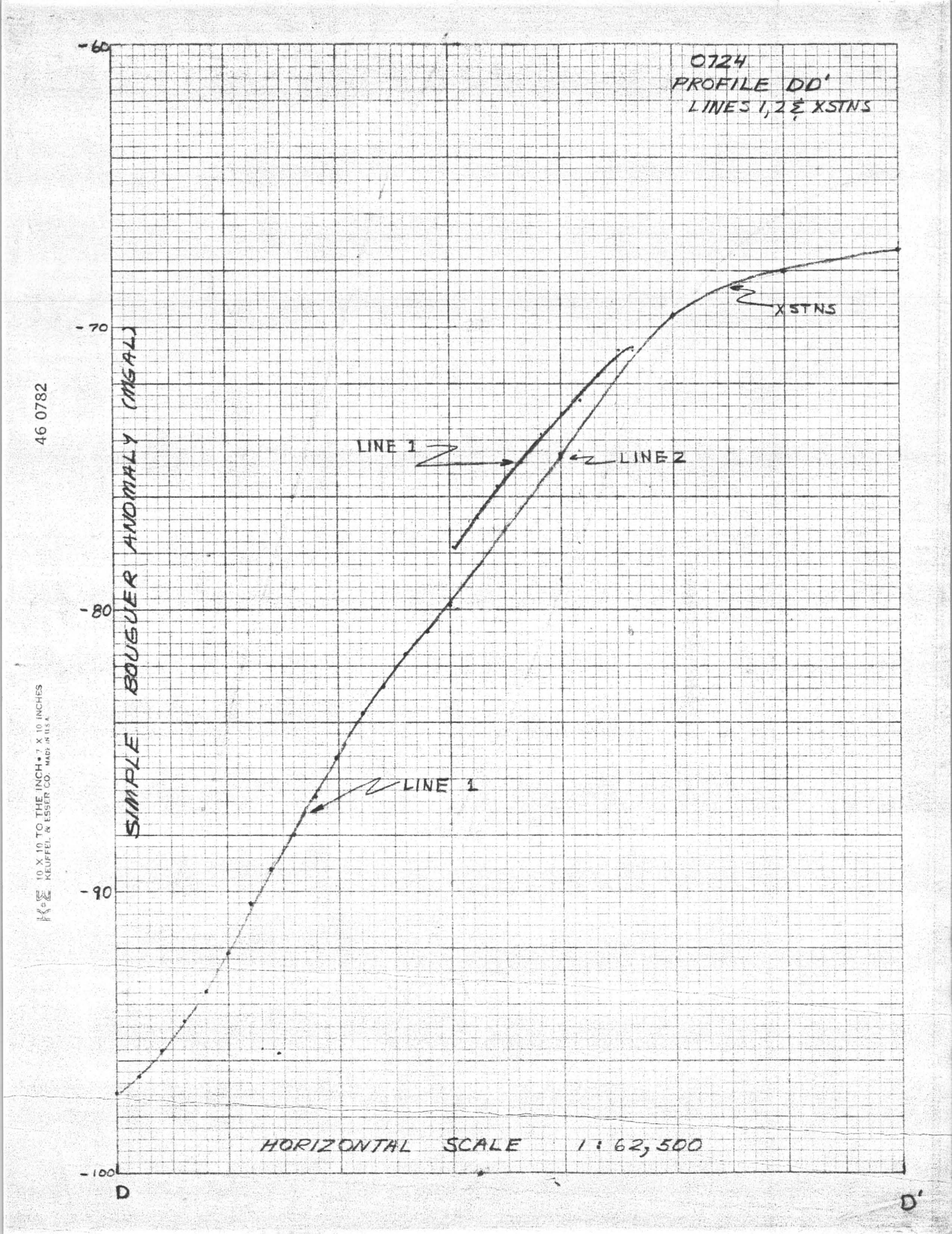
-95
-95
-100
-100

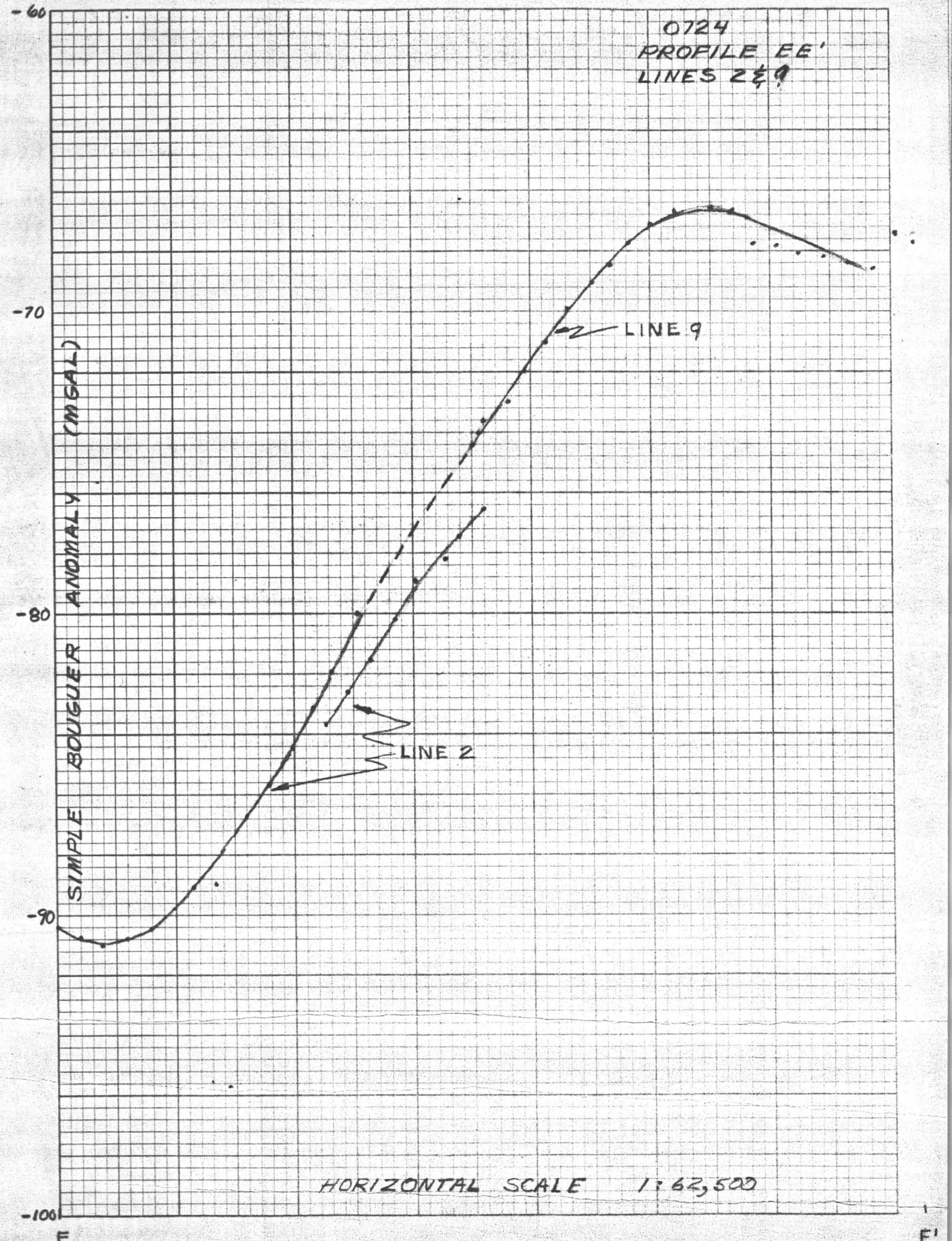
HORIZONTAL SCALE
1:62,500

C
C'

47 0782

10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.


0724
PROFILE DD'
LINES 1, 2 & XSTNS
-60
-70
-80
-90
-100
SIMPLE BOUGUER ANOMALY (MGAL)
LINE 1
LINE 2
XSTNS
LINE 1
HORIZONTAL SCALE 1:62,500
D
D'
46 0782
10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



46 0782
46 0782
10 X 10 TO THE INCH • 7 X 10 INCHES
K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG)	(MIN)	WEST LONGITUDE (DEG)	(MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
------- DRIFT RATE= .014394 MGAL/HR -------									
STN X 1	32.	33.03	111.	41.35	1632.0	.125	979368.145	-19.935	-75.535
STN X 2	32.	32.16	111.	41.38	1701.0	.134	979366.206	-14.199	-72.150
STN X 3	32.	31.28	111.	41.38	1781.0	.142	979358.742	-12.939	-73.617
STN X 4	32.	30.41	111.	41.38	1870.0	.150	979350.367	-11.759	-75.469
STN X 5	32.	30.41	111.	42.39	1738.0	.156	979358.172	-16.369	-75.582
STN X 6	32.	30.89	111.	42.75	1703.0	.163	979362.196	-16.292	-74.312
STN X 7	32.	32.54	111.	42.44	1647.0	.174	979371.258	-14.743	-70.855
STN X 8	32.	33.03	111.	42.39	1623.0	.177	979373.345	-15.582	-70.876
LINE 1 STN 0	32.	31.99	111.	43.00	1654.0	.178	979369.910	-14.684	-71.034
LINE 1 STN 1	32.	31.95	111.	43.17	1648.0	.176	979370.225	-14.879	-71.025
LINE 1 STN 2	32.	31.85	111.	43.33	1647.0	.175	979370.500	-14.562	-70.674
LINE 1 STN 3	32.	31.75	111.	43.43	1647.0	.174	979370.224	-14.701	-70.813
LINE 1 STN 4	32.	31.57	111.	43.43	1652.0	.171	979368.750	-15.461	-71.743
LINE 1 STN 5	32.	31.39	111.	43.43	1655.0	.169	979367.447	-16.236	-72.620
LINE 1 STN 6	32.	31.28	111.	43.43	1660.0	.167	979366.648	-16.415	-72.970
LINE 1 STN 7	32.	31.12	111.	43.43	1663.0	.164	979365.451	-17.111	-73.768
LINE 1 STN 8	32.	30.95	111.	43.43	1667.0	.161	979363.907	-18.048	-74.841
LINE 1 STN 9	32.	30.88	111.	43.43	1671.0	.157	979362.530	-18.954	-75.883
LINE 1 STN 10	32.	30.62	111.	43.43	1674.0	.153	979361.176	-19.672	-76.703
LINE 1 STN 11	32.	30.41	111.	43.43	1679.0	.148	979359.521	-20.570	-77.772
LINE 1 STN 12	32.	30.41	111.	43.61	1673.0	.142	979359.522	-21.134	-78.131
LINE 1 STN 13	32.	30.41	111.	43.80	1670.0	.135	979359.449	-21.489	-78.385
LINE 1 STN 14	32.	30.41	111.	43.99	1666.0	.131	979359.334	-21.981	-78.740
LINE 1 STN 15	32.	30.41	111.	44.18	1662.0	.126	979359.182	-22.509	-79.132
LINE 1 STN 16	32.	30.41	111.	44.43	1659.0	.121	979358.968	-23.005	-79.526
LINE 1 STN 17	32.	30.41	111.	44.60	1655.0	.114	979358.952	-23.397	-79.781
LINE 1 STN 18	32.	30.23	111.	44.60	1659.0	.105	979357.498	-24.230	-80.751
LINE 1 STN 19	32.	30.05	111.	44.60	1663.0	.100	979356.171	-24.935	-81.592
LINE 1 STN 20	32.	29.89	111.	44.61	1667.0	.096	979354.652	-25.860	-82.653
LINE 1 STN 21	32.	29.72	111.	44.61	1671.0	.089	979353.138	-26.767	-83.696
LINE 1 STN 22	32.	29.52	111.	44.61	1674.0	.079	979351.053	-28.298	-85.329
LINE 1 STN 23	32.	29.36	111.	44.61	1677.0	.073	979349.400	-29.451	-86.585
LINE 1 STN 24	32.	29.19	111.	44.61	1680.0	.067	979347.536	-30.801	-88.037
LINE 1 STN 25	32.	29.02	111.	44.61	1684.0	.061	979345.882	-31.848	-89.220
LINE 1 STN 26	32.	28.86	111.	44.61	1689.0	.056	979344.179	-32.863	-90.406
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LINE 1 STN 28	32.	28.50	111.	44.61	1696.0	.042	979340.208	-35.685	-93.466
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LINE 1 STN 35	32.	27.75	111.	45.11	1705.0	-.019	979335.066	-38.960	-97.048
LINE 1 STN 36	32.	27.63	111.	45.11	1708.0	-.027	979334.481	-39.099	-97.290
LINE 1 STN 37	32.	27.45	111.	45.11	1712.0	-.035	979333.977	-38.983	-97.309

GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG)	(MIN)	WEST LONGITUDE (DEG)	(MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
LINE 1 STN 38	32.	27.29	111.	45.11	1716.0	-.040	979333.752	-38.614	-97.077
LINE 1 STN 39	32.	27.12	111.	45.11	1720.0	-.047	979333.733	-38.025	-96.625
LINE 1 STN 40	32.	26.95	111.	45.11	1724.0	-.053	979333.700	-37.452	-96.187
LINE 1 STN 41	32.	26.72	111.	45.11	1728.0	-.063	979334.140	-36.323	-95.194
LINE 1 STN 42	32.	26.57	111.	45.11	1732.0	-.066	979334.312	-35.570	-94.578
LINE 1 STN 43	32.	26.41	111.	45.11	1736.0	-.074	979334.447	-34.841	-93.985
LINE 1 STN 44	32.	26.25	111.	45.11	1740.0	-.079	979334.412	-34.283	-93.563
LINE 1 STN 45	32.	26.07	111.	45.11	1743.0	-.083	979334.396	-33.772	-93.155
LINE 1 STN 46	32.	25.87	111.	45.11	1746.0	-.085	979334.269	-33.344	-92.829
LINE 1 STN 47	32.	25.75	111.	45.11	1749.0	-.088	979334.040	-33.128	-92.715
LINE 1 STN 48	32.	25.59	111.	45.11	1752.0	-.091	979333.789	-32.880	-92.569
LINE 1 STN 49	32.	25.41	111.	45.11	1755.0	-.095	979333.673	-32.469	-92.260
LINE 1 STN 50	32.	25.26	111.	45.11	1758.0	-.097	979333.532	-32.124	-92.018
LINE 1 STN 51	32.	25.18	111.	45.11	1760.0	-.100	979333.514	-31.845	-91.807
STN X 9	32.	32.16	111.	44.44	1626.0	-.107	979373.280	-14.179	-69.575
STN X 10	32.	33.03	111.	44.42	1613.0	-.108	979376.797	-13.070	-68.023
STN X 11	32.	33.90	111.	44.44	1601.0	-.109	979379.459	-12.722	-67.267
------- DRIFT RATE= .020377 MGAL/HR -------									
LINE 1 STN 51	32.	25.18	111.	45.11	1760.0	.041	979333.445	-31.913	-91.875
LINE 1 STN 52	32.	25.18	111.	45.30	1760.0	.055	979333.986	-31.372	-91.334
LINE 1 STN 53	32.	25.18	111.	45.50	1755.0	.061	979334.510	-31.319	-91.110
LINE 1 STN 54	32.	25.18	111.	45.70	1750.0	.084	979335.162	-31.138	-90.759
STN X 12	32.	22.46	111.	48.39	1922.0	.139	979329.919	-16.506	-81.987
STN X 13	32.	22.46	111.	47.00	1854.0	.154	979332.601	-20.220	-83.385
STN X 14	32.	23.33	111.	47.00	1830.0	.160	979335.029	-21.232	-83.579
STN X 15	32.	24.19	111.	47.00	1798.0	.166	979338.796	-21.643	-82.899
LINE 1 STN 55	32.	25.18	111.	46.00	1756.0	.179	979335.955	-29.780	-89.606
LINE 1 STN 56	32.	25.18	111.	46.19	1757.0	.183	979336.437	-29.204	-89.063
LINE 1 STN 57	32.	25.18	111.	46.39	1758.0	.186	979336.956	-28.591	-88.484
LINE 1 STN 58	32.	25.18	111.	46.65	1759.0	.188	979337.678	-27.775	-87.702
LINE 1 STN 59	32.	25.18	111.	46.85	1762.0	.189	979338.226	-26.944	-86.974
LINE 1 STN 60	32.	25.18	111.	47.00	1766.0	.189	979338.568	-26.226	-86.392
LINE 1 STN 61	32.	25.18	111.	47.20	1770.0	.190	979339.012	-25.406	-85.708
LINE 1 STN 62	32.	25.18	111.	47.40	1777.0	.190	979339.426	-24.334	-84.875
LINE 2 STN 0	32.	25.18	111.	47.67	1785.0	.189	979339.641	-23.366	-84.179
LINE 2 STN 1	32.	25.32	111.	47.67	1780.0	.188	979339.835	-23.833	-84.476
LINE 2 STN 2	32.	25.49	111.	47.67	1773.0	.187	979339.592	-24.966	-85.370
LINE 2 STN 3	32.	25.66	111.	47.67	1765.0	-.081	979338.684	-26.857	-86.989
LINE 2 STN 4	32.	25.83	111.	47.67	1765.0	.185	979338.676	-27.096	-87.228
LINE 2 STN 5	32.	26.03	111.	47.67	1748.0	.184	979338.461	-29.182	-88.735
LINE 2 STN 6	32.	26.21	111.	47.67	1742.0	.181	979338.531	-29.921	-89.269
LINE 2 STN 7	32.	26.37	111.	47.67	1735.0	.179	979338.756	-30.572	-89.682
LINE 2 STN 8	32.	26.54	111.	47.67	1728.0	.175	979339.206	-31.012	-89.884
LINE 2 STN 9	32.	26.70	111.	47.67	1721.0	.173	979339.694	-31.400	-90.033
LINE 2 STN 10	32.	26.90	111.	47.67	1716.0	.166	979340.253	-31.583	-90.046
LINE 3 STN 1	32.	26.89	111.	47.46	1716.0	.158	979339.916	-31.906	-90.369
LINE 3 STN 2	32.	26.89	111.	47.27	1717.0	.153	979339.520	-32.208	-90.705

GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG) (MIN)	WEST LONGITUDE (DEG) (MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
LINE 3 STN 3	32. 26.89	111. 47.07	1717.0	.148	979339.108	-32.620	-91.117
LINE 3 STN 4	32. 26.89	111. 46.89	1717.0	.144	979338.678	-33.050	-91.547
LINE 3 STN 5	32. 26.89	111. 46.67	1717.0	.136	979338.201	-33.527	-92.024
LINE 3 STN 6	32. 26.89	111. 46.46	1717.0	.128	979337.829	-33.899	-92.396
LINE 3 STN 7	32. 26.89	111. 46.27	1720.0	.122	979337.260	-34.186	-92.785
LINE 3 STN 8	32. 26.89	111. 46.08	1721.0	.116	979336.905	-34.447	-93.080
LINE 3 STN 9	32. 26.89	111. 45.87	1723.0	.110	979336.193	-34.971	-93.672
LINE 3 STN 10	32. 26.89	111. 45.63	1724.0	.103	979335.428	-35.642	-94.377
LINE 3 STN 11	32. 26.89	111. 45.42	1724.0	.094	979334.855	-36.215	-94.950
LINE 3 STN 12	32. 26.89	111. 45.23	1725.0	.089	979334.259	-36.716	-95.486
LINE 1 STN 40	32. 26.96	111. 45.11	1724.0	.019	979333.619	-37.546	-96.281
------- DRIFT RATE= .014378 MGAL/HR -------							
LINE 3 STN 0	32. 26.90	111. 47.67	1716.0	.002	979340.263	-31.573	-90.036
LINE 3 STN 13	32. 26.96	111. 47.84	1716.0	.012	979340.658	-31.259	-89.722
LINE 3 STN 14	32. 27.03	111. 48.62	1715.0	.019	979341.050	-31.056	-89.485
LINE 3 STN 15	32. 27.11	111. 48.21	1715.0	.023	979341.535	-30.681	-89.109
LINE 3 STN 16	32. 27.17	111. 48.38	1714.0	.029	979341.916	-30.475	-88.869
LINE 3 STN 17	32. 27.25	111. 48.55	1713.0	.034	979342.353	-30.241	-88.601
LINE 3 STN 18	32. 27.32	111. 48.74	1712.0	.041	979342.848	-29.935	-88.262
LINE 3 STN 19	32. 27.39	111. 48.90	1711.0	.047	979343.421	-29.552	-87.844
LINE 3 STN 20	32. 27.45	111. 49.08	1711.0	.052	979343.897	-29.157	-87.449
LINE 3 STN 21	32. 27.53	111. 49.25	1712.0	.059	979344.452	-28.617	-86.943
LINE 3 STN 22	32. 27.61	111. 49.42	1710.0	.064	979344.844	-28.521	-86.780
LINE 3 STN 23	32. 27.68	111. 49.61	1712.0	.069	979345.543	-27.730	-86.056
LINE 3 STN 24	32. 27.74	111. 49.75	1710.0	.082	979346.149	-27.394	-85.652
LINE 3 STN 25	32. 27.81	111. 49.91	1710.0	.092	979346.940	-26.697	-84.956
LINE 3 STN 26	32. 27.88	111. 50.10	1711.0	.096	979347.833	-25.805	-84.098
LINE 3 STN 27	32. 27.95	111. 50.27	1711.0	.110	979348.895	-24.839	-83.131
LINE 3 STN 28	32. 28.01	111. 50.44	1712.0	.117	979350.019	-23.703	-82.029
LINE 3 STN 29	32. 28.09	111. 50.62	1713.0	.123	979351.234	-22.503	-80.863
LINE 3 STN 30	32. 28.16	111. 50.80	1713.0	.127	979352.442	-21.389	-79.750
LINE 3 STN 31	32. 28.23	111. 50.99	1713.0	.133	979353.709	-20.218	-78.578
LINE 3 STN 32	32. 28.28	111. 51.11	1713.0	.139	979353.972	-20.023	-78.383
LINE 3 STN 33	32. 28.35	111. 51.29	1719.0	.146	979354.258	-19.267	-77.832
LINE 3 STN 34	32. 28.43	111. 51.45	1730.0	.152	979354.404	-18.196	-77.135
LINE 3 STN 35	32. 28.50	111. 51.65	1740.0	.155	979354.521	-17.234	-76.514
LINE 3 STN 36	32. 28.59	111. 51.81	1750.0	.158	979354.158	-16.779	-76.400
LINE 3 STN 37	32. 28.65	111. 51.99	1758.0	.162	979354.007	-16.258	-76.152
LINE 3 STN 38	32. 28.72	111. 52.18	1758.0	.166	979353.944	-16.416	-76.310
LINE 3 STN 39	32. 28.80	111. 52.35	1755.0	.169	979353.914	-16.838	-76.629
LINE 3 STN 40	32. 28.87	111. 52.50	1758.0	.172	979353.471	-17.094	-76.988
LINE 3 STN 41	32. 28.93	111. 52.68	1758.0	.175	979353.590	-17.057	-76.950
LINE 3 STN 42	32. 29.00	111. 52.85	1758.0	.178	979353.577	-17.165	-77.058
LINE 3 STN 43	32. 29.07	111. 53.01	1754.0	.180	979354.030	-17.183	-76.940
LINE 3 STN 44	32. 29.14	111. 53.18	1758.0	.183	979353.879	-17.053	-76.947
LINE 3 STN 45	32. 29.22	111. 53.37	1750.0	.185	979354.279	-17.514	-77.135
LINE 3 STN 46	32. 29.30	111. 53.57	1748.0	.186	979354.813	-17.278	-76.831

