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Density, porosity, and magnetic properties of rock specimens from southwestern Arizona

by

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Abstract

Petrophysical data on 364 rock specimens from southwest Arizona are tabulated and summarized by major rock suites for that part of southwest Arizona covered by the Ajo 1^{o} x 2^{o} quadrangle and the Papago Indian Reservation. Data for 202 of these specimens are new and previously unreported. The tabulation also contains data from theses by B. A. Hargan and B. T. May, University of Arizona.

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INTRODUCTION

This report presents data obtained from petrophysical examination of 202 rock samples collected in conjunction with geophysical field work in southwestern Arizona (fig. 1). Many of the sample sites are on the Luke Air Force Gunnery and Bombing Range which ordinarily has limited access. Physical properties measured were density, porosity, magnetic susceptibility, and natural remanent magnetization. Rock samples were taken as time permitted during the course of gravity surveys which determined the distribution of sample sites. Petrophysical analysis was also performed on a time available basis, thus complete analyses are not available for all rocks.

The new data are supplemented by data from 118 sample locations tabulated in the University of Arizona Gravity Data Base bedrock file. These data were provided to the U.S. Geological Survey under terms of a research grant (see Hargan, 1978) awarded to the University by the U.S. Geological Survey. Also included in the present compilation are data from 44 samples analyzed for magnetic properties and reported in a thesis by B. T. May (1968). There also exists a summary of rock-density data in the vicinity of lat. 32°N, long. 112°W by Greenes (1980), and a generalized discussion and tabulation of petrophysical data of mineralized terrane in the Southwest by Brant (1966). Neither of the latter two data sets are included here.

DATA

Appendix B tabulates the locations, rock identifications, and petrophysical measurements for all samples of this report. The tabulation is a computer listing that has been sorted alphabetically first by rock type (the abbreviations used are listed in appendix A) and second by physiographic locality. Sample locations except for those extracted from May's thesis (1968) are shown on plate 1. May's data were collected in a small area surrounding the Ajo porphyry copper deposit and individual sample locations cannot be clearly shown at the scale of 1:250,000. The source of data is listed in appendix B as: 1, USGS data; 2, University of Arizona data; 3, May's data.

Sampling for the USGS data consisted of collecting one or more hand-sized specimens from each locality. The specimens were broken from rock-outcrops without determining orientation. These specimens were subsequently cored to produce, on the average, about five cylindrical samples from each locality for analysis. Each core was one-inch (25 mm) in diameter and 1-2 inches (25-50 mm) in length. Appendix B lists the average of results of laboratory

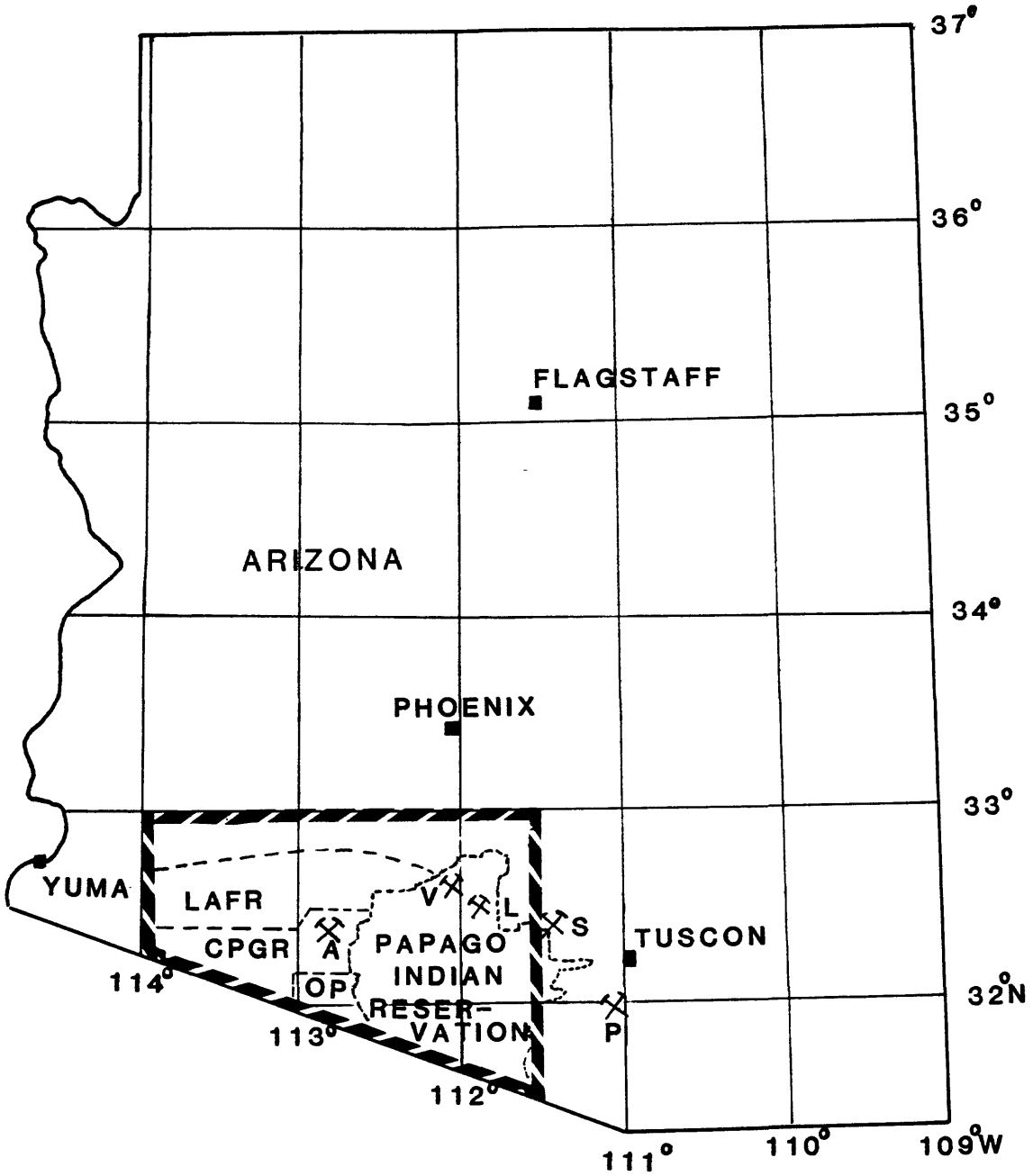

Fig. 1 -- Map showing area of rock sampling in southwest Arizona. The hachured border shows the area of plate 1, and includes the Ajo 1-degree by 2-degree quadrangle (lat. 32° - 33° N., long. 112° - 114° W), the Papago Indian Reservation, Luke Air Force Bombing and Gunnery Range (LAFR), Cabeza-Prieta Game Range (CPGR) and Organ Pipe Cactus National Monument (OP). Porphyry copper mineral deposits shown are Ajo (A), Vekol (V), Lakeshore (L), Silver Bell (S) and Pima-Mission (P).

