

**Modal mineralogy of some granitic
rocks from eastern Maricopa and
northern Gila Counties, Arizona**

by

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and Stephen M. Richard**

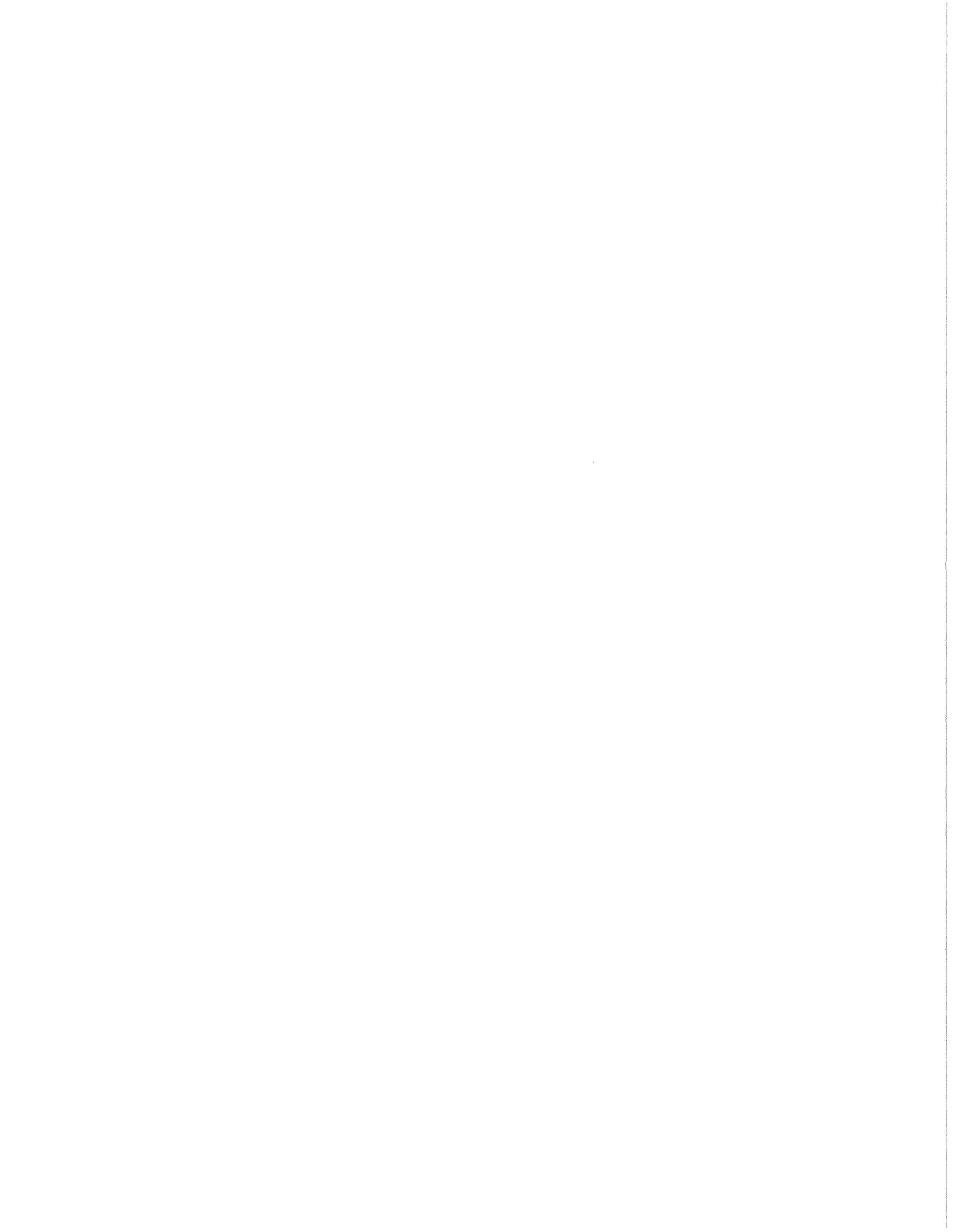
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Modal mineralogy of some granitic rocks from eastern Maricopa and northern Gila Counties, Arizona

Granitic rocks are classified by their relative proportions of quartz, plagioclase feldspar, and potassium feldspar. Geologic mapping in the Mesa 10 x 20 Quadrangle by the Arizona Geological Survey, done in part with federal funds provided by the STATEMAP program, covered large areas of granitic rocks. In order to properly classify and name these rocks, a set of sample was collected (by SJS) and sent to Quality Thin Sections (QTS) in Tucson, Arizona, where the samples were cut into slabs (typically about 8 x 15 cm) and chemically stained to allow distinction of K-feldspar and plagioclase. The plagioclase stain was not effective in most cases, for reasons unknown to the responsible commercial technician at QTS, but most of the slabs took the K-feldspar stain which clearly identified the K-feldspar. After spraying the slabs with clear acrylic spray, quartz could generally be distinguished from plagioclase by the lack of secondary mineral development in the quartz. Plagioclase also tended to have a white chalky color, possibly in part due to attack by hydrofluoric acid during the staining process, and this chalky white contrasts with the gray color of quartz.

Slab mineral populations were determined by point counting using a binocular microscope and a set of counting grids consisting of clear acetate sheets with a rectangular grid of tiny dots marking the counting points. As the grid was traversed, the mineral underneath each dot was counted. The counting grid was selected to use a grid with the largest spacing possible so that ~1000 points could be counted over the entire cut face of the slab. The largest grid size available (#104.5 = 2.8 mm dot spacing) was used for all but one sample. Seven rows of points were counted in each pass across the sample, and the sub totals for each 'pass' were recorded. Variation in mineral content with each pass reflects mineral population heterogeneity. Variations are not presented in the data table, but could be determined from the data presented.

Table 1 provides basic geologic information concerning the samples, Table 2 and Figure 1 provide location information, and Table 3 contains counting data and calculated percentages. The fraction of dark ("mafic," or magnesium- and iron-bearing) minerals is also given in raw count form and as a percentage of total rock. Quartz and feldspar percentage data are plotted in Figure 2, and rock classifications are determined from this plot. Finally, Appendix 1 contains map figures of the sample location plotted on topographic and/or geologic maps. This information is included to provide an unambiguous record of sample locations.

All but two of the studied samples are classified as granites according to the IUGS classification scheme (Streckeisen, 1973). Three samples, two of the Payson Granite and one from the McDowell Mountains labeled "Fountain Hills," fall in the syenogranite subfield of the granite field. Except for two mafic samples with 35 and 57 % mafic minerals, all of the other samples fall in the monzogranite subfield of the granite field.