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GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG)	(MIN)	WEST LONGITUDE (DEG)	(MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
STN X 16	32.	28.12	111.	52.11	1720.0	.189	979353.328	-19.791	-78.390
STN X 17	32.	27.65	111.	52.11	1750.0	.187	979351.741	-17.916	-77.537
STN X 18	32.	26.83	111.	52.02	1808.0	.184	979345.989	-17.098	-78.696
STN X 19	32.	26.04	111.	52.22	1940.0	.178	979338.031	-11.566	-77.660
LINE 2 STN 10	32.	26.90	111.	47.67	1716.0	.152	979340.258	-31.577	-90.040
LINE 2 STN 11	32.	27.05	111.	47.67	1712.0	.147	979340.549	-31.866	-90.193
LINE 2 STN 12	32.	27.23	111.	47.67	1707.0	.143	979340.930	-32.201	-90.357
LINE 2 STN 13	32.	27.39	111.	47.67	1703.0	.138	979341.026	-32.699	-90.719
LINE 2 STN 14	32.	27.56	111.	47.67	1698.0	.131	979341.291	-33.136	-90.985
LINE 2 STN 15	32.	27.78	111.	47.67	1694.0	.126	979342.064	-33.038	-90.751
LINE 2 STN 16	32.	27.95	111.	47.67	1690.0	.120	979342.750	-32.959	-90.536
LINE 2 STN 17	32.	28.11	111.	47.67	1687.0	.115	979343.897	-32.312	-89.787
LINE 2 STN 18	32.	28.26	111.	47.67	1683.0	.108	979345.064	-31.726	-89.064
LINE 2 STN 19	32.	28.45	111.	47.67	1680.0	.100	979346.558	-30.772	-88.008
LINE 2 STN 20	32.	28.66	111.	47.67	1676.0	.092	979348.394	-29.598	-86.698
LINE 2 STN 21	32.	28.82	111.	47.67	1677.0	.081	979349.979	-28.136	-85.271
LINE 2 STN 22	32.	29.00	111.	47.67	1671.0	.074	979351.504	-27.421	-84.350
LINE 2 STN 23	32.	29.15	111.	47.67	1667.0	.035	979353.181	-26.325	-83.118
LINE 2 STN 24	32.	29.32	111.	47.67	1664.0	.024	979354.767	-25.252	-81.943
LINE 2 STN 25	32.	29.41	111.	47.67	1662.0	.007	979357.033	-23.296	-79.919
LINE 2 STN 26	32.	29.41	111.	47.49	1665.0	-.042	979356.067	-23.980	-80.706
LINE 2 STN 27	32.	29.41	111.	47.30	1663.0	-.048	979355.378	-24.858	-81.515
LINE 2 STN 28	32.	29.41	111.	47.10	1662.0	-.054	979354.660	-25.670	-82.293
LINE 2 STN 29	32.	29.41	111.	46.91	1663.0	-.061	979353.891	-26.344	-83.001
LINE 2 STN 30	32.	29.41	111.	46.66	1665.0	-.068	979353.070	-26.978	-83.703
LINE 2 STN 31	32.	29.68	111.	46.66	1662.0	-.076	979354.737	-25.960	-82.583
LINE 2 STN 32	32.	29.84	111.	46.66	1659.0	-.083	979356.250	-24.947	-81.468
LINE 2 STN 33	32.	30.03	111.	46.66	1657.0	-.087	979357.891	-23.752	-80.205
LINE 2 STN 34	32.	30.18	111.	46.66	1653.0	-.090	979359.610	-22.614	-78.931
LINE 2 STN 35	32.	30.40	111.	46.66	1650.0	-.093	979361.503	-21.303	-77.517
------- DRIFT RATE= .001556 MGAL/HR -------									
LINE 2 STN 35	32.	30.40	111.	46.66	1650.0	-.063	979361.453	-21.353	-77.567
LINE 2 STN 36	32.	30.40	111.	46.46	1649.0	-.056	979360.867	-22.033	-78.213
LINE 2 STN 37	32.	30.67	111.	46.41	1647.0	-.045	979362.090	-21.366	-77.477
LINE 2 STN 38	32.	30.74	111.	46.39	1643.0	-.041	979363.363	-20.564	-76.539
LINE 2 STN 39	32.	30.83	111.	46.25	1642.0	-.035	979363.849	-20.294	-76.236
LINE 2 STN 40	32.	30.85	111.	46.06	1640.0	-.027	979363.603	-20.755	-76.629
LINE 2 STN 41	32.	30.92	111.	45.87	1640.0	-.022	979363.600	-20.854	-76.727
LINE 2 STN 42	32.	30.99	111.	45.68	1642.0	-.015	979363.652	-20.709	-76.650
LINE 2 STN 43	32.	31.09	111.	45.45	1643.0	-.007	979364.571	-19.832	-75.808
STN X 20	32.	31.29	111.	45.95	1638.0	.006	979366.519	-18.627	-74.432
STN X 21	32.	32.16	111.	45.95	1623.0	.013	979371.423	-16.319	-71.613
STN X 22	32.	32.16	111.	46.47	1618.0	.019	979373.036	-15.176	-70.300
STN X 23	32.	32.16	111.	47.50	1613.0	.027	979375.353	-13.329	-68.283
STN X 24	32.	33.05	111.	47.50	1598.0	.034	979378.060	-13.245	-67.688
STN X 25	32.	33.91	111.	47.50	1584.0	.042	979379.819	-13.974	-67.940
STN X 26	32.	34.79	111.	47.50	1577.0	.051	979382.182	-13.469	-67.196

GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG)	(MIN)	WEST LONGITUDE (DEG)	(MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
STN X 27	32.	35.63	111.	47.50	1594.0	.060	979383.172	-12.025	-66.331
STN X 28	32.	36.51	111.	47.50	1631.0	.068	979381.153	-11.763	-67.330
STN X 29	32.	37.36	111.	47.50	1635.0	.077	979382.848	-10.851	-66.554
STN X 30	32.	33.92	111.	45.45	1604.0	.108	979379.881	-12.045	-66.692
LINE 2 STN 44	32.	31.11	111.	45.26	1643.0	.140	979365.070	-19.361	-75.337
LINE 2 STN 45	32.	31.15	111.	45.09	1643.0	.143	979365.502	-18.983	-74.959
LINE 2 STN 46	32.	31.18	111.	44.90	1642.0	.147	979365.885	-18.735	-74.676
LINE 2 STN 47	32.	31.23	111.	44.70	1641.0	.153	979366.188	-18.594	-74.501
LINE 2 STN 48	32.	31.28	111.	44.43	1641.0	.161	979366.206	-18.644	-74.552
LINE 2 STN 49	32.	31.30	111.	44.25	1642.0	.168	979366.434	-18.349	-74.291
LINE 2 STN 50	32.	31.39	111.	44.10	1643.0	.170	979366.957	-17.855	-73.831
LINE 2 STN 51	32.	31.45	111.	43.94	1644.0	.172	979367.811	-16.988	-72.998
LINE 2 STN 52	32.	31.53	111.	43.85	1646.0	.175	979368.613	-16.107	-72.185
LINE 2 STN 53	32.	31.65	111.	43.62	1647.0	.176	979369.457	-15.333	-71.445
LINE 2 STN 54	32.	31.75	111.	43.43	1647.0	.177	979370.287	-14.639	-70.751
LINE 4 STN 0	32.	27.85	111.	44.59	1705.0	.178	979334.939	-39.224	-97.312
LINE 4 STN 1	32.	27.97	111.	44.49	1705.0	.178	979335.592	-38.734	-96.822
LINE 4 STN 2	32.	28.09	111.	44.45	1703.0	.177	979336.838	-37.839	-95.859
LINE 4 STN 3	32.	28.21	111.	44.23	1702.0	.176	979338.185	-36.749	-94.735
LINE 4 STN 4	32.	28.37	111.	44.20	1700.0	.169	979339.809	-35.531	-93.449
LINE 4 STN 5	32.	28.54	111.	44.13	1698.0	.167	979341.510	-34.249	-92.099
LINE 4 STN 6	32.	27.78	111.	44.42	1710.0	.156	979334.674	-38.923	-97.181
LINE 4 STN 7	32.	27.78	111.	44.21	1713.0	.152	979334.836	-38.479	-96.840
LINE 4 STN 8	32.	27.78	111.	44.02	1715.0	.149	979335.182	-37.945	-96.373
LINE 4 STN 9	32.	27.78	111.	43.83	1717.0	.146	979335.691	-37.247	-95.744
LINE 4 STN 10	32.	27.78	111.	43.58	1719.0	.142	979336.343	-36.408	-94.973
LINE 4 STN 11	32.	27.78	111.	43.37	1725.0	.137	979336.711	-35.475	-94.245
LINE 4 STN 12	32.	27.78	111.	43.18	1733.0	.133	979337.060	-34.374	-93.416
LINE 4 STN 13	32.	27.78	111.	42.99	1740.0	.128	979337.309	-33.466	-92.746
LINE 4 STN 14	32.	27.78	111.	42.78	1747.0	.125	979337.571	-32.546	-92.065
LINE 4 STN 15	32.	27.78	111.	42.55	1757.0	.121	979338.015	-31.161	-91.020
LINE 4 STN 16	32.	27.78	111.	42.36	1763.0	.116	979338.371	-30.240	-90.304
LINE 4 STN 17	32.	27.78	111.	42.16	1772.0	.108	979338.688	-29.077	-89.448
LINE 4 STN 18	32.	27.92	111.	41.96	1780.0	.092	979340.476	-26.727	-87.370
LINE 4 STN 19	32.	27.95	111.	41.76	1792.0	.085	979341.669	-24.446	-85.498
LINE 4 STN 20	32.	28.05	111.	41.61	1798.0	.079	979342.492	-23.195	-84.451
LINE 4 STN 21	32.	28.13	111.	41.45	1808.0	.072	979343.505	-21.350	-82.947
LINE 4 STN 22	32.	28.16	111.	41.45	1825.0	.065	979344.459	-18.838	-81.014
LINE 4 STN 23	32.	28.28	111.	41.11	1840.0	.060	979345.863	-16.186	-78.873
LINE 4 STN 24	32.	28.36	111.	40.95	1855.0	.051	979346.239	-14.509	-77.707
LINE 4 STN 25	32.	28.40	111.	40.86	1870.0	.044	979346.479	-12.911	-76.621
LINE 4 STN 26	32.	28.48	111.	40.57	1887.0	.029	979346.433	-11.467	-75.756
LINE 4 STN 27	32.	28.61	111.	40.45	1900.0	.025	979345.981	-10.874	-75.605
LINE 4 STN 28	32.	28.70	111.	40.30	1918.0	.016	979345.461	-9.823	-75.168
LINE 4 STN 29	32.	28.82	111.	40.15	1925.0	.009	979343.718	-11.071	-76.654
LINE 4 STN 30	32.	28.89	111.	40.00	1930.0	.002	979343.626	-10.788	-76.541
LINE 4 STN 31	32.	28.95	111.	39.81	1930.0	-.005	979343.408	-11.087	-76.841
LINE 4 STN 32	32.	29.01	111.	39.63	1925.0	-.012	979344.979	-10.069	-75.652

GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

	STATION NUMBER	NORTH LATITUDE (DEG) (MIN)	WEST LONGITUDE (DEG) (MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
LINE 4	STN 33	32. 29.04	111. 39.44	1920.0	-.017	979346.167	-9.392	-74.805
LINE 4	STN 34	32. 29.05	111. 39.31	1915.0	-.025	979346.483	-9.560	-74.802
		------- DRIFT RATE= -.011493 MGAL/HR -------						
LINE 5	STN 0	32. 27.30	111. 36.98	1985.0	-.056	979334.835	-12.243	-79.870
LINE 5	STN 1	32. 27.13	111. 37.00	2010.0	-.051	979332.986	-11.509	-79.988
LINE 5	STN 2	32. 27.04	111. 37.13	1995.0	-.046	979334.094	-11.689	-79.657
LINE 5	STN 3	32. 27.01	111. 37.32	1995.0	-.041	979334.092	-11.651	-79.619
LINE 5	STN 4	32. 27.04	111. 37.51	1980.0	-.037	979335.383	-11.811	-79.268
LINE 5	STN 5	32. 27.07	111. 37.70	1980.0	-.032	979335.987	-11.248	-78.705
LINE 5	STN 6	32. 27.08	111. 37.90	1970.0	-.026	979336.800	-11.390	-78.506
LINE 5	STN 7	32. 27.05	111. 38.10	1970.0	-.023	979336.650	-11.499	-78.615
LINE 5	STN 8	32. 27.01	111. 38.29	1960.0	-.018	979337.223	-11.812	-78.587
LINE 5	STN 9	32. 26.97	111. 38.48	1945.0	-.011	979337.872	-12.519	-78.784
LINE 5	STN 10	32. 26.91	111. 38.67	1935.0	-.006	979338.077	-13.174	-79.097
LINE 5	STN 11	32. 26.88	111. 38.87	1925.0	-.002	979337.724	-14.426	-80.009
LINE 5	STN 12	32. 26.85	111. 39.05	1915.0	.004	979338.139	-14.911	-80.153
LINE 5	STN 13	32. 26.83	111. 39.24	1905.0	.007	979338.559	-15.404	-80.306
LINE 5	STN 14	32. 26.82	111. 39.43	1895.0	.013	979338.800	-16.090	-80.651
LINE 5	STN 15	32. 26.82	111. 39.57	1890.0	.016	979338.601	-16.760	-81.151
LINE 5	STN 16	32. 26.67	111. 39.60	1885.0	.024	979336.893	-18.733	-82.954
LINE 5	STN 17	32. 26.51	111. 39.66	1885.0	.029	979335.010	-20.399	-84.620
LINE 5	STN 18	32. 26.34	111. 39.70	1895.0	.033	979333.273	-20.965	-85.526
LINE 5	STN 19	32. 26.19	111. 39.74	1900.0	.038	979331.564	-22.000	-86.731
LINE 5	STN 20	32. 26.02	111. 39.79	1900.0	.044	979329.830	-23.502	-88.234
LINE 5	STN 21	32. 25.87	111. 39.83	1905.0	.050	979328.190	-24.468	-89.370
LINE 5	STN 22	32. 25.70	111. 39.89	1908.0	.056	979326.952	-25.193	-90.197
LINE 5	STN 23	32. 25.61	111. 39.91	1910.0	.061	979326.370	-25.465	-90.537
LINE 5	STN 24	32. 25.59	111. 40.09	1900.0	.068	979326.198	-26.550	-91.282
LINE 5	STN 25	32. 25.56	111. 40.28	1890.0	.072	979326.130	-27.517	-91.908
LINE 5	STN 26	32. 25.53	111. 40.49	1880.0	.076	979326.286	-28.261	-92.311
LINE 5	STN 27	32. 25.32	111. 40.49	1878.0	.085	979325.973	-28.477	-92.459
LINE 5	STN 28	32. 25.17	111. 40.49	1880.0	.090	979325.252	-28.806	-92.856
LINE 5	STN 29	32. 25.17	111. 40.85	1868.0	.095	979325.723	-29.464	-93.105
LINE 5	STN 30	32. 25.17	111. 41.51	1838.0	.100	979326.085	-31.923	-94.542
LINE 5	STN 31	32. 25.17	111. 41.89	1822.0	.106	979325.973	-33.540	-95.614
LINE 5	STN 32	32. 25.17	111. 42.55	1802.0	.112	979326.453	-34.942	-96.335
LINE 5	STN 33	32. 25.17	111. 42.92	1788.0	.118	979327.310	-35.402	-96.317
LINE 6	STN 0	32. 22.93	111. 38.53	2004.0	.148	979319.647	-19.703	-87.978
LINE 6	STN 1	32. 23.05	111. 38.44	2008.0	.150	979319.446	-19.692	-88.103
LINE 6	STN 2	32. 23.22	111. 38.35	2012.0	.152	979319.525	-19.467	-88.014
LINE 6	STN 3	32. 23.37	111. 38.28	2010.0	.153	979319.689	-19.695	-88.174
LINE 6	STN 4	32. 23.50	111. 38.16	2020.0	.155	979318.861	-19.759	-88.579
LINE 6	STN 5	32. 23.65	111. 38.07	2024.0	.156	979318.268	-20.180	-89.136
LINE 6	STN 6	32. 23.75	111. 37.95	2028.0	.157	979317.961	-20.246	-89.338
LINE 6	STN 7	32. 23.83	111. 37.79	2038.0	.158	979317.641	-19.734	-89.167
LINE 6	STN 8	32. 23.90	111. 37.62	2045.0	.158	979317.480	-19.332	-89.004
LINE 6	STN 9	32. 24.02	111. 37.51	2050.0	.158	979317.648	-18.857	-88.699

GRAVITY SURVEY DATA

MINING GEOPHYSICAL SURVEYS - 2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG) (MIN)	WEST LONGITUDE (DEG) (MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
LINE 6 STN 10	32. 24.14	111. 37.36	2060.0	.158	979317.843	-17.884	-88.067
LINE 6 STN 11	32. 24.28	111. 37.16	2073.0	.157	979318.107	-16.588	-87.213
LINE 6 STN 12	32. 24.40	111. 37.05	2083.0	.156	979318.571	-15.346	-86.312
LINE 6 STN 13	32. 24.53	111. 36.91	2090.0	.155	979319.390	-14.046	-85.250
LINE 6 STN 14	32. 24.63	111. 36.76	2100.0	.154	979320.402	-12.228	-83.774
LINE 6 STN 15	32. 24.70	111. 36.60	2115.0	.153	979321.345	-9.970	-82.027
LINE 6 STN 16	32. 24.76	111. 36.45	2120.0	.151	979322.572	-8.354	-80.581
LINE 6 STN 17	32. 24.84	111. 36.30	2125.0	.149	979322.668	-7.896	-80.293
LINE 6 STN 18	32. 24.91	111. 36.11	2135.0	.147	979321.691	-8.028	-80.766
LINE 6 STN 19	32. 25.00	111. 35.96	2145.0	.145	979321.347	-7.554	-80.633
LINE 6 STN 20	32. 25.10	111. 35.85	2150.0	.142	979321.049	-7.518	-80.766
LINE 6 STN 21	32. 25.23	111. 35.71	2160.0	.131	979320.684	-7.119	-80.708
LINE 6 STN 22	32. 25.28	111. 35.52	2170.0	.127	979319.639	-7.291	-81.221
LINE 6 STN 23	32. 25.35	111. 35.33	2185.0	.124	979318.646	-6.969	-81.410
LINE 6 STN 24	32. 25.41	111. 35.15	2195.0	.120	979316.954	-7.801	-82.583
LINE 6 STN 25	32. 25.49	111. 34.95	2210.0	.117	979315.600	-7.853	-83.146
LINE 6 STN 26	32. 25.59	111. 34.75	2231.0	.112	979315.055	-6.559	-82.567
LINE 6 STN 27	32. 25.82	111. 34.14	2268.0	.105	979312.455	-5.992	-83.261
LINE 6 STN 28	32. 26.12	111. 33.58	2281.0	.098	979311.065	-6.566	-84.278
------- DRIFT RATE= .010416 MGAL/HR -------							
LINE 7 STN 0	32. 25.17	111. 40.87	1868.0	.012	979325.709	-29.477	-93.118
LINE 7 STN 1	32. 24.99	111. 40.87	1870.0	.010	979325.420	-29.334	-93.043
LINE 7 STN 2	32. 24.83	111. 40.87	1872.0	.008	979325.209	-29.139	-92.916
LINE 7 STN 3	32. 24.68	111. 40.87	1874.0	.007	979324.917	-29.039	-92.885
LINE 7 STN 4	32. 24.52	111. 40.87	1876.0	.006	979324.694	-28.857	-92.771
LINE 7 STN 5	32. 24.34	111. 40.87	1878.0	.005	979324.464	-28.654	-92.636
LINE 7 STN 6	32. 24.20	111. 40.87	1881.0	.004	979324.476	-28.169	-92.253
LINE 7 STN 7	32. 24.03	111. 40.87	1883.0	.002	979324.213	-28.014	-92.166
LINE 7 STN 8	32. 23.88	111. 40.87	1885.0	.001	979323.699	-28.135	-92.356
LINE 7 STN 9	32. 23.71	111. 40.87	1887.0	-.000	979323.102	-28.314	-92.602
LINE 7 STN 10	32. 23.55	111. 40.87	1890.0	-.001	979322.791	-28.125	-92.515
LINE 7 STN 11	32. 23.33	111. 40.87	1893.0	-.002	979322.453	-27.882	-92.375
LINE 7 STN 12	32. 23.17	111. 40.87	1893.0	-.004	979322.108	-28.009	-92.502
LINE 7 STN 13	32. 22.99	111. 40.87	1893.0	-.005	979321.790	-28.083	-92.576
LINE 7 STN 14	32. 22.83	111. 40.87	1893.0	-.006	979321.415	-28.241	-92.734
LINE 7 STN 15	32. 22.67	111. 40.87	1894.0	-.007	979320.980	-28.364	-92.891
LINE 7 STN 16	32. 22.46	111. 40.87	1894.0	-.008	979320.766	-28.293	-92.820
LINE 5 STN 34	32. 25.18	111. 43.56	1775.0	-.012	979328.826	-35.121	-95.594
LINE 5 STN 35	32. 25.18	111. 43.94	1772.0	-.013	979329.899	-34.330	-94.701
LINE 5 STN 36	32. 25.18	111. 44.59	1763.0	-.013	979332.259	-32.817	-92.881
LINE 5 STN 37	32. 25.18	111. 44.99	1762.0	-.013	979333.206	-31.965	-91.995
LINE 5 STN 38	32. 25.18	111. 45.12	1760.0	-.013	979333.584	-31.775	-91.737
STN X31	32. 22.09	111. 49.08	1975.0	-.012	979326.499	-14.439	-81.726
STN X32	32. 21.77	111. 50.15	2070.0	-.012	979320.537	-11.030	-81.553
STN X33	32. 21.13	111. 50.46	2140.0	-.011	979315.919	-8.195	-81.103
STN X34	32. 20.74	111. 51.31	2400.0	-.009	979298.758	-.371	-82.137
LINE 8 STN 0	32. 30.40	111. 47.68	1645.0	.010	979365.221	-18.055	-74.099