measurements on samples from each locality. The measurement techniques followed procedures documented by Hunt and others (1979) and are briefly described below. Sample identification for rock type was based largely on macroscopic examination of the hand specimens prior to coring. A small percentage of the cores were thin-sectioned and subjected to petrographic classification. Some of the rock-types listed are highly general, for instance "volcaniclastic rock". Three rocks were not identified and are listed as unknown. The geologic unit (Wilson and others, 1969, May, 1969, Kahle and others, 1978) for each sample locality is shown in Appendix B, but is of limited value, except for the area around Ajo, inasmuch as formation ages and classifications are often questionable in this part of Arizona. New geologic mapping is presently underway.

Density measurements were obtained on the cylindrical samples using the buoyancy or Archimedes' method. The samples were dried in an oven at 105°C and then weighed (W_d) to an accuracy of 0.1 mg. The samples were next vacuum-saturated with distilled water and subsequently weighed both in air and submerged but suspended in a water bath. From these data dry bulk densities (D) were calculated as follows:

$$D = \frac{W_d}{W_s - W_{sp}}$$

where W_s and W_{sp} are respectively the water-saturated weights in air and suspended in water. The density of distilled water at room temperature was assumed to be one g/cm^3.

Porosity (P), in percent, were calculated from the above data by the relation

$$P = \left(\frac{W_s - W_d}{W_s - W_{sp}}\right) 100.$$

The above equation expresses a measure of the pores that are saturable by water. Total porosity can only be obtained by pulverizing the rock material to a degree sufficient to eliminate all occluded pores.

Magnetic susceptibilities were measured using a direct-reading model 3101 Bison bridge, an instrument patterned after a design originally described by Mooney (1953). A correction factor was applied to the readings because the cylinder lengths were usually less than the depth of the sample holder.

Natural remanent magnetization was determined from measurements made with a Schonstedt spinner magnetometer using either a three- or six-spin technique. Six-spin measurements are usually required for those samples whose remanent intensity falls below 10^{-4} emu/cm^3 (Hunt and others, 1979). In a six-spin measurement the core sample is alternately spun in opposite directions at each of the three axial orientations. Prior to measurement each sample was reduced in length to conform to the 25x25 mm size required for use in the Schonstedt magnetometer. Because the original orientation of the samples was not known only the remanent magnetic intensity determined as the absolute value of the vector sum of the components is reported.

The International System of units (SI) is used in this report. Inasmuch as cgs-emu units are commonly reported for petrophysical properties, the conversions between systems for the quantities used in this report are

summarized below. The reader is referred to Sheriff (1973, p. 134) for a table of conversions for magnetic quantities, and to U.S. National Bureau of Standards (1974) and the American Society for Testing and Materials (1976) for a description of the SI system.

Volume percent porosity and specific gravity (numerically equivalent to cgs density) are constant between systems. SI density (kg/m^3) is related to cgs density (g/cm^3) by:

$$10^{-3}\ kg/m^3 = 1\ g/cm^3$$

Remanent magnetization, M, in SI units of amp/m is related to cgs-emu units of oersted, or emu/cm^3, by:

$$10^{-3}\ amp/m\ (SI) = 1\ oersted\ (cgs,\ emu/cm^3)$$

Note that magnetization has the units of magnetic field, $\underline{H}$, which in the cgs-emu system is numerically equivalent to magnetic induction $\underline{B}$ (gauss, $\underline{B} = \mu_o \underline{H}$) because the magnetic permeability in free space (μ_o) is defined as 1 gauss/oersted. This equivalence is not present in the SI system because $\mu_o = 4\pi \times 10^{-7}$ testa-m/amp.

Magnetic susceptibility, S, is a dimensionless ratio of induced magnetization to external magnetic field $\underline{H}$. The relationships between systems is given by:

$$4\pi\ SI = 1\ cgs\text{-}emu$$

The Koenigsberger ratio is also a dimensionless ratio of remanent magnetization, M, to induced magnetization, SH. This ratio is invariant between systems. The magnetic field, H, is related between systems by

$$\frac{10^3}{4\pi}\ amp/m\ (SI) = 1\ gauss\ (cgs\text{-}emu).$$

A typical value for Earth's total magnetic intensity in southern Arizona is 79.6 amp/m, equivalent to 0.5 gauss (50,000 gamma).

DISCUSSION

Tables 1 - 3 summarize the measurements according to the major rock suites represented. Tables 1 and 2 show the logarithmic-mean values and ranges for magnetic properties; table 3 shows the linear mean values and ranges for density and porosity. Range for each quantity is expressed as the limits within which 80-percent of the data fall, centered on the median. Query marks on the lower range of magnetic susceptibility (Table 1) means that the minimum value was less than the resolution of measurement.

The Koenigsberger ratio, Q, andapparent susceptibility, S_a (Table 2) are computed quantities (Nagata, 1969). The Koenigsberger ratio is the ratio of the amplitudes of remanent magnetization to induced magnetization that is given as:

$$Q = \frac{M}{SH}$$

Table 1 -- Logarithmic mean values for measured magnetic properties S and M. The number of samples available for each quantity is given by n. Rock-type abbreviations are listed in appendix B. Ranges are given as 80-percentile limits centered on the median. Queries on the low end of the susceptibility range indicate the sample had magnetization below the resolution of measurement (1.26×10^{-4} SI, or 0.1×10^{-5} emu).