Table 1. Geologic information

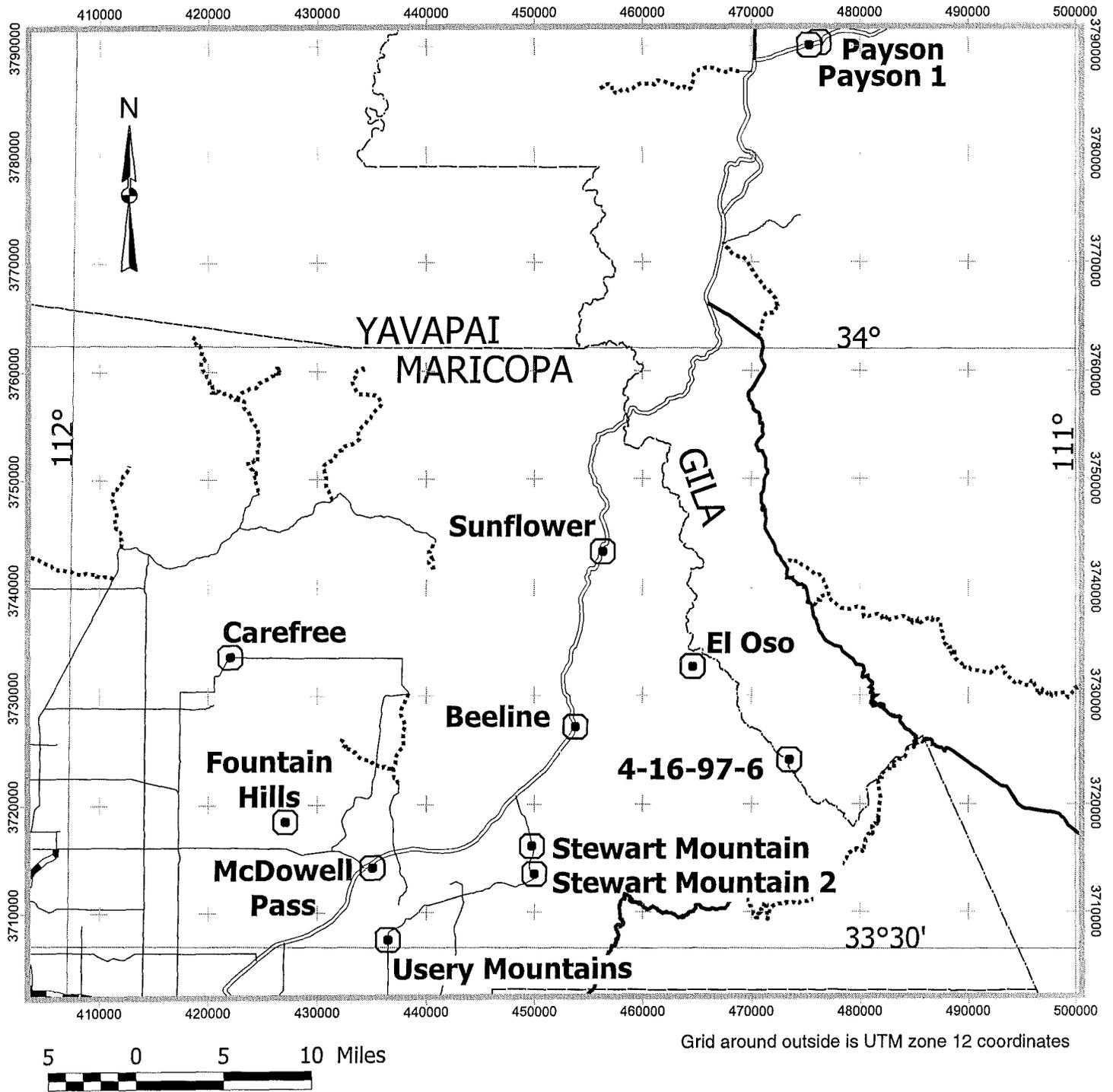
Sample name	7 ½' Quadrangle	Source of geologic information	Previous map-unit designations
Sunflower	Boulder Mountain	Skotnicki and Leighty (1998), OFR 98-15	Xgr—Granite. Sunflower Granite used previously
Payson, Payson 1	Payson North	Star Valley, Hwy 260 roadside	Payson Granite
McDowell Pass	Granite Reef Dam	Skotnicki (1995), OFR 95-16	Yf—Non-foliated felsic granitoid
Carefree (Pinnacle Peak)	McDowell Peak	Little (1975), ASU M.S. thesis, Isachsen and others (1999), OFR 99-5, Skotnicki (1996), OFR 96-11 Skotnicki and others (1997), OFR 97-02	Camelback Granite of Doorn and Péwé (1991); Carefree Granite of Skotnicki (pers. comm.); Pinnacle Peak Granite of Isachsen and others (1999)
Usery Mountains	Granite Reef Dam	Skotnicki (1995), OFR 95-16	Xgc—Medium to coarse-grained granitoid
Fountain Hills	Sawik Mountain	Skotnicki (1995), OFR 95-16	YXg—Felsic granitoid
Stewart Mountain	Stewart Mountain	Skotnicki and Leighty (1997b), OFR 97-12	Xgc—Coarse-grained granite
Stewart Mountain 2	Stewart Mountain	Skotnicki and Leighty (1997b), OFR 97-12	Xd—Diorite
4-14-97-6	Four Peaks	Skotnicki (2000), OFR 00-11	Xd—Diorite. This unit is part of the Buckhorn Creek Crystalline Complex of Spencer and Richard (1999), OFR 99-6
Beeline	Mine Mountain	Skotnicki and Leighty (1997a), OFR 97-11	Xg—Quartz monzonite
El Oso	Mine Mountain	Skotnicki and Leighty (1997a), OFR 97-11	Yg—Granite
Schultze Granite	Pinal Mountains	Ransome (1904)	

Table 2. Sample locations

	UTME	UTMN	Degrees Latitude	Minutes Latitude	Decimal Latitude	Degrees Longitude	Minutes Longitude	Decimal Longitude
Sunflower	456165	3743145	33	49.85	33.8308	111	28.35	-111.4725
Payson	476220	3790275	34	15.3	34.2550	111	15.5	-111.25833
Payson 1	475275	3790025	34	15.15	34.2525	111	16.1	-111.26833
McDowell Pass	435025	3714020	33	34	33.5667	111	42	-111.7
Carefree	421755	3733410	33	44.48	33.7413	111	50.5	-111.84167
Usery Mountains	436405	3707375	33	30.38	33.5063	111	41.05	-111.68417
Fountain Hills	427100	3718230	33	36.27	33.6045	111	47.15	-111.78583
Stewart Mountain	449815	3715150	33	33.7	33.5617	111	32.35	-111.53917
Stewart Mountain 2	449930	3713330	33	35.1	33.5850	111	32.5	-111.54167
4-16-97-6	473340	3724610	33	39.46	33.6577	111	17.15	-111.28583
Beeline	453700	3727270	33	41.05	33.6842	111	29.93	-111.49883
El Oso	463350	3731975	33	44.08	33.7347	111	22.94	-111.38233
Schultze	505420	3691225						