GRAVITY SURVEY DATA

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STATION NUMBER	NORTH LATITUDE (DEG)	(MIN)	WEST LONGITUDE (DEG)	(MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
LINE 8 STN 1	32.	30.40	111.	47.87	1644.0	.015	979365.790	-17.580	-73.590
LINE 8 STN 2	32.	30.39	111.	48.05	1644.0	.017	979366.510	-16.846	-72.856
LINE 8 STN 3	32.	30.38	111.	48.26	1643.0	.019	979367.161	-16.276	-72.252
LINE 8 STN 4	32.	30.38	111.	48.46	1643.0	.023	979367.740	-15.697	-71.673
LINE 8 STN 5	32.	30.40	111.	48.56	1643.0	.032	979368.120	-15.344	-71.320
LINE 8 STN 6	32.	30.39	111.	48.76	1645.0	.037	979368.327	-14.935	-70.979
LINE 8 STN 7	32.	30.39	111.	48.98	1648.0	.039	979367.403	-15.577	-71.723
LINE 8 STN 8	32.	30.38	111.	49.14	1655.0	.041	979368.202	-14.106	-70.491
LINE 8 STN 9	32.	30.38	111.	49.37	1665.0	.043	979367.885	-13.482	-70.207
LINE 8 STN 10	32.	30.40	111.	49.60	1675.0	.049	979367.621	-12.833	-69.899
LINE 8 STN 11	32.	30.39	111.	49.79	1690.0	.052	979367.041	-11.988	-69.565
LINE 8 STN 12	32.	30.39	111.	49.98	1703.0	.054	979366.022	-11.784	-69.804
LINE 8 STN 13	32.	30.38	111.	50.19	1730.0	.056	979364.670	-10.583	-69.523
LINE 8 STN 14	32.	30.38	111.	50.39	1750.0	.057	979363.308	-10.064	-69.685
LINE 8 STN 15	32.	30.40	111.	50.62	1787.0	.029	979362.375	-7.544	-68.426
LINE 8 STN 16	32.	30.40	111.	47.53	1645.0	.063	979364.739	-18.537	-74.581
LINE 8 STN 17	32.	30.40	111.	47.15	1646.0	.063	979363.479	-19.703	-75.780
LINE 8 STN 18	32.	30.38	111.	46.93	1648.0	.062	979362.497	-20.470	-76.616
LINE 8 STN 19	32.	30.40	111.	46.70	1650.0	.061	979361.431	-21.375	-77.589
------- DRIFT RATE= .005133 MGAL/HR -------									
LINE 9 STN 0	32.	33.23	111.	49.62	1599.0	.081	979378.215	-13.241	-67.717
LINE 9 STN 1	32.	33.10	111.	49.49	1601.0	.080	979378.196	-12.895	-67.440
LINE 9 STN 2	32.	33.96	111.	49.37	1603.0	.079	979378.163	-13.911	-68.524
LINE 9 STN 3	32.	33.82	111.	49.28	1605.0	.078	979378.022	-13.673	-68.354
LINE 9 STN 4	32.	33.68	111.	49.20	1607.0	.077	979377.858	-13.458	-68.207
LINE 9 STN 5	32.	33.48	111.	49.14	1609.0	.076	979377.608	-13.248	-68.066
LINE 9 STN 6	32.	33.32	111.	49.09	1611.0	.074	979377.509	-12.941	-67.826
LINE 9 STN 7	32.	33.17	111.	49.05	1613.0	.073	979377.166	-12.891	-67.845
LINE 9 STN 8	32.	31.99	111.	49.01	1615.0	.071	979376.733	-11.529	-66.551
LINE 9 STN 9	32.	31.88	111.	48.88	1617.0	.065	979376.375	-11.549	-66.639
LINE 9 STN 10	32.	31.75	111.	48.76	1620.0	.062	979376.003	-11.462	-66.654
LINE 9 STN 11	32.	31.66	111.	48.69	1622.0	.060	979375.740	-11.414	-66.675
LINE 9 STN 12	32.	31.49	111.	48.64	1624.0	.057	979374.998	-11.737	-67.065
LINE 9 STN 13	32.	31.31	111.	48.54	1625.0	.053	979374.041	-12.354	-67.717
LINE 9 STN 14	32.	31.24	111.	48.38	1625.0	.049	979373.190	-13.111	-68.473
LINE 9 STN 15	32.	31.12	111.	48.23	1627.0	.044	979372.394	-13.555	-68.985
LINE 9 STN 16	32.	31.00	111.	48.01	1633.0	.040	979370.932	-14.289	-69.924
LINE 9 STN 17	32.	30.89	111.	47.88	1636.0	.036	979369.531	-15.259	-70.996
LINE 9 STN 18	32.	30.75	111.	47.79	1639.0	.032	979368.190	-16.127	-71.966
LINE 9 STN 19	32.	30.58	111.	47.79	1642.0	.025	979366.781	-17.022	-72.963
LINE 9 STN 20	32.	30.40	111.	47.66	1645.0	.017	979365.126	-18.150	-74.194
LINE 10 STN 0	32.	27.78	111.	44.03	1715.0	.005	979335.122	-38.005	-96.433
LINE 10 STN 1	32.	27.61	111.	44.08	1717.0	-.001	979333.701	-39.006	-97.503
LINE 10 STN 2	32.	27.43	111.	44.08	1719.0	-.004	979332.794	-39.481	-98.046
LINE 10 STN 3	32.	27.27	111.	44.08	1722.0	-.007	979331.982	-39.792	-98.459
LINE 10 STN 4	32.	27.11	111.	44.08	1727.0	-.010	979331.566	-39.521	-98.358
LINE 10 STN 5	32.	26.90	111.	44.08	1732.0	-.011	979331.344	-38.987	-97.995

GRAVITY SURVEY DATA

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SILVER BELL WEST PROJECT -- FOR PILLAR, LOWELL, AND ASSOCIATES -- MGS 0724

STATION NUMBER	NORTH LATITUDE (DEG)	(MIN)	WEST LONGITUDE (DEG)	(MIN)	ELEV. (FT)	TIDE CORR (MGAL)	OBSERVED GRAVITY (MGAL)	FREE AIR ANOMALY (MGAL)	SIMPLE BOUGUER ANOMALY RHO 2.670 (MGAL)
LINE 10 STN 6	32.	26.90	111.	43.93	1733.0	-.017	979331.153	-39.083	-98.125
LINE 10 STN 7	32.	26.77	111.	43.83	1737.0	-.025	979330.917	-38.766	-97.944
LINE 10 STN 8	32.	26.63	111.	43.73	1742.0	-.029	979330.572	-38.451	-97.799
LINE 10 STN 9	32.	26.46	111.	43.65	1747.0	-.031	979330.377	-37.945	-97.464
LINE 10 STN 10	32.	26.34	111.	43.52	1751.0	-.033	979329.982	-37.801	-97.456
LINE 10 STN 11	32.	26.20	111.	43.41	1756.0	-.034	979329.693	-37.428	-97.254
LINE 10 STN 12	32.	26.02	111.	43.39	1760.0	-.036	979329.390	-37.111	-97.073
LINE 10 STN 13	32.	25.88	111.	43.31	1765.0	-.037	979329.146	-36.694	-96.826
LINE 10 STN 14	32.	25.73	111.	43.18	1770.0	-.037	979328.734	-36.432	-96.734
LINE 10 STN 15	32.	25.60	111.	43.08	1775.0	-.038	979328.251	-36.268	-96.741
LINE 10 STN 16	32.	25.49	111.	42.93	1780.0	-.038	979327.683	-36.216	-96.859
LINE 10 STN 17	32.	25.37	111.	42.79	1787.0	-.008	979327.282	-35.795	-96.676
------- DRIFT RATE= -.022840 MGAL/HR -------									
LINE 10 STN 18	32.	25.25	111.	42.63	1795.0	.091	979326.615	-35.547	-96.701
LINE 10 STN 18	32.	25.25	111.	42.63	1795.0	.091	979326.618	-35.544	-96.698
LINE 10 STN 18	32.	25.25	111.	42.63	1795.0	.092	979326.622	-35.540	-96.694
LINE 10 STN 5	32.	26.90	111.	44.08	1732.0	.100	979331.436	-38.895	-97.902
LINE 9 STN 20	32.	30.40	111.	47.66	1645.0	.103	979365.160	-18.116	-74.160

R.4E. R.5E. R.6 E. R.7 E. R.8 E.

T 9 S

T 10 S

T 11 S

T 12 S

TAT MOMOLI VALLEY

SAWTOOTH MTS.

SLATE MOUNTAINS

AGUIRRE VALLEY

WEST SILVER BELL MTS.

SANTA ROSA MTS.

PAPAGO INDIAN RESERVATION

PINAL COUNTY

PIMA COUNTY

LINE 1

LINE 2

LINE 3

LINE 4

LINE 5

LINE 6

LINE 7

LINE 8

LINE 9

LINE 10

Rhyolite

Qb

Ti

p€

p€ gr

TKg

TKsc

KA

Possible shallow bedrock

Bedrock at 350'

In alluvium at 1100'?

Shallow bedrock

Deep alluvial basin

5000'-10000' of alluvial fill

(Δ) = 04- 0.2 gm/cm³

PAPAGO INDIAN RESERVATION BOUNDARY

SCALE 1: 62500

GRAVITY SURVEY

INTERPRETATION MAP

(BOUGUER GRAVITY for 2.67 gm/cm³)

SILVER BELL WEST PROJECT

PINAL & PIMA COUNTIES, ARIZONA

for

PILLAR, LOWELL & ASSOCIATES

by

mining geophysical surveys INC.

0724

Registered Professional Engineer (Geophysics) CERTIFICATE NO. 8842 W. GORDON WIEDUWILT DATE SIGNED 5/2/73 Arizona U. S. A.

R4E R5E R6E R7E. R8E.

T 9 S

T 10 S

T 11 S

T 12 S

TAT MOMOLI VALLEY

SAWTOOTH MTS.

SLATE MOUNTAINS

SANTA ROSA MTS

WEST SILVER BELL MTS.

PINAL COUNTY

PIMA COUNTY

PAPAGO INDIAN RESERVATION

PAPAGO INDIAN RESERVATION BOUNDARY

LINE 1

LINE 2

LINE 3

LINE 4

LINE 5

LINE 6

LINE 7

LINE 8

LINE 9

LINE 10

A A'

B B'

C C'

D D'

E E'

F F'

SCALE 1: 62500

GRAVITY SURVEY

CONTOUR MAP

(BOUGUER GRAVITY for 2.67 gm/cm³)

SILVER BELL WEST PROJECT

PINAL & PIMA COUNTIES, ARIZONA

for

PILLAR, LOWELL & ASSOCIATES

by

mining geophysical surveys INC.

Registered Professional Engineer (Geophysical) CERTIFICATE NO. 8842 W. GORDON WIEDUWILT DATE SIGNED Arizona U. S. A.

0724

January 13, 1955

Dr. Ian Campbell
Department of Geology
California Institute of Technology
Pasadena, California

Dear Ian:

I am dispatching to you by parcel post a package containing six rock specimens together with two thin-section as follows:

#508 - DDH5039 @ 327' - igneous (thin-section)

#509 - DDH5041 @ 235' - igneous

#604 - DDH6008 @ 64' - igneous

#605 - DDH6011 @ 103' - igneous

#606 - DDH6015 @ 96' - igneous

#C-31-1 Churn Drill Hole C-31 @ 450' - Arkose (thin-section)

You will note that, with the exception of the last one, all the specimens are from the deeper levels of the mine and all are presumably of igneous origin.