Rock Suite and abbreviated rock types included	Susceptibility (S) SI x 10^4 (n)	mean	range	Remanent Magnetization (M) SI x 10^2 (n)	mean	range
metamorphic rock						
gneiss-gn	(17)	135.	2.39 - 1110.	(4)	68.9	2.32 - 492.
schist-sch, phy	(11)	80.3	3.77 - 5810.	(2)	8.45	4.89 - 14.6
granitoid igneous rock						
diorite, granodiorite -dio, gd	(8)	10.9	? - 138.	(3)	0.228	.0300 - 2.82
quartz diorite-qd	(4)	134.	21.4 - 402.	(4)	11.5	1.71 - 30.6.
quartz monzonite-qm	(21)	31.8	2.14 - 278.	(15)	3.61	0.410 - 30.1
granite-g	(40)	91.9	17.6 - 754.	(5)	0.440	0.0200 - 61.8
aphanatic-porphyritic igneous rock						
basalt-b	(41)	104.	41.2 - 226.	(24)	32.0	2.38 - 150.
andesite-and,andp	(46)	109.	18.8 - 383.	(11)	15.8	5.77 - 42.8
latite-l,lp	(5)	17.5	? - 119.	(0)	-	-
dacite-dac,dacp	(19)	4.86	? - 175.	(1)	8.62	-
rhyodacite-ryd	(4)	38.2	18.1 - 147.	(4)	13.2	8.09 - 26.9
quartz latite-ql,qlp	(5)	0.302	? - 25.1	(0)	-	-
rhyolite-rhy	(19)	3.82	? - 178.	(9)	2.20	0.07 - 113.
indurated volcaniclastic and sedimentary rock						
volcaniclastic rock- volc,tuff	(85)	119.	3.02 - 1150.	(13)	17.0	2.34 - 76.1
breccia,conglomerate- bx congl	(11)	24.9	? - 692.	(3)	0.692	0.400 - 0.930
limestone-ls	(9)	35.9	? - 178.	(0)	-	-
marble-mar	(5)	10.9	7.54 - 20.1	(0)	-	-

Table 2 -- Logarithmic mean values for computed magnetic properties Q and S_a. The number of samples available for each quantity is given by n. Rock-type abbreviations are listed in appendix B. Ranges are given as 80-percentile limits centered on the median.

Rock Suite and abbreviated rock types included	(n)	Koenigsberger's Ratio (Q) dimensionless mean	range	Apparent Susceptibility (S_a) SI x 10^4 mean	range	Susceptibility* SI x 10^4 mean
metamorphic rock						
gneiss-gn	(4)	3.74	.146 - 518.	371.	45.7 - 1239.	46.4
schist-sch, phy	(2)	0.431	.0570 - 3.26	105.	16.1 - 680.	49.2
granitoid igneous rock						
diorite, granodiorite -dio, gd	(3)	0.0295	.0100 - 0.0514	20.1*	1.58 - 145.	19.4
quartz diorite-qd	(4)	0.215	0.0278 - 3.60	212.	98.3 - 443.	134.
quartz monzonite-qm	(14)	0.199	0.0479 - 1.25	80.9	6.23 - 407.	53.2
granite-g	(5)	0.0453	0.00631- 0.794	28.3*	2.31 - 1590.	24.4
aphanatic-porphyritic igneous rock						
basalt-b	(24)	0.810	0.0964 - 4.22	220.	92.7 - 586.	99.2
andesite-and,andp	(11)	0.831	0.299 - 1.96	97.5*	35.8 - 210.	48.9
latite-l,lp	(0)	-	-	-	-	-
dacite-dac,dacp	(1)	2.69	-	29.7	-	8.04
rhyodacite-ryd	(4)	.865	0.236 - 1.87	76.5	38.4 - 182.	38.2
quartz latite-ql,qlp	(0)	-	-	-	-	-
rhyolite-rhy	(9)	1.10	0.410 - 32.7	13.2	1.43 - 386.	5.04
indurated volcaniclastic and sedimentary rock						
volcaniclastic rock- volc,tuff	(13)	0.442	.0386 - 7.96	204.	27.0 - 932.	96.4
breccia,conglomerate- bx congl	(3)	0.440	.421 - .468	5.69*	3.39 - 7.74	3.95
limestone-ls	(0)	-	-	-	-	-
marble-mar	(0)	-	-	-	-	-

*Apparent susceptibility should always equal or exceed susceptibility for a given sample. However, it will be noted that the starred logarithmic mean values are less than their corresponding logarithmic mean susceptibilities in Table 1. This is the result of the particular values of M and S in sample subsets which had both M and S measurements available for calculation of Q and S_a. Note that in the starred cases the number of samples with measured S greatly exceeds those for measured M. The last column shows S (logarithmic mean) for the same subset of data on which Q and S_a are calculated.

Table 3 -- Mean values and range for density properties. The number of sample measurements for D and P is given by n. Ranges are given as 80-percentile limits centered on the median. Wet bulk density is a computed quantity (see text). See appendix B for rock-type abbreviations.

Rock Suite and abbreviated rock types included	Dry Bulk Density (D) $kg/m^3 \times 10^{-3}$ (n)	mean	range	Porosity (P) volume-percent (n)	mean	range	Wet Bulk Density (W) $kg/m^3 \times 10^{-3}$
metamorphic rock							
gneiss-gn	(10)	2.65	2.63-2.77	(10)	1.9	1.3- 2.8	2.67
schist-sch,phy	(11)	2.82	2.57-3.16	(11)	2.0	.31- 7.5	2.84
granitoid igneous rock							
diorite,granodiorite -dio,gd	(4)	2.59	2.35-2.69	(4)	5.9	2.3-12.	2.65
quartz diorite-qd	(0)	-	-	(0)	-	-	-
quartz monzonite-qm	(1)	2.63	-	(1)	1.5	-	2.65
granite-g	(39)	2.66	2.56-2.73	(38)	2.9	1.0- 7.3	2.69
aphanitic-porphyritic igneous rock							
basalt-b	(26)	2.39	2.10-2.88	(26)	15.	6.6-27.	2.54
andesite-and,andp	(23)	2.56	2.21-2.77	(23)	10.	1.5-18.	2.66
latite-l,lp	(0)	-	-	(0)	-	-	-
dacite-dac,dacp	(1)	2.41	-	(1)	8.0	-	2.49
rhyodacite-ryd	(4)	2.27	2.22-2.32	(4)	11.	9.5-14.	2.38
quartz latite-ql,qlp	(0)	-	-	(0)	-	-	-
rhyolite-rhy	(7)	2.38	2.03-2.66	(7)	16.	2.6-36.	2.54
indurated volcaniclastic and sedimentary rock							
volcaniclastic rock- volc,tuff	(56)	2.72	2.57-2.92	(56)	7.1	0.59-17.	2.79
breccia,conglomerate- br congl	(6)	2.66	2.54-2.78	(6)	9.9	2.4-17.	2.76
limestone-ls	(7)	2.64	2.61-2.69	(7)	1.3	0.22-3.4	2.65
marble-mar	(5)	2.70	2.63-2.87	(5)	1.7	0.33-2.9	2.71

The value of H used in the calculation was 39.8 amp/m (0.5 oersted) equivalent to 50,000 nT (gammas). Apparent susceptibility is calculated as

$$S_a = S\ (1 + Q)$$

The Q value indicates the relative importance of remanent magnetization compared to the induced magnetization; a low Q suggests that one may neglect remanent magnetization for interpretation. If the Q value approaches 1 or is greater than 1, some difficulties may be expected in modelling the magnetic field (Strangway, 1967). If the direction of $\underline{M}$ can be ascertained to be roughly parallel or antiparallel to $\underline{H}$, S_a can be usefully substituted for S in model computations of total magnetic intensity.