References Cited

- Doorn, P.L., and Péwé, T.L., 1991, Geologic and gravimetric investigations of the Carefree Basin, Maricopa County, Arizona: Arizona Geological Survey Special Paper 8, 187 p., 10 pl., scale 1:24,000.
- Isachsen, C.E., Gehrels, G.E., Riggs, N.R., Spencer, J.E., Ferguson, C.A., Skotnicki, S.J., and Richard, S.M., 1999, U-Pb geochronologic data from zircons from eleven granitic rocks in central and western Arizona: Arizona Geological Survey Open-File Report 99-5, 27 p.
- Little, L.A., 1975, Geology and land-use investigation in the Pinnacle Peak area, Maricopa County, Arizona: Tempe, Arizona State University unpub. M.S. thesis, 102 p., 5 pl., scale 1:14,400.
- Ransome, F.L., 1904, Description of the Globe quadrangle, Arizona: U.S. Geological Survey Geological Atlas Folio 111, 17 p., scale 1:62,500.
- Skotnicki, S.J., 1995, Geologic map of the Fountain Hills / Mount McDowell area, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 95-16, 25 p. scale 1:24,000.
- Skotnicki, S.J., 1996, Geologic map of portions of the Fort McDowell and McDowell Peak Quadrangles, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 96-11, 20 p. scale 1:24,000.
- Skotnicki, S.J., 2000, Geologic map of the Four Peaks 7.5' Quadrangle, Maricopa and Gila Counties, Arizona: Arizona Geological Survey Open-File Report 00-11, scale 1:24,000, 35 p.
- Skotnicki, S.J., and Leighty, R.S., 1997a, Geologic map of the Mine Mountain Quadrangle, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 97-11, 11 p., scale 1:24,000.
- Skotnicki, S.J., and Leighty, R.S., 1997b, Geologic map of the Stewart Mountain Quadrangle, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 97-12, 19 p., scale 1:24,000.
- Skotnicki, S.J., and Leighty, R.S., 1998, Geologic Map of the Boulder Mountain 7.5' Quadrangle, Maricopa and Gila Counties, Arizona: Arizona Geological Survey Open-File Report 98-15, scale 1:24,000, 17 p. text.
- Skotnicki, S.J., Leighty, R.S., and Pearthree, P.A., 1997, Geologic map of the Wildcat Hill Quadrangle, Maricopa County, Arizona: Arizona Geological Survey Open-File Report 97-02, 16 p., scale 1:24,000.
- Spencer, J.E., and Richard, S.M., 1999, Geologic map and report for the Theodore Roosevelt Dam area, Gila and Maricopa Counties, Arizona: Arizona Geological Survey Open-File Report 99-6, scale 1:24,000, 28 p.
- Streckeisen, A.L., 1973, Plutonic rocks: Classification and nomenclature recommended by the IUGS Subcommittee on the Systematics of Igneous Rocks: *Geotimes*, v. 18, n. 10, p. 26-30.



Map Showing Locations where samples were collected

Fig. 1

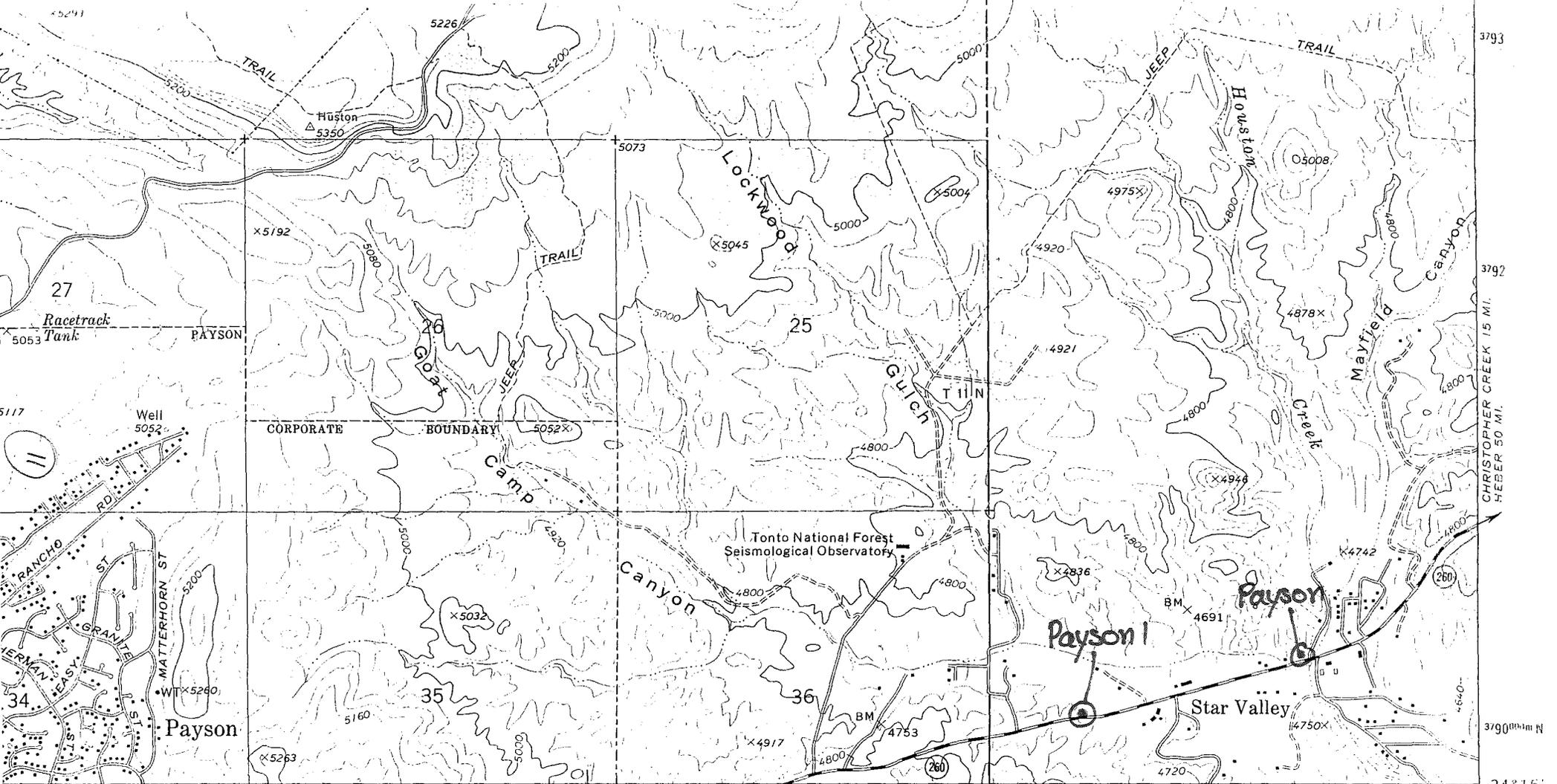
TABLE 3.