From the thin-section, Kennison has tentatively classified #508 as "dacite porphyry". This is from a hole drilled vertically downward from the eastern section of the 500 level and hence the specimen came from a depth (below surface) of about 827'.

#509 was classed as "rhyolite porphyry" by Kennison. It is from a vertical hole located at the east end of the 500 level. The specimen is from a depth of over 700' below surface and about 175' ENE of No. 508.

#604 was from a hole drilled inclined down into the footwall by the Pima Company. It was identified by other petrographers as "quartz monzonite porphyry". It was from a depth of about 635' and was apparently from a dike as the hole passed completely through it.

Kennison logged #605 as "rhyolite porphyry". This is from a horizontal hole drilled to the footwall on the 600 level and is about 250' southwest of Spec. #604.

#606 is from a horizontal hole toward the footwall drilled near the west end of the 600 level. It is about 250' west of, and at the same elevation as #605.

None of these five rocks resembles our typical albite syenite from the eastern part of the mine workings and we are tentatively assuming that they are from entirely different and probably younger intrusives. However, with "quartz monzonite porphyry", "dacite porphyry", and "rhyolite porphyry", the porphyry roster is becoming rather crowded and I am hoping that we can correlate some or all of them and narrow down the field a bit. They seem to be relatively fresh and we trust they won't be difficult from the petrogenetic standpoint.

No. C-31-1 is from a churn drill hole some 600' east of the mine workings. We apparently are "lost" in the geologic column here. The entire hole has been in a siliceous arkose (or arkosite) resembling the Red Hill material and not our dark, impure hanging-wall arkosite of X Cut 43. Since Kennison had made the thin-section, I am sending it along for your opinion and comments.

I trust that you are entirely recovered from your laryngitis.

With best regards,

Sincerely,

K. K. Welker

KKW:jm

January 19, 1955

Dr. Ian Campbell
Department of Geology
California Institute of Technology
Pasadena, California

Dear Ian:

I sent you yesterday by first class mail the six thin-sections which you had left with Kennison. I also included two other sections made by Kennison recently. One is a "rhyolite" from the northwest section of the mine and one is a "siltstone?" from the Daisy mine, which adjoins the Pima on the west.

Currently we are calling our "notorious" hangingwall formation "pyroclastic". John found a specimen in Crosscut 43 E that shows very clearly the clastic nature-angular fragments of over ¼". However, some specimen still look megascopically much like quartzite, and others suspeciously like rhyolite. We may be dealing with some kind of a volcanic pile with intercalated flows, tuffs and sediments.

Sincerely,

K. K. Welker

KKW;jm

Notes on Cyprus-Pima Thin Sections

508. DDH 5039 @ 327' - In thin section this rock shows a strikingly porphyritic texture, with phenocrysts of quartz (many of them resorption rounded) up to 4 mm. in diameter, and rectangular phenocrysts (many showing albite twinning) of sodic plagioclase up to 2 mm. in diameter, set in a fine-grained groundmass consisting of a mosaic of quartz and feldspar grains averaging only 0.03 mm. The groundmass feldspar is not twinned, but it is -- like the phenocrysts -- a feldspar of low negative relief, and thus might be either orthoclase or albite. The phenocryst feldspars are rather considerably sericitized. Since the groundmass feldspar is not altered, it is probable that the two feldspars are of different composition, and that the groundmass feldspar is thus more probably potassic. A few local concentrations of opaque grains and of sericite-chlorite aggregates suggest the former presence of a ferromagnesian mineral, probably biotite. Apatite is sparingly present, but occurs in grains up to 0.1 mm in diameter.

The petrographic classification of this rock hinges on the nature of the groundmass feldspar. If this is orthoclase, the rock is clearly a microporphyritic rhyolite; if the groundmass feldspar is sodic plagioclase the rock could still (according to some authorities) be designated as rhyolite; but soda-rhyolite or (no extra charge for these!) such names as quartz-keratophyre or beschtauite would be more precise.

C-31-1 Churn Drill Hole C-31 @ 450' - This section, although consisting of a wide variety of grain size (0.01 mm to 1.0 mm) nevertheless has a distinctly clastic (possibly pyroclastic) aspect. The two major constituents are quartz and feldspar. Quartz makes up most of the larger grains (these are angular, with frayed edges), as well as about half of the fine-grained groundmass material, and it is also present as a vein-filling (together with a small amount of carbonate.) The feldspar is of low negative relief and is probably orthoclase or albite. It is for the most part confined, to the groundmass, altho a few vaguely lath-shaped larger grains suggest former phenocrysts or possibly fragments of a feldspathic rock. Some of the feldspar is slightly sericitized, and there are also local concentrations of sericite within the section. Apatite, in grains up to 0.05 mm, is relatively abundant. Opaque grains (magnetite and sulphides) are widely disseminated. Traces of zircon are present.

Certainly this rock can be correlated with the "arkosite" or FRDK series. In composition it is an arkose; but in texture I doubt that it should be so classed. It would seem more plausible to assume a rhyolitic pyroclastic which had undergone some silicification, and possibly other alteration, for the origin of this rock.

Notes on Cyprus-Pima Thin-Sections

Nos. 509, 604, 605, 606 and "Daisy 301" and "3015 at 74".

509. DDH 5041 A 235' - This is a microporphyritic igneous rock, composed of phenocrysts (up to 2 mm) of quartz and of twinned plagioclase (about oligoclase in composition), set in a relatively coarse and relatively even-grained groundmass likewise composed of quartz and feldspar. The groundmass feldspar is untwinned, and of lower index than the feldspar phenocrysts and may well be orthoclase (could also be albite).

The plagioclase and the quartz phenocrysts are present in approximately equal amount and together make up 20-25% of the section. Both occur in grains of about the same maximum dimensions. The plagioclase is euhedral to subhedral; the quartz, subhedral to anhedral. Sericitization of the plagioclase varies from faint to rather strong. Some sericite is also irregularly distributed in the groundmass. One grain of zircon, 0.03 mm in length, was noted.

The groundmass texture of this rock is distinctly coarser than that of the average extrusive rhyolite; but it is not anything like so coarse as the texture of the average granite or quartz-monzonite. On texture, I should class this rock as a hypabyssal type (i.e., dike, sill, or very small stock), rather than as an extrusive or plutonic type. The naming of the rock calls for borderline decisions, both with respect to the texture, and with respect to the composition. Following A.K. Wells general recommendations for hypabyssal rocks, I would be inclined to call this rock a porphyritic microgranite (implying that it is transitional between granite and rhyolite), and if the groundmass feldspar turns out tobe albite, you can prefix "albite" or "soda" to the name.

And -- it just might be a pyroclastic!

604. DDH 6008 @ 64' - This rock is clearly a breccia -- though of just what type is problematical. In this connection, it might be worth while sectioning and studying samples from the unites immediately adjacent to what was interpreted as a "dike" in the drill hole log.

The major minerals are quartz and alkali feldspar. A few grains of the latter show albite twinning; all show sericitization to varying degrees. A few flakes of chlorite are present, probably as an alteration of original biotite.

Texture changes are abrupt, even within the thin-section. In one area, for example, grains will average 0.2 mm in diameter; while in an elongate (the shape is vaguely suggestive of bedding) area immediately adjoining, the grains will average only 0.02 mm. Most grains are highly angular; many grains suggest clastic outlines; a few suggest phenocrysts.

Of the various possibilities, I lean somewhat to the idea that this is a pyroclastic breccia, and in this case, I would call the rock a rhyolitic tuff-breccia. It might be a fine-grained breccia of sedimentary accumulation, in which case it would come nearer than anything I have yet seen from this area, to being an arkosite; and it could be called a fine-grained arkosic breccia. And -- just to make things more difficult -- I cannot exclude the possibility that this might be a tectonic breccia, for if you had a rock like No. 509 (for example) close to a major fault zone, this is exactly what you might get.

605. DDH 6011 @ 103' - The bulk of this rock consists of a very fine-grained mosaic (0.01 to 0.02 mm) of quartz and alkali feldspar, the latter predominating. Scattered through this groundmass, and making up perhaps 10% of the section, are patches of quartz and of plagioclase which in some instances vaguely, in other instances more definitely suggest phenocrysts (or phenoclasts). The plagioclase rarely shows any twinning -- possibly as the result of alteration. Sericitization is slight to moderate on the feldspars. Quartz veinlets are present, and some of these are not unlike fragmental quartzite grains in appearance and conceivably might have this origin. Apatite, in grains up to 0.05 mm, occurs sparingly.

In composition, this rock is very similar to No. 509. The texture here suggests a fine-grained pyroclastic, and I would be inclined to call this rock a rhyolitic tuff.

606. DDH 6015 @ 96' - This rock has distinctly the appearance of a fine-grained clastic. The major minerals are again quartz and alkali feldspar, with minor amounts of -- but widely disseminated -- sericite; also traces of apatite, zircon, biotite, and opaques. The large quartz grains in the section seem to be the result of secondary silicification and veining; but there are numerous fairly equant, and occasionally slightly rounded quartz grains about 0.07 mm in diameter scattered through a very fine-grained (0.01 mm) matrix of quartz and alkali feldspar which makes up the bulk of the section.

I think it rather likely that this is a pyroclastic, and I would designate the rock as a rhyolitic tuff.

"3015 at 74" - (Kennison thin-section). The section is composed almost entirely of quartz and feldspar, with quartz considerably predominating. The feldspar (albite or orthoclase) is only slightly sericitized.

There is a marked disparity of grain sizes in this section. A few quartz grains measure more than 3.0 mm, and from this grains range down to many of extremely small dimensions. This is not the textural pattern than is ordinarily found in a volcanic porphyry and is perhaps best explained by assuming the rock to be a pyroclastic. In this respect the somewhat resorbed and frayed edges of some of the larger quartz grains are a bit anomalous; since this feature is more suggestive of magmatic reaction. On the whole, however, I would class this rock as a rhyolitic tuff.

"Daisy Mine 301" - (Kennison thin-section). This is an extremely fine-grained rock, in which perhaps 90% of the grains average less than 0.005 mm. Indeed, the only larger grains are those in secondary quartz veins, of which many are present in the section.

The dominant mineral is alkali feldspar, followed closely in amount by quartz, a little of which occurs in relatively large clastic grains while much occurs intermixed with the felspar in the groundmass. Sericite is widely distributed in tiny spicules. Apatite is sparingly disseminated, in grains up to 0.02 mm. Carbonate and a few feldspar veinlets are present, along with and also separately from the quartz veins.

In its fine-grained texture, I agree that this rock could certainly qualify for a "siltstone"; but the preponderance of feldspar is at least most unusual in an ordinary siltstone. I should therefore be more inclined to regard this as a pyroclastic, and to call it a fine-grained rhyolitic tuff.

Notes on Cyprus-Pima thin sections

1. Arkose Surface. Surface exposure near Red Hill a couple of thousand feet east of mine workings. A medium - somewhat angular-grained rock, composed of quartz and low index feldspar in approximately equal amounts. Some of the quartz is shattered and possibly brecciated. Some of the feldspar is altered to a mosaic of fine grains not unlike chert, except that index is relatively low. Possibly this represents albitization? or argillization? Absence of dark minerals is notable. A little iron staining occurs, suggesting former presence of a few femags. Some leucoxene? is present.

301. Hornfels. 300 level East Drift @ 55' West of Pt. 3028. This rock is a fine-grained intermixture of diopside (possibly some epidote also), and carbonate, with locally some veins and matrix material of a low birefringent, low negative index material that suggests alkali feldspar. No qz specifically identified as such. Rock could be contact metamorphism of a siliceous dolomite.