The wet bulk density, W, (Table 3) is also a computed quantity. It is calculated by the expression:

$$W = D + \frac{P}{100}$$

where D is the dry bulk density and P is the percent porosity. This quantity may be of more value than dry bulk density if one is concerned about rock strata beneath the water table. In southern Arizona the water table can be from a hundred meters to a kilometer or more below the valley floors.

The more magnetic rock suites (table 1) are the basalts, andesites, and volcaniclastic rocks (S about 104 to 119 x 10^{-4} SI), along with the metamorphic rocks (S about 80 x 10^{-4} SI for schists and 135 x 10^{-4} SI for gneisses). Quartz diorite also shows quite high susceptibility (about 134 x 10^{-4} SI) as does granite (about 92 x 10^{-4} SI). The value for quartz diorite is open to query because there are only 4 samples contributing to the mean. Mineralized rock in the porphyry copper deposits of the southwest are largely associated with granodiorite and quartz monzonite (Creasy, 1966, Stringham, 1966) and in line with Brant's observation (1966) these associated rocks show relatively moderate susceptibility (about 11 to 31 x 10^{-4} SI). The aphanatic-porphyritic equivalents of these associated rocks show susceptibilities of similar or lower values (0.30 and 38 x 10^{-4} SI) for quartz latite and rhyodacite respectively.

The aphanitic igneous rocks generally have lower magnetization than their granitoid equivalents. The apparent exception is the granodiorite-rhyodacite pair, however there are only 4 samples available for the rhyodacite rocks. Although there were too few samples of the porphyries in each rock suite to list them separately, the porphyry rocks showed lower susceptibilities than the non-porphyries by factors of about 0.05 to 0.5. For instance, of the 19 samples of the dacite-dacite porphyry group, the 13 dacite rocks had S of 6.00 x 10^{-4} SI compared to the 6 dacite porphyry rocks with S of 3.07 x 10^{-4} SI; the 2 latite rocks had S of 102. x 10^{-4} SI compared to 5.41 x 10^{-4} SI for the 3 latite porphyry rocks.

The high susceptibility for limestone (about 36 x 10^{-4} SI) is related to relatively high detrital content. Most of the limestones sampled were dark grey to black and finely crystalline.

The present data indicate that remanent magnetization on the average accounts for over 80-percent of the rock magnetization for the gneiss, basalt,

dacite, rhyodacite and rhyolite suites, and for more than 20% of the rock magnetization in all other igneous and metamorphic rock suites studied except for diorite-granodiorite (3-percent) and granite (5-percent). There are no data for the latite and quartz latite rock suites or for the limestone and marble suites. It is pointed out that remanent magnetization measurements were made on fewer samples than were susceptibility measurements. Those mean values shown that are based on less than 11 samples are considered tentative. This is true for all quantities in the data tables.

The densest rock suite (table 3) is schist (2.82×10^3 kg/m^3). Gneisses, along with the granitoid igneous rocks have densities whose means cluster between 2.59 and 2.66×10^3 kg/m^3. The indurated sedimentary rocks fall within the density range 2.64 to 2.70×10^3 kg/m^3. The volcaniclastic rocks show densities of 2.72×10^3 kg/m^3 and are more similar in density to the indurated sedimentary rocks than to the aphanitic-porphyritic igneous rocks. The relative high porosities of the volcaniclastic and aphanitc-porphyritic rocks (8 to 16%) account in part for their densities being lower than those of the granitoid igneous rock suites (2 to 6% porosities).

It is of interest that the dry bulk densities of basalt (2.54×10^3 kg/m^3), andesite (2.65×10^3 kg/m^3) and rhyolite (2.51×10^3 kg/m^3) as reported by Johnson and Olhoeft (1983) are higher by .09 to .35 $\times 10^3$ kg/m^3 than the densities reported here (table 3). The data in Johnson and Olhoeft's report come largely from measurements on a world-wide distribution of rocks compiled by Washington (1917).

SUMMARY

Petrophysical measurements on rock samples from southwest Arizona are tabulated in appendix B and are statistically summarized according to major rock types in the tables 1, 2, and 3 of this report. The data are further condensed in table 4. The granitoid igneous and metamorphic rocks (A) and indurated sedimentary and volcaniclastic rocks (D) have similar densities, typical of the usual value used to reduce gravity data (2.67×10^3 kg/m^3). The granitoid igneous and metamorphic rocks (A) contrast to the more dense schists (B) and the less dense, higher porosity, aphanitic-porphyritic igneous rocks (C). The four rock groups shown on table 3 are sub-divided into more specific rock types that have differing magnetic susceptibility and apparent susceptibility. The apparent magnetic susceptibility is a measure of the relative importance of remanent magnetization to induced magnetization, but the maximum value of this parameter in interpretation can only be realized by knowing the direction of remanent magnetization which was not determined in the present work. Gneiss (A1) and quartz diorite (A2) are the most magnetic rock suites in the present data, followed by the volcaniclastic (D1) and basalt-andesite rock suites (C1). Remanent magnetization is indicated to be important in all these except the quartz diorite suite (A2). Schist (B) is also relatively magnetic and its remanent magnetization is of moderate importance. The rock suites most commonly associated with mineralized igneous rock (A3 and C2) are indicated to be less magnetic than the gneiss (A1) and quartz diorite (A2) granitoid rock suites and the basalt-andesite (C1) and volcaniclastic (D2) rock suites. Table 3 shows the rocks of suite C2 to be less magnetic but with relatively more important remanent magnetization than their granitoid equivalents (A3). Indurated sedimentary rocks (D2) can have magnetization equivalent to the less magnetic of the igneous rocks.

Table 4 -- Condensed summary of average magnetic and density properties for rock-sample measurements in southwest Arizona. The values of magnetic susceptibility in parenthesis are from the subset of data that was used to calculate the apparent susceptibility. Values queried are based on less than 11 samples.