ID #	Sample ID	Grid	Quartz	K-feldspar	Plagioclase	Mafic	Operator	Date	Notes
1	Sunflower		221	231	198	70	J.E.S.	12/1/1999	Plag stain poor but chalky white color allows distinction from quartz. Collected by Steve Skotnicki. Medium grained, slightly to moderately
2			650			720			Total Q+P+K and total counts
3			34	35.5	30.5	9.7			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
4	Payson	104.5	57	91	26	13	J.E.S.	4/14/1999	Row 1. Easy count, plag is chalky white. Sample collected by Steve Skotnicki. Some K-feldspar is rimmed irregularly by plag and plag-quartz
5	Payson	104.5	69	132	47	17	J.E.S.	4/14/1999	Row 2. Easy count, plag is chalky white. Sample collected by Steve Skotnicki.
6	Payson	104.5	24	52	13	9	J.E.S.	4/14/1999	Row 3. Easy count, plag is chalky white. Sample collected by Steve Skotnicki.
7	Payson	104.5	66	117	50	19	J.E.S.	4/14/1999	Row 4. Easy count, plag is chalky white. Sample collected by Steve Skotnicki.
8	Payson	104.5	79	113	48	19	J.E.S.	4/14/1999	Row 5. Easy count, plag is chalky white. Sample collected by Steve Skotnicki.
9			295	505	184	77			
10			984			1061			Total Q+P+K and total counts
11			30.0	51.3	18.7	7.3			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
12	McDowell Pass	104.5	25	55	38	9	J.E.S.	4/14/1999	Row 1. Slab sprayed with Krylon but still difficult to impossible to distinguish quartz from plagioclase. Sample collected by Steve Skotnicki. Equigranular, medium grained.
13	McDowell Pass	104.5	65	70	84	22	J.E.S.	4/14/1999	Row 2. Slab sprayed with Krylon but still difficult to impossible to distinguish quartz from plagioclase.
14	McDowell Pass	104.5	85	97	135	19	J.E.S.	4/14/1999	Row 3. Slab sprayed with Krylon but still difficult to impossible to distinguish quartz from plagioclase.
15	McDowell Pass	104.5	88	84	96	19	J.E.S.	4/14/1999	Row 4. Slab sprayed with Krylon but still difficult to impossible to distinguish quartz from plagioclase.
16			263	306	353	69			
17			922			991			Total Q+P+K and total counts
18			28.5	33.2	38.3	7.0			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
19	Payson 1	104.5	116	91	29	2	J.E.S.	4/20/1999	Ca stain. Possibly plag is albite with >10% K.
20	Payson 1	104.5	112	120	24	4	J.E.S.	4/20/1999	Ca stain. Possibly plag is albite with >10% K.
21	Payson 1	104.5	134	92	30	8	J.E.S.	4/20/1999	Row 3. Mostly easy count but some plag has moderate yellow stain and no Ca stain. Possibly plag is albite with >10% K. Medium grained and equigranular.
22			362	303	83	14			
23			748			762			Total Q+P+K and total counts
24			48.4	40.5	11.1	1.8			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points

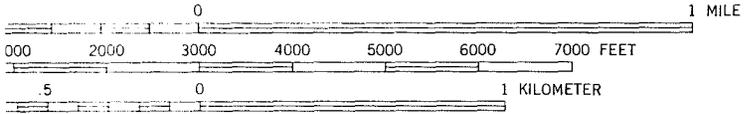
ID #	Sample ID	Grid	Quartz	K-feldspar	Plagioclase	Mafic	Operator	Date	Notes
25	Carefree (Pinnacle Peak)	104.5	70	67	76	25	J.E.S.	4/26/1999	Row 1. 1.4 Ga granite. Big K-feldspar and plag crystals. Chalky white plagioclase and gray quartz. Easy count. Heterogeneity due to large crystal size.
26	Carefree (Pinnacle Peak)	104.5	86	38	84	30	J.E.S.	4/26/1999	Row 2. 1.4 Ga granite. Big K-feldspar and plag crystals. Chalky white plagioclase and gray quartz. Easy count. Heterogeneity due to large crystal size.
27	Carefree (Pinnacle Peak)	104.5	59	71	53	21	J.E.S.	4/26/1999	Row 3. 1.4 Ga granite. Big K-feldspar and plag crystals. Chalky white plagioclase and gray quartz. Easy count. Heterogeneity due to large crystal size.
28	Carefree (Pinnacle Peak)	104.5	59	72	76	31	J.E.S.	4/26/1999	Row 4. 1.4 Ga granite. Big K-feldspar and plag crystals. Chalky white plagioclase and gray quartz. Easy count. Heterogeneity due to large crystal size.
29			274	248	289	107			
30			811			918			Total Q+P+K and total counts
31			33.8	30.6	35.6	11.7			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
32	Usery Mountains	104.5	72	54	90	64	J.E.S.	4/27/1999	plag-quartz distinction, especially small grains.
33	Usery Mountains	104.5	56	69	89	66	J.E.S.	4/27/1999	Row 2. 2-3 cm K-feldspar produces inhomogeneity. Slight difficulty with
34	Usery Mountains	104.5	34	28	139	57	J.E.S.	4/27/1999	Row 3. 2-3 cm K-feldspar produces inhomogeneity. Slight difficulty with
35	Usery Mountains	104.5	45	136	78	42	J.E.S.	4/27/1999	plag-quartz distinction, especially small grains.
36			207	287	396	229			
37			890			1119			Total Q+P+K and total counts
38			23.3	32.2	44.5	20.5			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
39	Fountain Hills	104.5	83	126	58	9	J.E.S.	4/28/1999	Row 1. Plag-quartz distinction difficult for some grains, some error introduced.
40	Fountain Hills	104.5	85	119	57	24	J.E.S.	4/28/1999	Row 2. Plag-quartz distinction difficult for some grains, some error introduced.
41	Fountain Hills	104.5	55	129	42	9	J.E.S.	4/28/1999	Row 3. Plag-quartz distinction difficult for some grains, some error introduced.
42	Fountain Hills	104.5	89	132	48	25	J.E.S.	4/28/1999	Row 4. Plag-quartz distinction difficult for some grains, some error introduced.
43			312	506	205	67			
44			1023			1090			Total Q+P+K and total counts
45			30.5	49.5	20.0	6.1			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points