303. Hornfels? 300 level East Drift @ 10' West of Pt. 3028. Section is of very fine grained material, cluded with iron-stain and clay? It contained some diopside and carbonate, and low index feldspar-like mineral, as in the preceding section. One small garnet noted.

304. Tremolite hornfels. 300 level East Drift @ Point 3033. Most of the section consists of a fine-grained, decussate pattern, aggregate of tremolite. A few bands of diopside? are present. Opaques, probably sulphides, occur chiefly in the tremolitic zones. A low index, low biref. mineral is present as part of the matrix of the tremolite.

308. 300 level East Drive @ 33' East of 3033. The buil of this section consists of a very fine-grained aggregate of a low-birefringent, low negative index mineral - possibly secondary albite, or an argillization product. Nests and patches of carbonate occur; and veinlets of quartz. Also flakes and wisps of sericite? Under high power, some grains suggest clastic occurrence.

This rock is indeterminate. Might be an argillite; might be an altered igneous rock (argillization or albitization).

310. Garnet-diopside hornfels. 300 level East Drift @ 75' East of 3033. Face This section shows a medium, to even coarse grained mixture of diopside and garnet, with some matrix of low birefringent, low index feldspar? This is faint iron-staining, and some kaolin-like clouding over much of the section. The section gives an impression of local microfracturing, and of garnets and diopside somewhat squeezed and/or drawn out in irregular bands.

311. Quartz-tremolite hornfels. 300 level. Shaft X-Cut North. Fragments in fault breccia. Siltstone? Most of the section consists of a fine-grained intermixture of quartz and tremolite. The quartz grains, especially some of the slightly larger ones, appear clastic; but whether cataclastic (due to proximity to faulting of the rock) or sedimentary-clastic, is almost impossible to say. The latter is perhaps slightly more probable in view of the relatively uniform grains size (ca. 0.03 mm). A few garnets, of about this size also, were noted. Rock could be metamorphosed equivalent of a marl, or calcareous siltstone.

312. Diopside hornfels. 300 level. Shaft X-Cut 1½' South of Ventilation battice. Mod? Along a slip in clay garnet zone. The section consists mainly of fine-grained diopside, with some veins, and locally a matrix of carbonate. A few small euhedrons of garnet are present.

at about 2' in from edge.

401. Highly altered igneous? rock??/ 400 level East X-Cut 43-S @ 29' South of Pt. 4046. Most of the section consists of a very fine-grained mosaic of a low birefringent, low negative index mineral: possibly albite? possibly argillization? There is perhaps as much as 5% of bleached biotite present. Also a surprising number of small, euhderal apatite grains, and one or two zircons were noted. Somewhat iron stained.

at about 2" or 3" in from edge

402. 400 level East X-Cut 43-S @ 32½' South of Pt. 4046./ On the whole, this section is rather similar to the preceding, but gives the impression of being even more deeply altered. Apatite, however, occurs in some larger grains, and is more abundant than in 401. The ground mass matrix has a more strongly negative index. Biotite is more thoroughly bleached, and is less abundant than in 401. One zircon noted. Section is veined by iron-stained, partly opaque material - not identified. Rock is possibly igneous.

403. Rhyolite. 400 level East X-Cut 43-S @ 37½' South of Pt. 4046. At about 1-2' from south edge. The section shows numerous quartz microphenocrysts, a few with characteristic resorption-rounding. Very scant microphenocrysts of sodic plagioclase. The groundmass is fine-grained to very fine-grained (possibly devitrified?), and has an aggregate index just below balsam. A number of highly iron-stained areas suggest former femag (biotite?) microphenocrysts.

Whether or not this rock was pyroclastic is almost impossible to guess.

405. 400 level East X-cut 43-S @ 57' South of Pt. 4046. The groundmass of this rock is a very fine grained argillic? mosaic of a low birefringent, low index minerals. Veins of medium grained quartz and of carbonate are common. Some sericite is present, also a little apatite. There are faint su gestions of qz microphenocrysts (suggesting a rock similar to 403) but these might equally well be the result of secondary silicification.

Specific determination of this rock is impossible. Best guess might be a highly altered igneousrock.

406. 400 level East X-cut 43-S @ about 30' South of Pt. 4046. Most of the section consists of fine-grained mosaic, something similar to the preceding (404): a low birefringent. low index (about same as balsam) argillic? mineral. There is a relatively large amount (ca 5 to 10%)of bleached biotite, occurring in relatively large remnants; also a little apatite. There are a few suggestions (textural) of medium-grained feldspars. Veinlets of partly opaque, iron-stained carbonate? are present.

Likliest guess for this rock: igneous, possibly even intrusive igneous.

407. Siltstone. 400 level. 41-W-X-Cut N. @ about 46' South of face. Siltstone? Most of the section is a very fine grained mixture of quartz, feldspar?, sericite, biotite (bleached)?, chlorite. Somewhat regularly disseminated (in rude bands) are slightly large, obviously clastic quartz grains (a few suggest resorption rounding). A small amount of quartz, and carbonate veining.

Rock possibly might be a pyroclastic; siltstone considered more likely.

408. Syenite (albitite?)? DDH 4039 @ 97' (Syenite) The major portion of the section consists of medium-grained, negative index feldspar with positive optical sign, thus suggesting albite; but it is notable that it is wholly without twinning. There is extensive dissemination (not veining) of carbonate. Also a good deal of highly bleached biotite in medium-grained flakes. No quartz found. A very little apatite.

409. Hornfels? DDH 4036 @ 130'-150' (Probably not igneous(Hornfels-apatiti) Largest component of the section was not specifically identified. It is in equant to prismatic colorless grains, fine-grained, very low birefringence, very high index, parallel extinction?, negative elongation. Indocrase? (possibly apatite??). Mixed in are bleached biotite areas, merging into iron-stained, semi-opaque, unidentified portions of the section.

501. Diopside-garnet hornfels. 500 level. 52-E X-Cut South at face. Contact of clay garnet and serpentine rocks. The bulk of this section consists of very fine grained, to fine grained diopside in a granular mosaic, with some greenish garnet (grossularite?) Some carbonate veins.

502. Diopside hornfels. DDH 5032 60'-95' (Calba "CaSi") (Diopside hornfels similar to 501(Cg-Serp contact) This section is very similar to the preceding, except that: (1(no garnet was noted; (2) diopside is in a broader size raxnge, from very fine grained to almost coarse, and some is in fan-shaped aggregates; and (3) carbonate is in lesser amount and mostly in local patches, rather than in veinlets.

503. Albite syenite. 500 Level E @ 42' W of 05034 This is a medium grained rock, somewhat shattered (brecciated.) and is composed very largely of untwinned, relatively fresh sodic feldspar (negative index against balsam; optically positive). Some carbonate is present in the shatter cracks, and in veinlets and patches. Small euhderal grains of apatite are relatively abu abundant. Bleached biotite and sericite, which may be related to it, are fairly abundant. Some rutile? present. Local iron-staining.

504. Near E Face 500 level drift (probably igneous) Highly altered rock. It consists of a confused (as to texture), fine-grained aggregate of which the major component seems to be a low index feldspar, probably albite? together with considerable partly bleached biotite, sericite, and locally, carbonate. Some of the albits? occurs in "flamboyant" vein structure and is clearly secondary. Conceivably some of the groundmass albite? might be primary, altho this seems unlikely. There are a few tiny xls of zircon, also a very little apatite. A lot of leucoxene?

This may quite possibly be an alteration of an igneous rock. Arkosite seems a bit doubtful, in view of the relatively large amount of biotite present.

601. Garnet hornfels. "Clay-garnet" The bulk of this section consists of coarse grained units of an almost isotropic garnet, within which are lesser amounts of diopside as fine-granular inclusions, and a small amount of carbonate. The garnet is considerably fractured, and along fractures occurs a dark-brown, almost opaque material, with greyish-white reflection, suggesting leucoxene?

314. DDH 3024, at 35½'. Garnetite (garent hornfels). This section is almost wholly of garnet, which from its greenish color in the hand specimen, is probably largely grossularite. Microfractures are abundant. These and small veinlets are filled with carbonate, sulphides, and - to a small amount - with an iron oxide, probably magnetite.

This rock belongs in the carbonate metamorphic series, and correlates most closely, composition-wise - with No. 601.

409. Phosphate rock? Because of the surprising and somewhat puzzling mineralogy revealed in the first section cut of this specimen (reported in the notes of November 23, 1954) a new section was cut from a different piece of the core. This confirms that the first section quite properly belongs with this rock. The new section, fortunately, provides a few large crystals of the undetermined mineral, and one of these yielded a rather poor interference figure which sufficed, however, strongly to suggest that the mineral is uniaxial, and opticially negative. This information, together with some determinations made on cruched grains in immersion oils, practically confirms that the major component of this rock is apatite. It occurs in grains ranging from a few microns in diameter to some as much as 0.2 mm. A few carbonate veinlets are present and some carbonate may occur as a sort of groundmass mesostasis. Also present as a sort of mesostasis, is a very fine-grained, faintly brownish, high birefringent material suggestive of iron-stained, sericite. A few flakes that may be altered biotite also occur.

This is an unusual rock, and its orgin is puzzling. The most likely guess is that it is a recrystallized phosphate rock. It might also have formed as the result of apatitization of some earlier (unknown) rock. Cases of phosphate metasomatism are known, but are most uncommon. In either case, it seems most probably that this rock should be correlated with the carbonate (non-clastic) sedimentary series.

410. "Serpentive" rock from 43 X-Cut 400 level. Exact location? Magnetite hornfels (or skarn). The bulk of this section consists of a fine-grained mass of magnetite (the hand specimen will deflect a magnet over a range of half and inch or more!) Occuring as nests and veinlets within the magnetite is tremolite (or actinolite). There are also small amounts of diopside, garnet, and possibly a very little chlorite.

The rock represent contact metamorphism of a dolomite, accompanied by notable iron metasomatism.

411. Arkosic quartzite from 43 X-Cut 400 level Exact location? Impure quartzite? About 70% of this section consists of grains of quartz, of irregular outlines, and in sizes ranging from very small to as much as 0.5 mm. The remainder of the section consists of fine-grained, low index feldspar (?), sericite (some of which may be an alteration of feldspar; some of which may have formed by recrystallization of argillaceous components in the quartzite), and local clusters of medium-grained epidote. Tiny crystals of apatite are surprisingly numerous. Some sulphide is present. No traces of bedding were noted. A few veinlets are filled with a moderately high index, practically isotropic material - not specifically identified).

411. (con.) This rock is very probably an impure quartzite. Impurities are indeed to be expected in a sedimentary quartzite where the degree of sorting (as to size) is a s poor as in this rock. The degree of doubt indicated in the name (above) stems from the fact that at least some of the quartz in this rock is secondarily introduced, that no poistively clastic-outline grains were identified as such, and that therefore the rock conceivably could represent silicification of some other unknown, and possibly wholly different, type. I think that the chances are at least four out of five that this sample, however, belongs in the sedimentary (clastic) series.

505. Whitish alteration product from 500 level X-Cut 53N @ 30' N of Pt. 5031. Garnet-diopside hornfels (mylonitized). This section shows a micro-brecciated, pulverized intermixture of garnet and diopside, with a few nexts and veinlets of carbonate. Considerable sulphide (pyrite?) is present and much although not all of this also shows brecciation, suggesting that sulphides were introduced before the faulting. Although the hand specimen is so fine-grained and pulverant as to be almost like clay, the minerals in the section show surprisingly little alteration (faint ironstaining on the garnet is about all).

The rock clearly belongs in the carbonate series.