Rock Group	Magnetic Susceptibility SI x 10^4		Apparent Susceptibility SI x 10^4	Dry Bulk Density $kg/m^3 \times 10^{-3}$	Volume percent porosity
A-granitoid igneous-metamorphic rock				2.59-2.66	2-6%
A1 - gneiss	135	(46)?	371		
A2 - quartz diorite	134?	(134)?	212?		
A3 - granite-diorite-granodiorite-quartz monzonite	11-92	(19-53)	20-81		
B-schist	80	(49)?	105?	2.82	2%
C-aphanitic-porphyritic igneous rock				2.27-2.56	8-16%
C1 - basalt-andesite	104-109	(49-99)	98-220		
C2 - latite-dacite-rhyodacite-quartz latite-rhyolite	0.30-38	(5.0-38)	13-98		
D-indurated sedimentary and volcaniclastic rock				2.64-2.72	1-10%
D1-volcaniclastic rock	119	(96)	204		
D2-sedimentary rock	11-36	(4.0)?	5.69?		

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Part of the area sampled was on the Cabeza-Prieta Game Range where Mr. Rog DeRosa of the U.S. Fish and Wildlife Service was very helpful. Mr. William F. Wallace, Superintendent of the Organ Pipe National Monument and Mr. Terry Peters cooperated in work conducted on the National Monument. Mr. Addison Smith, the Mining Department Director for the Papago Tribe arranged access for our work in the Papago lands.

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APPENDIX A, Table A1

List of abbreviations used for rock types in the data tabulation of Appendix B.

alsk	alaskite
and	andesite
and,lprplt	andesite,lightly prophylitized
and,myrlcav	andesite with myrolitic cavities
and,prph	andesite,porphyritic
and,prph,calstr	andesite,porphyritic with calcite stringers
and,prph,ornplag	andesite,porphyritic with oriented plagioclase
and,prph,prplt	andesite,porphyritic,prophylitized
and,vesc	andesite,vesicular
andp	andesite-porphry
andp,flasp	andesite,feldspathic
b	basalt
b,prph	basalt,porphyritic
b,vesc	basalt,vesicular
b,wth	basalt,weathered
bx	breccia
clt	calcalutite
congl	conglomerate
dac	dacite
dac,achl-ep	dacite,altered chlorite-epidote
dac,met	dacite,metamorphozed
dac,prph	dacite,porphyritic
dac,prph,arg	dacite,porphyritic,argillaceous
dac,prph,plag	dacite,porphyritic with plagioclase phenocrysts
dacp	dacite-porphry
dacp,bi,plag	dacite-porphry,biotite and plagioclase phenocry
dacp,epd	dacite-porphry epodized
dacp,plag	dacite-porphry with plagioclase phenocrysts
dacp,prplt	dacite-porphry,prophylitized
dio	diorite
g	granite
gd	granodiorite
gd,chlz	granodiorite,chloritized
gd,fgr,lalt	granodiorite,fine-grained,lightly-altered
gd,pegt	granodiorite,pegmatitic
gn	gneiss
gn,dio,bi	gneiss,diorite with biotite
gn,g	granite-gneiss
gn,qm	gneiss,quartz-monzonite
l	latite
l,prph,bi	latite,porphyritic with biotite phenocrysts
lp	latite-porphry
ls	limestone
ls,mic	micritic limestone
ls,red	limestone,red
mar	marble
peg	pegmatite
phy	phyllite
phy,tuff	phyllitic tuff
qd	quartz-diorite
ql,prph	quartz-latite,porphyritic
ql,silc	quartz-latite,silicified
qlp	quartz-latite porphry

APPENDIX A, Table A1 - continued

qm	quartz-monzonite
qm,chlz	quartz-monzonite,chloritized
qm,lalt	quartz-monzonite,lightly altered
qm,lchlz	quartz-monzonite,lightly chloritized
qm,prplt	quartz-monzonite,prophylitized
rhy	rhyolite
ryd	rhyodacite
sch	schist
sch,grnscn,tuff	greenschist-tuff
skn,diops	diopside-skarn
ss,ironst	sandstone,iron-stained
ss,qtz	quartzite
tuff	tuff
tuff,ashf	tuff,ash-flow
tuff,ashf,silc	tuff,ash-flow, silicified
tuff,bas	tuff,basaltic
tuff,scor	tuff,scoriaceous
tuff,silc	tuff,silicified
tuff,ss	tuff,sandstone
tuff,volcbx	tuff,volcanic breccia
tuff,weld	tuff,welded
unk	unidentified rock
unk,silc,calstr	unidentified rock,silicified with calcite strin
volc	volcaniclastic rock
volc,mudf	volcaniclastic rock, mudflow

APPENDIX A, Table A2

List of abbreviations used for geologic map formations in the data tabulation of Appendix B.

MAP UNITS USED FOR DATA SOURCE 1
TAKEN FROM KOHLE,CONWAY AND HAXEL(1978)

Qs	Sedimentary deposits	Quaternary
Qb	Basalt flows	Quaternary
Qts	Sedimentary deposits	Tertiary and Quaternary
Qtb	Basalt flows	Tertiary and Quaternary
Ts	Conglomerate,breccia and sandstone	Tertiary
Tvs	Silicic volcanic rocks	Tertiary
Tvi	Intermediate volcanic rocks	Tertiary
Tb	Basalt flows	Tertiary
Ti	Hypabyssal intrusive rocks and plugs	Tertiary
TKg	Granitic rocks: granite to diorite	Tertiary and Cretaceous
TKgm	Granitic rocks,accessory muscovite,garnet	Tertiary and Cretaceous
Kv	Volcanic rocks,silicic to matic	Cretaceous
Ka	Andesite	Cretaceous
Mzsc	Schist,phyllite,semi-schist,and quartzite	Mesozoic
Mzgn	Gneiss	Mesozoic
Mzg	Granitic rocks	Mesozoic
Mzsv	Sedimentary rocks	Mesozoic
pCm	Gneiss and schist	Precambrian
pCg	Granitic rocks	Precambrian

MAP UNITS USED FOR DATA SOURCE 2
KOHLE,CONWAY,HAXEL(1978)

Qs	Sedimentary deposits	Quaternary
Qtb	Basalt flows	Tertiary and Quaternary
Tb	Basalt flows	Tertiary
Tvi	Intermediate volcanic rocks	Tertiary
TKg	Granitic rocks,granite to diorite	Cretaceous
TKgm	Granitic rocks,accessory muscovite or garnet	Cretaceous
Mzsc	Schist,phyllite,semi-schist,and quartzite	Mesozoic
Mzg	Granitic rocks,granitic to dioritic	Mesozoic
Mzsv	Sedimentary rocks	Mesozoic
unk	unknown	