ID #	Sample ID	Grid	Quartz	K-feldspar	Plagioclase	Mafic	Operator	Date	Notes
46	Stewart Mountain	104.5	60	60	75	34	J.E.S.	4/30/1999	Row 1. Fairly easy count, Minor difficulties distinguishing quartz from plag. Slight question as to whether masses of sericitic(?) plagioclase(?) should
47	Stewart Mountain	104.5	67	62	82	61	J.E.S.	4/30/1999	Row 2. Fairly easy count, Minor difficulties distinguishing quartz from plag. Slight question as to whether masses of sericitic(?) plagioclase(?) should
48	Stewart Mountain	104.5	68	59	85	40	J.E.S.	4/30/1999	Slight question as to whether masses of sericitic(?) plagioclase(?) should be counted as plag or mafic. Most counted as plag, but maybe primary
49	Stewart Mountain	104.5	62	72	73	72	J.E.S.	4/30/1999	Row 4. Fairly easy count, Minor difficulties distinguishing quartz from plag. Slight question as to whether masses of sericitic(?) plagioclase(?) should
50			257	253	315	207			
51			825			1032			Total Q+P+K and total counts
52			31.2	30.7	38.2	20.1			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
53	Stewart Mtn. #2 (mafic)	104.5	4	2	87	126	J.E.S.	4/30/1999	
54			93			219			
55			4.3	2.2	93.5	57.5			
56	4-14-97-6	64	58	0	214	148	J.E.S.	4/30/1999	Might get better numbers (slightly) if sprayed with krylon to make quartz look more transparent and less like mafics (quartz is dark). Probably only a very minor factor.
57			272			420			Total Q+P+K and total counts
58			21.3	0	78.7	35.2			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
59	Beeline	104.5	86	87	38	48	J.E.S.	4/12/1999	Row 1; Plag and quartz difficult to distinguish because K-stain poor. Transparency of quartz vs. milkyness of plag used for distinguishing. Quartz transparency augmented by spray-on coating.
60	Beeline	104.5	78	94	51	40	J.E.S.	4/12/1999	Row 2
61	Beeline	104.5	61	75	56	30	J.E.S.	4/12/1999	Row 3
62	Beeline	104.5	59	65	58	51	J.E.S.	4/12/1999	Row 4
63	Beeline		284	296	213	132	J.E.S.	12/1/1998	Plag stain weak, some confusion with quartz.
64			568	617	416	301			
65			1601			1902			Total Q+P+K and total counts
66			35.5	38.5	26.0	15.8			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
67	Beeline	104.5	62	63	63	34	S.M.R.	12/7/1998	row 4; don't count grains w/in about 1.5 cm of edge of slab
68	Beeline	104.5	98	105	104	50	S.M.R.	12/7/1998	row 3
69	Beeline	104.5	104	108	81	51	S.M.R.	12/7/1998	row 2
70	Beeline	104.5	148	172	110	54	S.M.R.	12/7/1998	row 1; includes to edge of slab
71			412	448	358	189			
72			1218			1407			Total Q+P+K and total counts
73			33.8	36.8	29.4	13.4			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points

ID #	Sample ID	Grid	Quartz	K-feldspar	Plagioclase	Mafic	Operator	Date	Notes
74	El Oso	104.5	267	364	307	133	J.E.S.		First sample counted, only total count data recorded
75			938			1071			Total Q+P+K and total counts
76			28.5	38.8	32.7	12.4			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
77	Schultze 3-23-98-4	73	141	189	419	47	S.M.R.	12/2/1998	same sample as U-Pb sample
78			749			796			Total Q+P+K and total counts
79			18.8	25.2	55.9	5.9			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points
80	Schultze 3-23-98-3	73, 81	448	283	991	189	S.M.R.	12/2/1998	SAMPLE LOCATION NOT KNOWN
81			1722			1911			Total Q+P+K and total counts
82			26.0	16.4	57.5	9.9			%Q/Q+P+K, %P/Q+P+K, %K/Q+P+K, %mafic/total points



(PAYSON SOUTH)
3752 III NE
SCALE 1:24 000



CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
VERTICAL DATUM OF 1929

CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
NATIONAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092

Payson 1
475275
3790025

Payson
476220
3790275



QUADRANGLE LOCATION

ROAD CLASSIFICATION

- Primary highway, hard surface
- Light-duty road, hard or improved surface
- Secondary highway, hard surface
- Unimproved road
- Interstate Route
- U. S. Route
- State Route

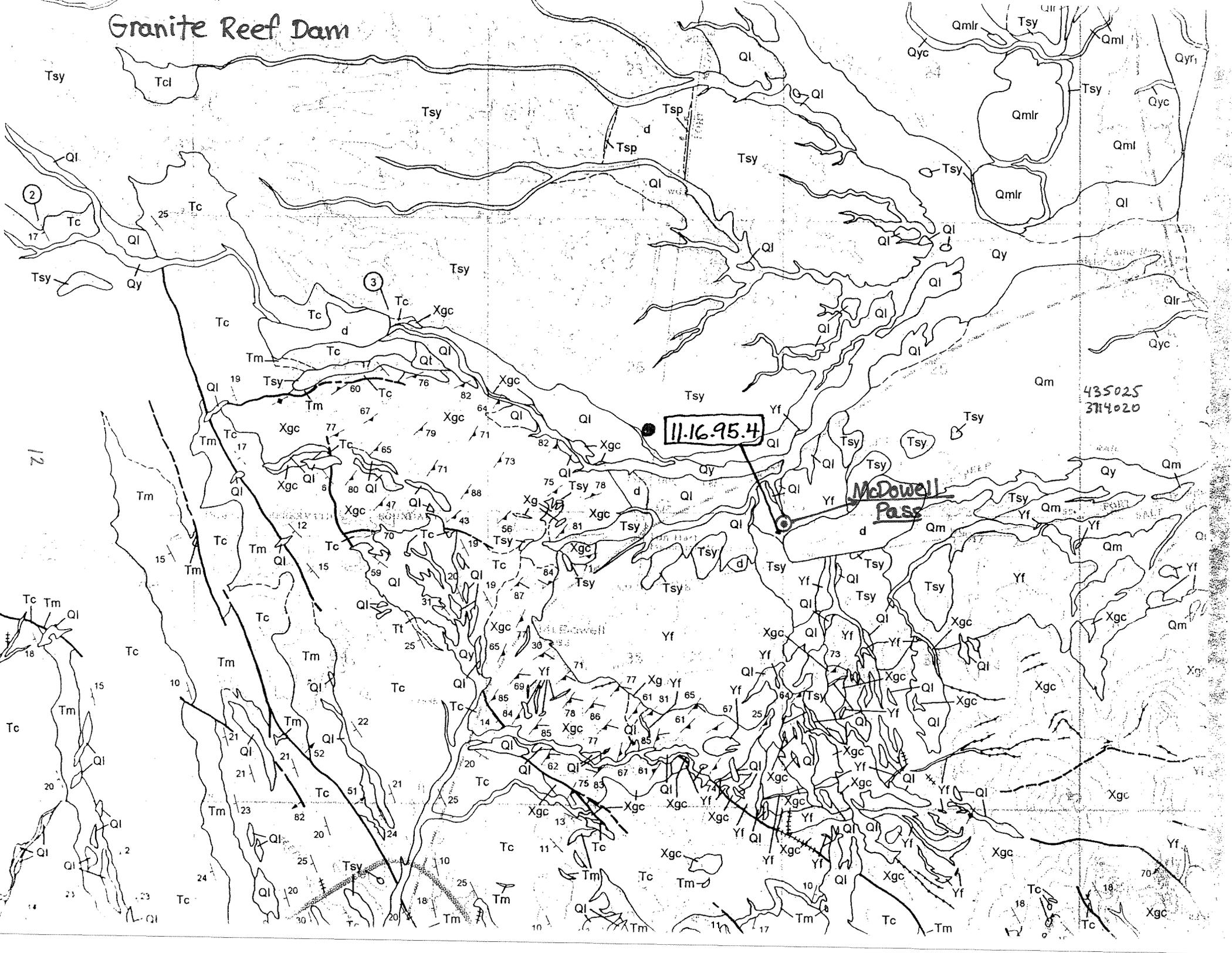
PAYSON NORTH, ARIZ.