DDH 4030 at 30' No thin section was made since the material seemed to be homogeneous. Instead, crushed grains were examined in immersion oils. The rock is a garnetite, or garnet hornfels. Frpm the greenish color of the specimen, it is probably very close to grossularite in composition.

CP-1. Syenite. DDH 3016 @ ~~120'~~ 100½ This is a relatively coarse-grained (3.0mm) igneous rock, composed very largely of potash feldspar (untwinned, negative index, negative optic sign). Somewhat bleached biotite, in small flakes, is sparingly present. Traces of apatite and magnetite are found. There is wide-spread, though faint, sericitization and slight kaolinization. A few sulphides occur. A few quartz, and quartz-carbonate veinlets are present, and there is additional carbonatization of some of the feldspar.

CP-2. DDH "5034 @ 253' Quartz-chlorite-sericite rock. At first sight this section resembles those of the "FRDK" serice (referred to below) - chiefly in that it is very fine grained and contains numerous quartz veinlets and isolated patches and grains of quartz, some which could well be clas clastic. But in contrast to the "FRDK" series, this section (CP-2) is largely lacking the negative index feldspathic component. Instead, CP-2 appears to be composed mostly of quartz and tiny flakes of high index, very low birefringent chlorite, with lesser amounts of sericite. Some carbonate is present, chiefly within quartz veinlets. Sulphides and apatite were noted; also local concentrations of epidote.

CP-4 DDH - 3016 @ ~~100'~~ 120½ Rhyolite. The bulk of this section is composed of a very fine-grained, holocrystalline mosaic of quartz and low index feldspar (probably orthoclase) which is often characteristic of rhyolites. Scattered through this matrix are microphenocrysts of quartz and feldspar, the latter considerably kaolinized. Many of the quartz microphenocrysts show resorption rounding, and a few show characteristic embayments. Traces of apatite and magnetite occur. There is some quartz veining, and ironstaining; also a few sulphide metacrysts. One relatively large fragment (?) of quartzite is present.

412. Face 41WXCN 400 level "FRDK" (This classic designation, for "Funny Rock - Don't Know," is adopted here for just this situation. I do not know whether it is of igneous or sedimentary derivation. In the present instance I lean slightly to the idea that is an altered igneous rock, but this may be largely because it is so closely that is an altered igneous rock, but this may be largely because it is so closely similar to No. 405 previously considered as possibly igneous. There are, in fact, some elements in the texture of this rock that suggest a clastic origin; but there is nothing that seems truly diagnostic for either igneous or sedimentary.

The section is composed very largely of rather fine-grained (av. 0.01mm low index untwinned feldspar (albite or orthoclase, presumably). Sericite is widely disseminated; carbonate and quartz veinlets are present, as it quartz in isolated grains. There are numerous small shreds of pale biotite (some is partly chloritized); and fine-grained pyrite is present. The section almost certainly correlates, at least in terms of present composition and texture, with No. 405. 43EXCN @ 57' N of 4046.

413. "FRDK". 400 level 43EXCS @168' south of Pt. 4046. This section is in many respects similar to No. 412. Such differences as exist are: (1) more quartz veining, and greater numbers of isolated quartz grains. (2) Greater variations in size of grain in the fine-grained feldspathic component. (These two features vaguely suggest bedding). (3) Considerable apatite, concentrated in the more "chloritic" areas. One of these apatite grains is 0.15mm in diameter - unusually large for sedimentary apatite in a rock otherwise so fine-grained. (4) A few tabular, low index feldspar, measuring up to 2.5mm, and suggestive of microphenocrysts. The evidence here is highly contradictory. Some of the isolated quartz grains look clastic; some of the textural distribution looks clastic. But the apatite, and the feldspar "microphenocrysts" look distinctly igneous. Regardless of this, the rock, as a rock, is very similar to Nos. 405 and 412.

414. 400 level 43E X-Cut S @ 362' South of 4046. Impure quantzite? Although I have had varying degrees of doubt concerning the two preceding specimens, this sections seems pretty certainly to be of sedimentary origin. The rounding of quartz grains, and the general "sedimentary distribution" is here almost unmistakable. The fine-grained matrix is identical with the presumed feldspathic material of the two preceding sections 412 and 413. I am therefore inclined to think that all of these rocks may represent original sediments, with varying degrees of hydrothermal alteration. Curiously, the clastic quartz grains in No. 414 are not recrystallized, nor do they show overgrowths.

This section, except for the greater abundance of quartz, and its obviously more clastic character, is not unlike Nos. 412 and 413. However, epidote occurs here in amounts of 5 to 10% of the section. It was not identified in the preceding two.

506. 500 level W Drift @ 40 E of Pt. 5019. Hornfels? The two major minerals in this section are magnetite and pyrite - so little silicate material occurs, that the section may not in this respect constitute a valid sample of the rock. The chief non-opaque component is fine-grained, matte-like, almost massive sericite. Also present is chlorite, in stellate growths showing distinctive "ultra-blue" interference colors. Diopside is sparingly present.

602. Tremolite hornfels. 600 level 61WXCN Face. At least 90% of this section consists of a fine-grained matter of tremolite. There are local concentrations of pyrite and magnetite, with the former greatly predominating; also a few carbonate veinlets cut the section, and traces of greenish garnet (or spinel?) were noted. The section is almost "a dead ringer" for No. 304.

603. "FRDK" 600 level - Shaft X Cut. FW. This is another in this indeterminate series. Mineralogically and texturally it closely resembles Nos. 412 and 413, in that it consists largely of a fine-grained feldspathic (or quartzo-feldspathic) matrix, with numerous quartz veinlets and isolated patches and grains of quartz - none of which in this section have any distinctly clastic look. Carbonate appears to be absent; but sericite is relatively abundant: only to a slight degree is the sericite disseminated through the matrix; rather it is concentrated in numerour patches and irregular veinlets. Traces of apatite, magnetite and chlorite occur; and limonite-stained opaque metacrysts are present.

MORE NOTES ON CYPRUS-PIMA THIN-SECTION

December 30, 1954

317. 3'E of collar DDH 3017. Sericite-albite (?) rock.

A crushed sample of this rock was first studied in immersion oils; but since it was apparent that several minerals, fine-grained and intimately intergrown, were involved, it was decided that a thin-section was required for petrographic determinations.

This rock consists almost entirely of secondary minerals. Sericite, in fine-grained, irregularly shaped flakes of only a few microns diameter, is dominant (ca. 50%); and a low-index feldspar (probably albite) amounts to about 30% of the rock. The albite makes up the unsericitized portions of the groundmass, and is also present as distinct veins. My impression is that all of this feldspar can be considered as a placement type. Dolomite is present as nests and veinlets and to a small extent as a dissemination, totalling perhaps 20% of the rock. This is suffident to give some effervescence from almost any small sample tested with acid; but on such a test, much commonly remains as an insoluble residue. The "hardness" of this rock is likewise deceptive, inasmuch as it is composed so largely of two fine-grained minerals of very different hardness: soft sericite, and hard feldspar. Traces of apatite and of iron-stainsare present in the rock. Some secondary silica may be present, but certainly not much.

This rock had best be classed with the "FRDK" series; although the extent of the alteration (assuming the feldspar to be secondary) is so great as to preclude any recognition of original character in the rock. The rock is similar to the FRDK series in possessing a considerable content of low-index feldspar; but if this is all secondary -- as I believe it in this case very probably to be -- then this means little or nothing so far as primary relationships are concerned.

S-335 (This was the number arbitrarily assigned to the "serpentine" from the shaft at 335 feet.)

Serpentine-tremolite hornfels. The specimen consists of fine-grained tremolite prisms, locally considerably broken and veined by a colorless to pale amber (in thin-section) serpentine mineral of very low birefringence and an index only slightly higher than balsam. There is also some sulphide present.

This section is of particular interest since it is the first in this series in which I have been able to identify a serpentine mineral in any significant amount. Here it makes up about 30% of the rock, with tremolite dominant (ca 50%)and sulphides making up the remaining 20%. A small amount of carbonate veining is present.

Most, if not all, of the serpentine present in this section could well have developed by alteration of the tremolite. Although both of these minerals may form primarly ultrabasic igneous rocks, my feeling is that in this instance - and in view of the known associations of similar tremolite elsewhere in this series - the rock is much more likely to belong in the hornfels group.

415-A 400 Level 41WXCS. (Specimen of 415 selected to show relatively "vitreous" and "unaltered" character.)
Altered pyroclastic? This is an extremely fine-grained rock, the bulk of the components averaging only about 0.005 mm in diameter. The major components are (in descending amount) quartz, sericite, and low index feldspar. All are finely intergrown, making both the minerals and their relative amounts difficult to determine with any accuracy. Some quartz grains, averaging around 0.2 mm are scattered through the section. A few of these have outlines suggesting resorption. The groundmass of the rock as a whole has somewhat of a clastic appearance. Veinlets of quartz and of quartz and sericite, wherein these minerals are relatively coarse-grained, occur throughout the section, and render the interpretation of the scattered individual grains of quartz difficult. Are they phenocrysts, phenoclasts, or porphyroblasts? A small amount of carbonate veining is also present.

There is nothing in this section that is diagnostic with respect to origin of this rock. Of the various possibilities, I lean slightly to the idea of an originally fine-grained pyroclastic, perhaps of rhyolitic or dacitic composition.

415-B Same as 415-A (Specimen of 415 selected to show a more "granular phase".) Altered pyroclastic??? This specimen is very similar, in most respects, to 415-A. The mineral composition and the groundmass texture are practically identical. There is, however, a larger proportion of feldspar and smaller amount of quartz than in 415-A. Furthermore, sericite in this section is more in concentrated patches, and less generally disseminated, than in 415-A. A number of small grains of apatite, and one or two of zircon, are present.

The one specific difference between this section and 415-A is the absence, in this section, of any of the relatively large quartz grains that are rather distinctive in 415-A. lacking these, there is not a single clue to possible origin of this rock; except that based upon the considerable over-all similarity of 415-A, so this specimen too might doubtfully be classed as an altered pyroclastic.

416. 400 Level 44EXCS at Face. Altered pyroclastic???
This rock is likewise very similar to the two preceding specimens, 415-A and B. In fact, it might be best described as being somewhat intermediate to these two. It has the same composition and the same fine-grained groundmass as 415-A andB; it has a few of the relatively large quartz grains that are more abundant in 415-A, and which may perhaps be interpreted as phenoclasts. Also present are a few grains of apatite, and one crystal of zircon measuring almost 0.07 mm in length - an astonishing size for this mineral in a rock wherein the average grain size of the common minerals is around 0.007 mm. Well-defined quartz, quartz-feldspar, and feldspar (albite?, adularia?) veinlets occur. In some of these small amounts of carbonate are also present.

The rock is - very doubtfully - correlated as a pyroclastic.

417. 400 Level 41 WCCS @ 45' N of Face. Diopside-plagioclase hornfels. This interesting rock consists of a fine-grained matrix of diopside and feldspar - in nearly equal amounts. The feldspar, in contrast to all other feldspars noted in this series, is a relatively high index feldspar, and in a very few grains some twinning was seen. Although the grains are too small for precise determination, the data suggest that this is a rather calcic plagioclase, probably bytownite or even anorthite. As such, it is probably not a primary igenous mineral, but is much more likely of contact metamorphic origin - a suggestion that is strengthened by its close association here with dipside. Othermetamorphic minerals, not specifically identified, may be present in small amounts, and some sulphide occurs.

There is little doubt but that this rock should be classed with the hornfels series - representing, however, the metamorphism of a carbonate rock with a higher proportion of argillaceous (aluminous) material than has characterized most of the others in this series.