WILSON,MOORE AND COOPER(1969)

Qs	Sedimentary deposits	Quaternary
Qtb	Basalt flows	Quaternary
Tvs	Silicic volcanic rocks	Tertiary
Tvi	Intermediate volcanic rocks	Tertiary
TKr	Volcanic rocks,rhyolitic	Cretaceous and Tertiary
TKg	Granite,quartz monzonite,granodiorite	Cretaceous and Tertiary
TKsc	Schist and phyllite	Cretaceous and Tertiary
TKgn	Gneiss	Cretaceous and Tertiary
Ka	Andesite flows and tuffs	Cretaceous

APPENDIX A, Table A2 - continued

MAP UNITS USED FOR DATA SOURCE 3
FROM B.T.MAY(1969)

Tlf	Locomotive Fanglomerate	Tertiary
Tcm	Cornelia Quartz Monzonite	Tertiary
Tcd	Cornelia Quartz Monzonite,dioritic border	Tertiary
Kcv	Concentrator Volcanics	Cretaceous
pCcg	Cardigan Gneiss	Precambrian

APPENDIX A, Table A3

List of abbreviations used to indicate sample station location and prefixing the sample identification number in appendix B. In most cases the location refers to the 15-minute quadrangle in southern Arizona.

AGC-AGUA CALIENTE MTS.
AGD-AGUA DULCE MTS.
AGM-AGUILA MTS.
AJO-AJO
ANP-ANTELOPE PEAK
AZH-AZTEC HILLS
BAB-BABOQUIVARI
CHU-CHUICHU
CHV-CHILDS VALLEY
CMP-CIMARRON PEAK
COC-COCURAQUE BUTTE
COM-COMOBABI MTS.
CPP-CABEZA PRIETA PEAK
DBK-DOUBLE PEAK
DIP-DIAZ PEAK
DIZ-DIAZ PEAK
ENP-ENGESSER PASS
EST-ESTRELLA
GAC-GU ACHI
GIB-GILA BEND
GRM-GRANITE MTS
GRP-GROWLER PEAK
GUA-GU ACHI
HAT-HAT MOUNTAIN
KAA- KAKA VALLEY
KIP-KINO PEAK
KOV-KOM VO
LSM-LA LESNA MTS.
LUK-LUKEVILLE
MID-MIDLAND
MNW-MOHAWK MTS. NORTHWEST
MOW-MOHAWK
MSE-MOHAWK MTS. SOUTHEAST
MSW-MOHAWK MTS. SOUTHWEST
MTA-MOUNT AJO
ONH-ONEILL HILLS
PAM-PALOMAS MTS.
PAP-PAPAGO
PIS-PISINIMO
PRP-PRESUMIDO PEAK
QTM-QUIJOTOA MTS.
QUI-QUITOBOQUITO SPRINGS
QUM-QUIJOTOA MTS.
RBM-RED BLUFF MOUNTAIN
ROL-ROLL
SCM-SIKORT CHUAPO MTS.
SEL-SELLS
SIA-SIERRA ARIDA
SRM-SILVER REEF MOUNTAINS
SRO-SANTA ROSA MTS.
SSM-SANTA ROSA MTS.
SVB-SILVER BELL PEAK

APPENDIX 4, Table A3 -- continued

THE-THEBA
TUM-TULE MTS.
VAH-VACA HILLS
VAM-VAMORI
VEM-VEKOL MTS.
VHL-VACA HILLS
VKM-VEKOL MTS.
WSE-WELLTON SE

APPENDIX B

Tabulation of rock specimen locations and petrophysical measurements. The tabulation is sorted alphabetically first by rock-type abbreviation and second by physiographic locality.

Sample: Identification code for the sampling station. The first three letters abbreviate the quadrangle name in which the sample was acquired.

Physiographic location: The name of the prominent physiographic feature in the vicinity of each sample station.

Map Unit: Abbreviation of the geologic map unit on which the sample was acquired, see Appendix A, table A2.

Rock Type: Abbreviation for the name and description of each sample, see Appendix A, table A1.

Magn. Suscept.: Measured magnetic susceptibility in units of 10^{-4} SI.[1]

Reman. Magn: Measured remanent magnetization in units of 10^{-2} amp/m (SI).[1]

Dry Dens.: Measured dry bulk density in units of 10^{-3} x kg/m^3.[1]

Wet Dens.: Measured wet bulk density in units of 10^{-3} x kg/m^3.[1]

Poros.: Measured volume percent pore space.[1]

Source Code: Code for the source of data: 1, U.S. Geological Survey, 2; University of Arizona (see Hargan, 1978); 3, May (1963).

[1] A value of -1.0 indicates that measurements are not available. A value of 0.0 for magnetic susceptibility or remanent magnetization indicates that the susceptibility was lower than the resolution of measurement (a maximum value of 1.25×10^{-4} was used in calculations of this report).