SE/4 PINE 15' QUADRANGLE
N3415—W11115/7.5

1973

AMS 3752 IV SE—SERIES V898

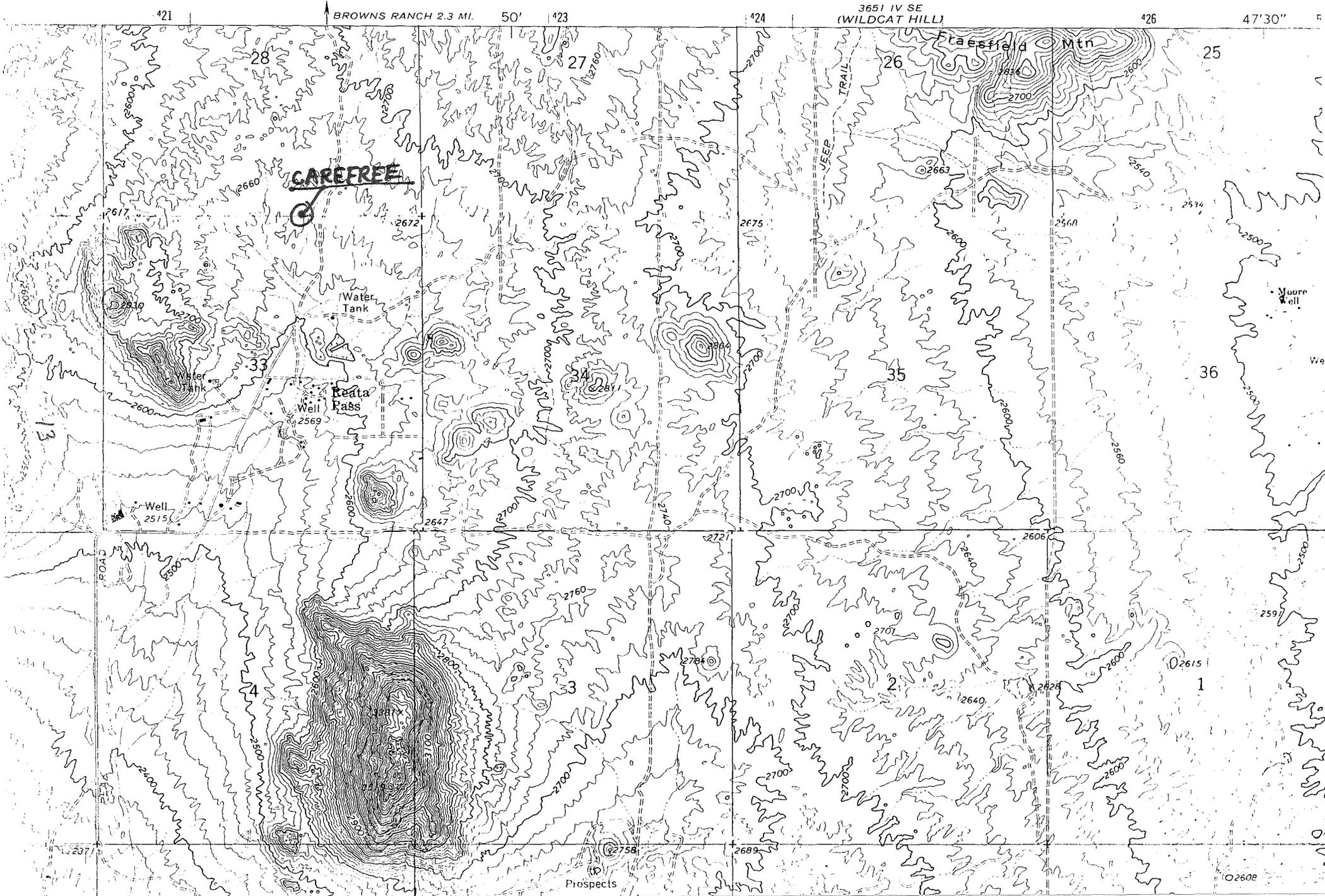
Granite Reef Dam

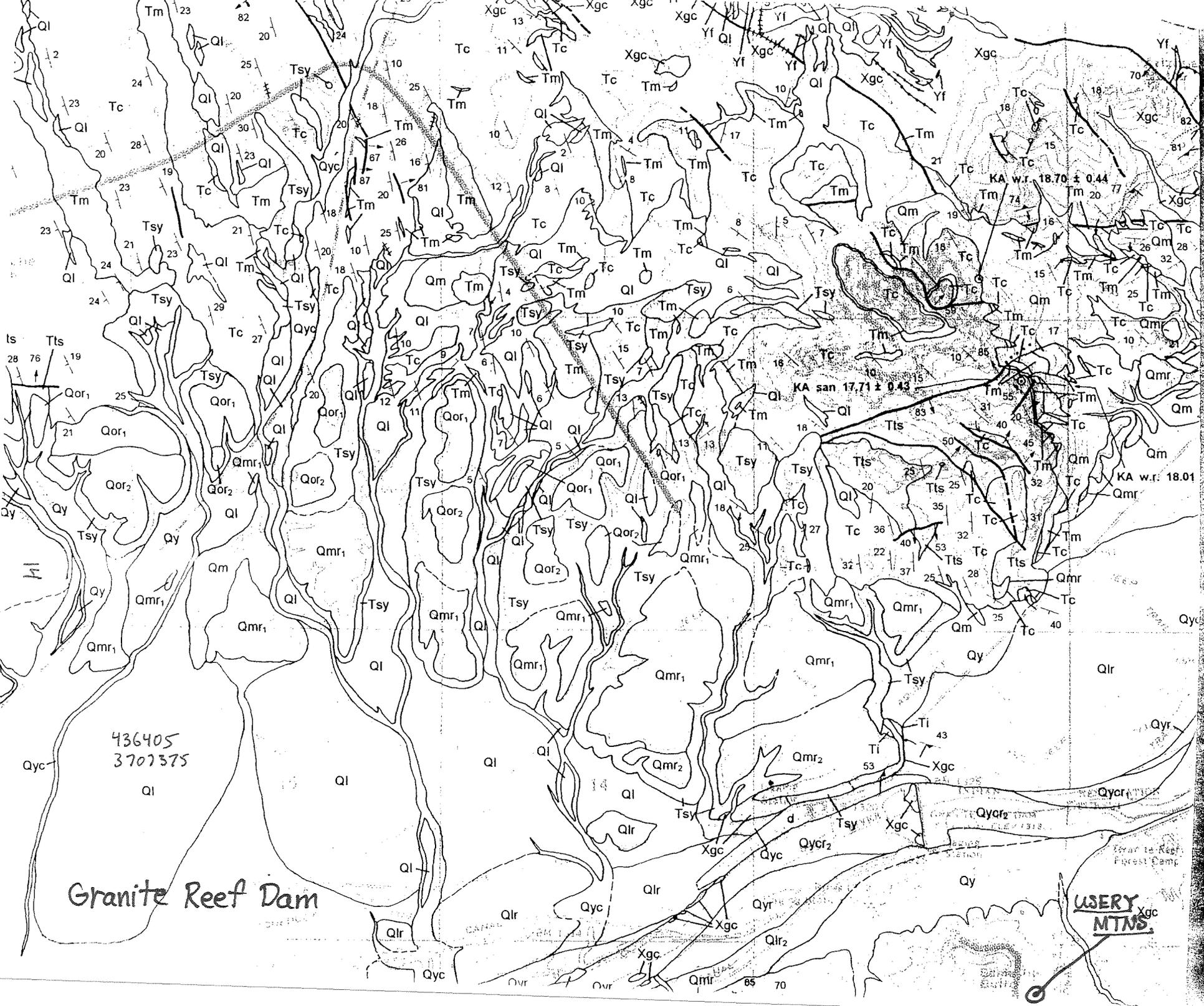


McDowell Peak

INTERIOR
MAP

421755
3733410





Granite Reef Dam

USERY MTS.

Forest Camp

436405
3707375

KA san 17.71 ± 0.43

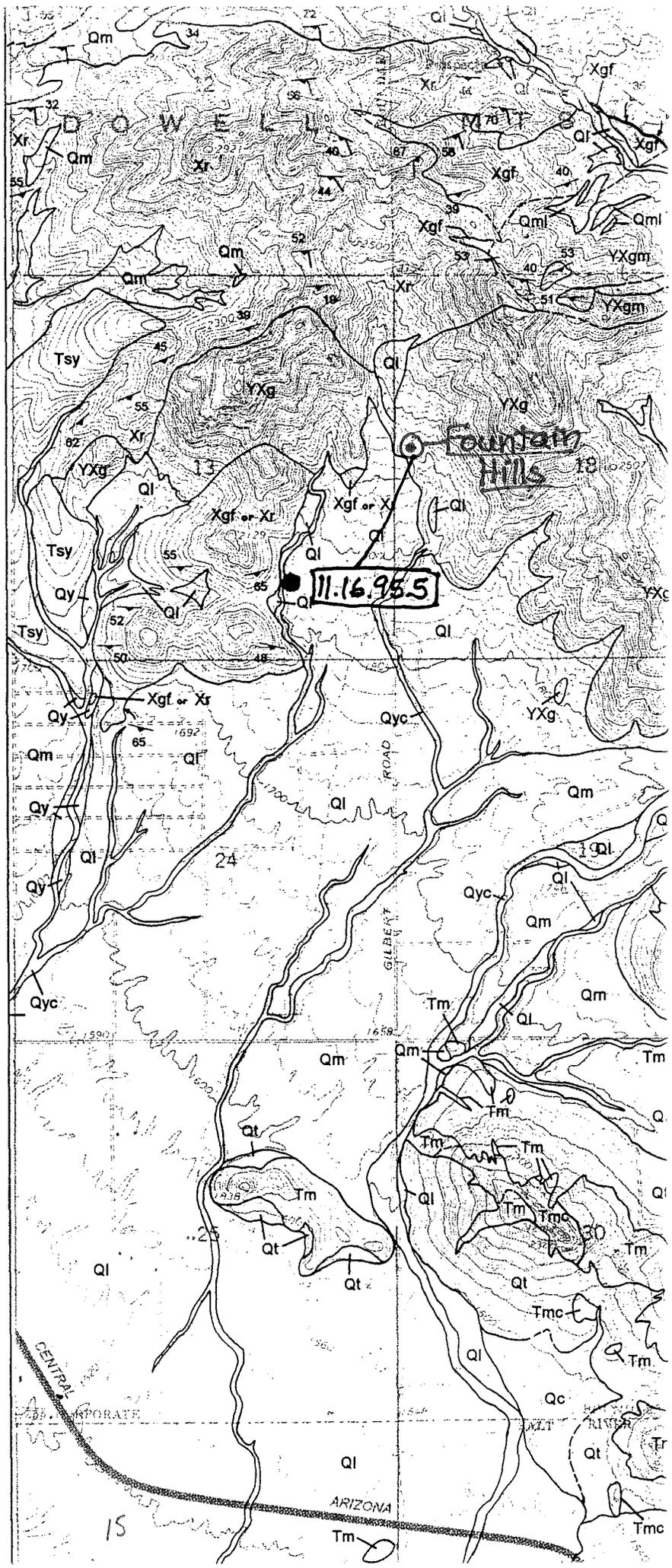
KA w.r. 18.70 ± 0.44

KA w.r. 18.01

Sawick Mtn.

427100
3718230

33° 35'



Mine Mtn.

3731

3730

12°30"