Tabulation of rock properties from southwest Arizona

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
PRP1494	31.555	111.601	Baboquivari Mts	TKg	alsk	0.0	-1.0	-1.00	-1.00	-1.00	2
COC605a	32.130	111.419	Aguirre Valley	Qs	and	75.4	-1.0	-1.00	-1.00	-1.00	2
MTA0886	32.111	112.671	Ajo Mts	Tvi	and	414.7	-1.0	2.75	2.85	9.87	1
COC0592	32.062	111.388	Altar Valley	Ka	and	150.8	-1.0	-1.00	-1.00	-1.00	2
QTM0746	32.174	112.156	Brownell Mts	Tvi	and	84.8	-1.0	-1.00	-1.00	-1.00	2
COM0736	33.018	114.023	Castle Dome Mts	Ka	and	120.6	-1.0	2.60	2.72	11.83	1
ENP0737	33.028	113.984	Castle Dome Mts	Ka	and	66.6	-1.0	2.77	2.87	9.92	1
RBM0735	32.986	114.005	Castle Dome Mts	Ka	and	94.2	-1.0	2.61	2.75	13.96	1
RBM0734	32.959	114.045	Castle Dome Mts	Ka	and	148.3	-1.0	2.61	2.79	18.23	1
ROL0738	38.982	113.968	Castle Dome Mts	Ka	and	566.7	-1.0	2.59	2.68	8.81	1
ROL0733	32.939	113.993	Castle Dome Mts	Ka	and	242.5	-1.0	2.84	2.97	13.26	1
PAP0212	32.440	112.181	Castle Mts	Tvi	and	52.8	-1.0	2.68	2.70	1.52	1
CHV124b	32.672	113.074	Crater Mts	Tvi	and	73.1	29.0	2.81	2.82	0.93	1
CHV0121	32.627	113.107	Crater Mts	Tvi	and	73.9	14.6	2.39	2.52	13.41	1
CHV0120	32.636	113.158	Crater Mts	Tvi	and	12.1	9.4	2.24	2.37	12.84	1
MID0380	32.628	112.992	Crater Range	Tvi	and	383.3	-1.0	2.73	2.79	5.82	1
CHV0335	32.632	113.046	Crater Range	Tvi	and	682.4	-1.0	2.73	2.78	5.08	1
CHV334#2	32.614	113.078	Crater Range	Tvi	and	22.6	-1.0	2.65	2.68	2.70	1
DIZ0790	31.913	112.564	Gu Vo Hills	Qtb	and	138.2	-1.0	-1.00	-1.00	-1.00	2
MTA977b	32.186	112.715	Gunsight Hills	Qs	and	62.8	-1.0	-1.00	-1.00	-1.00	2
PAP0219	32.552	112.221	Kaka Valley	Tb	and	1387.3	-1.0	2.69	3.14	45.44	1
PAP0218	32.539	112.232	Kaka Valley	Tb	and	321.7	-1.0	2.64	2.66	1.80	1
KOV0521	31.853	112.336	Kom Vo Valley	Qs	and	110.0	-1.0	-1.00	-1.00	-1.00	2
KOV0775	31.940	112.477	Mesquite Mts	Tvs	and	113.1	-1.0	-1.00	-1.00	-1.00	2
PIS0767	32.008	112.369	Quijotoa Valley	Qs	and	150.8	-1.0	-1.00	-1.00	-1.00	2
KAK063b	32.702	112.400	Sand Tank Mts	Tvi	and	41.7	5.8	2.13	2.27	13.77	1
KAK0053	32.677	112.377	Sand Tank Mts	Tvi	and	77.4	42.8	2.50	2.54	4.22	1
HAT086a	32.557	112.556	Sauceda Mts	Tvi	and	80.7	167.0	2.61	2.63	2.23	1
MID0175	32.703	112.802	Sauceda Mts	Ka	and	48.5	3.6	2.34	2.38	4.49	1
HAT0083	32.642	112.559	Sauceda Mts	Tvi	and	12.8	6.6	2.00	2.22	22.45	1
MID0178	32.634	112.740	Sauceda Mts	Ka	and	161.6	19.2	2.68	2.69	0.74	1
MID0176	32.682	112.807	Sauceda Mts	Ka	and	49.0	17.5	2.21	2.30	9.05	1
PIS0749	32.164	112.265	Sierra Blanca Mts	Tvi	and	119.4	-1.0	-1.00	-1.00	-1.00	2
SCM932a	32.277	112.571	Sikort Chuapo Mts	Tb	and	75.4	-1.0	-1.00	-1.00	-1.00	2
MTA965a	32.189	112.685	Gunsight Valley	TKg	and,lprplt	213.6	-1.0	-1.00	-1.00	-1.00	2
MTA0956	32.244	112.710	Pozo Redondo Mts	Tvi	and,myrlcav	50.3	-1.0	-1.00	-1.00	-1.00	2
CMP0845	32.488	112.394	Kaka Valley	Tb	and,prph	314.2	-1.0	-1.00	-1.00	-1.00	2
KAA0850	32.546	112.252	Kaka Valley	Tvi	and,prph	188.5	-1.0	-1.00	-1.00	-1.00	2
KOV903a	31.779	112.478	Mesquite Mts	Tvs	and,orph	150.8	-1.0	-1.00	-1.00	-1.00	2
CMP0966	32.283	112.413	Quijotoa Valley	Tb	and,prph	75.4	-1.0	-1.00	-1.00	-1.00	2
VKM0866	32.621	112.140	Vekol Valley	Tvi	and,prph,calstr	94.2	-1.0	-1.00	-1.00	-1.00	2
CMP0995	32.304	112.411	Quijotoa Valley	Tb	and,prph,ornplag	88.0	-1.0	-1.00	-1.00	-1.00	2
GAC1321	32.257	112.138	Brownell Mts	Mzsv	and,prph,prplt	377.0	-1.0	-1.00	-1.00	-1.00	2
KOV0903	31.779	112.478	Mesquite Mts	Tvs	and,vesc	163.4	-1.0	-1.00	-1.00	-1.00	2
DBK1123	32.767	111.992	Vaiva Hills	Qtb	and,vesc	175.9	-1.0	-1.00	-1.00	-1.00	2