3729

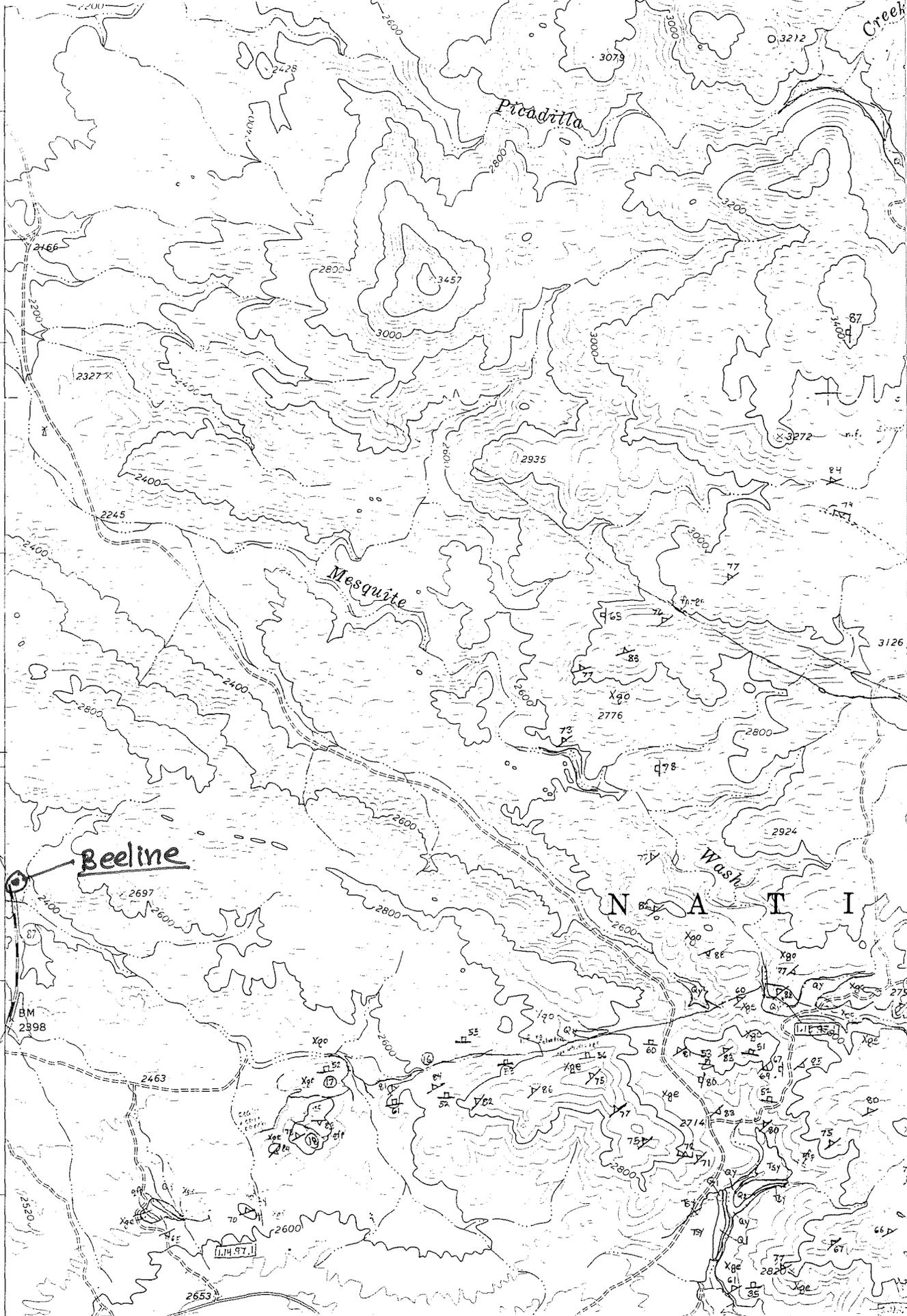
3651 11 NE
(ADAMS MESA)
SUNFLOWER 1.4 MI.
PAYSON 4.8 MI.

3727

PHOENIX 4.5 MI
MESA 2.9 MI

3726

453700
3727270



• Antiques
• rem. case
• Time sheet

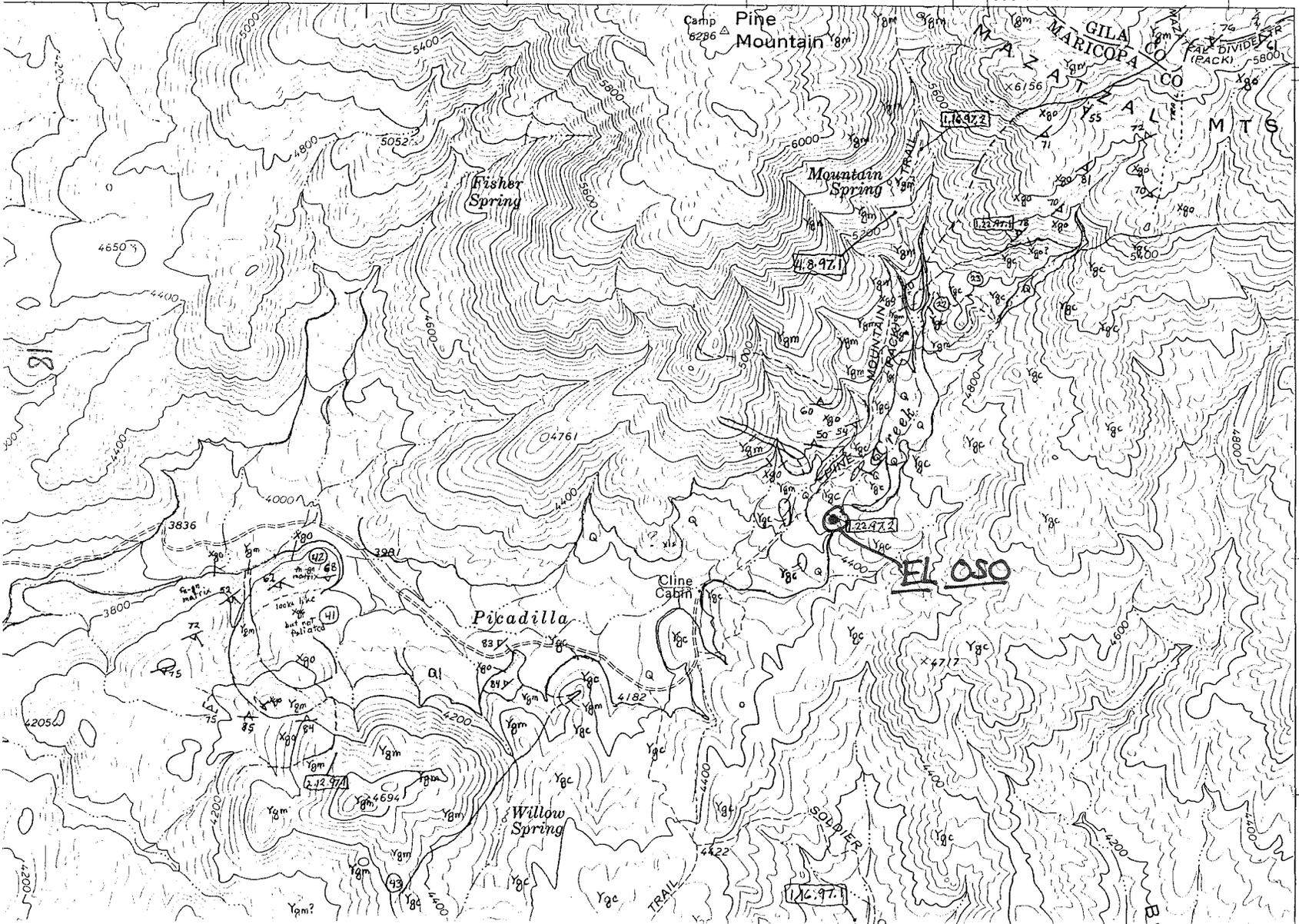
MINE MOUNTAIN QUADRANGLE
ARIZONA
7.5 MINUTE SERIES (TOPOGRAPHIC)

3751 IV SE
(TONTO BASIN)

460 461 25' 462 463 465 111° 22' 30" 33° 45'

660 000 FEET

1 000 000
FEET



Ygm = med. to fine gr
granite
Ygc = coarse-gr.
non-foliated
granite

Protractor
hand lens
reading high
for cleavage

463350
3731975

ρ = flow
foliation
in Ygc

σ = jointing

RING 0.4 MI.