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
VAM0665	31.602	111.920	Vamori Valley	TKg	andp	18.8	-1.0	-1.00	-1.00	-1.00	2
M000016	32.368	112.863	Little Ajo Mts	Tfp	andp,fldsp	46.1	12.0	-1.00	-1.00	-1.00	3
AJ00215	32.466	112.790	Batamote Mts	Tb	b	72.6	84.6	2.17	2.37	19.93	1
AJ00017	32.450	112.958	Childs Mtn	Tb	b	62.1	2.4	2.36	2.45	8.53	1
MIDW020	32.530	112.971	Childs Valley	Qb	b	75.9	6.7	2.33	2.53	20.21	1
AJ00157	32.416	112.920	Childs Valley	Qb	b	99.5	28.2	2.10	2.35	25.27	1
CHV0116	32.567	113.059	Childs Valley	Qb	b	37.7	78.9	2.24	2.39	14.83	1
CMP0986	32.405	112.468	Cimarron Mts	Tb	b	75.4	-1.0	-1.00	-1.00	-1.00	2
MID0008	32.608	112.960	Crater Mtn	Tb	b	70.4	17.3	2.40	2.54	14.29	1
CHV124a	32.672	113.074	Crater Mts	Tb	b	153.8	95.5	2.47	2.59	11.79	1
MID0095	32.636	112.960	Crater Mts	Tb	b	158.3	29.6	2.50	2.59	9.42	1
THE0135	32.783	112.906	Gila Bend Plain	Qb	b	42.7	1.0	2.02	2.32	29.62	1
THE0138	32.881	112.965	Gila Bend Plain	Qb	b	40.2	48.4	2.58	2.69	10.73	1
GRP0150	32.482	113.070	Growler Mts	Qtb	b	67.9	114.0	2.46	2.56	9.98	1
GRP0151	32.444	113.052	Growler Mts	Qtb	b	97.5	39.0	2.51	2.59	8.39	1
MTA0976	32.167	112.707	Gunsight Hills	Qs	b	75.4	-1.0	-1.00	-1.00	-1.00	2
CMP1585	32.474	112.287	Kaka Valley	Tb	b	69.1	-1.0	-1.00	-1.00	-1.00	2
GIB049b	32.792	112.544	Sand Tank Mts	Qb	b	289.0	137.0	2.26	2.44	18.41	1
KAK0057	32.589	112.344	Sand Tank Mts	Pcm	b	155.8	171.0	2.26	2.44	18.12	1
KAK063a	32.702	112.400	Sand Tank Mts	Tb	b	154.6	14.0	2.40	2.42	2.04	1
HAT0060	32.730	112.547	Sand Tank Mts	Qb	b	41.2	156.0	2.33	2.50	16.97	1
GIB049a	32.792	112.544	Sand Tank Mts	Qb	b	307.9	150.0	2.20	2.40	20.29	1
KAK0065	32.602	112.399	Sand Tank Mts	Qb	b	118.1	65.0	2.43	2.50	7.25	1
EST0186	32.840	112.477	Sand Tank Mts	Qb	b	106.8	1.1	2.68	2.70	1.83	1
HAT086b	32.557	112.556	Sauceda Mts	Tb	b	74.1	39.2	2.18	2.37	18.76	1
HAT0070	32.628	112.618	Sauceda Mts	Qb	b	201.6	34.3	2.39	2.46	6.64	1
MID0174	32.740	112.770	Sauceda Mts	Qb	b	152.1	117.0	2.52	2.64	11.89	1
SEN0030	32.779	113.138	Sentinel Plain	Pcg	b	137.0	21.9	2.91	3.18	27.00	1
SEN0035	32.820	113.205	Sentinel Plain	Qb	b	95.5	21.4	1.69	2.12	42.52	1
SRM1088	32.703	111.871	Tat Momoli Mts	Qs	b	226.2	-1.0	-1.00	-1.00	-1.00	2
AGM0329	32.658	113.368	Aguila Mts	Qb	b,prph	546.6	-1.0	2.88	2.96	7.73	1
SEN0319	32.800	113.178	Sentinel Plain	Qb	b,prph	505.2	-1.0	2.93	3.06	13.48	1
SAV1194	32.171	111.660	Aguirre Valley	Qtb	b,vesc	62.8	-1.0	-1.00	-1.00	-1.00	2
CMP1597	32.395	112.269	Castle Mts	Tb	b,vesc	226.2	-1.0	-1.00	-1.00	-1.00	2
CMP1598	32.382	112.327	Cimarron Mts	Mzg	b,vesc	65.3	-1.0	-1.00	-1.00	-1.00	2
CMP1599	32.380	112.331	Cimarron Mts	Mzg	b,vesc	62.8	-1.0	-1.00	-1.00	-1.00	2
CMP1591	32.470	112.317	Kaka Valley	Qs	b,vesc	90.5	-1.0	-1.00	-1.00	-1.00	2
SCM0823	32.240	112.420	Quijotoa Valley	Qs	b,vesc	138.2	-1.0	-1.00	-1.00	-1.00	2
CHU1033	32.769	111.818	Santa Rosa Valley	Tvi	b,vesc	138.2	-1.0	-1.00	-1.00	-1.00	2
COM0627	32.197	111.942	Santa Rosa Valley	Qs	b,vesc	201.1	-1.0	-1.00	-1.00	-1.00	2
DZP0783	31.834	112.566	Sierra de Santa Rosa	Tvi	b,vesc	31.4	-1.0	-1.00	-1.00	-1.00	2
SCM932b	32.277	112.571	Sikort Chuapo Mts	Tb	b,vesc	40.2	-1.0	-1.00	-1.00	-1.00	2
SCM0959	32.273	112.727	Pozo Redondo Mts	Qs	b,wth	81.7	-1.0	-1.00	-1.00	-1.00	2
MTA0890	32.056	112.654	Ajo Mts	Tvi	bx	692.4	-1.0	2.67	2.84	17.27	1
CHV0377	32.653	113.011	Crater Range	Tvi	bx	389.6	-1.0	2.59	2.68	9.00	1

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
CHV334#1	32.614	113.078	Crater Range	Tvi	bx	84.2	-1.0	2.54	2.63	8.54	1
CHV0333	32.650	113.195	Crater Range	Tvi	bx	678.6	-1.0	2.76	2.90	13.58	1
AGD0927	32.188	113.004	Growler Valley	Tvi	bx	516.5	-1.0	2.78	2.80	2.44	1
SSM1716	32.351	111.864	Santa Rosa Mts	TKsc	bx	0.0	-1.0	-1.00	-1.00	-1.00	2
DIP0898	31.881	112.636	Santa Rosa Mts	Tvi	bx	467.5	-1.0	2.61	2.70	8.56	1
SRM1729	32.500	111.941	Santa Rosa Valley	Qs	clt	18.8	-1.0	-1.00	-1.00	-1.00	2
VKM0870	32.618	112.081	Vekol Mts	Pzs	clt	0.0	-1.0	-1.00	-1.00	-1.00	2
VHL0581	32.333	111.503	Waterman Mts	unk	clt	0.0	-1.0	-1.00	-1.00	-1.00	2
M000031	32.347	112.863	Little Ajo Mts	Tlf	congl	2.4	0.4	-1.00	-1.00	-1.00	3
M000020	32.348	112.860	Little Ajo Mts	Tlf	congl	4.8	0.9	-1.00	-1.00	-1.00	3
M000028	32.349	112.866	Little Ajo Mts	Tlf	congl	5.4	0.9	-1.00	-1.00	-1.00	3
QTM1623	32.058	112.156	Quijotoa Mts	Mzsv	congl	0.0	-1.0	-1.00	-1.00	-1.00	2
KOV521s	31.853	112.336	Kom Vo Valley	Qs	dac	163.4	-1.0	-1.00	-1.00	-1.00	2
KAK0078	32.532	112.460	Sauceda Mts	Ti	dac	8.0	8.6	2.41	2.49	8.02	1
GAC1764	32.356	112.078	Sheridan Mts	Mzsc	dac,acnl-ep	12.6	-1.0	-1.00	-1.00	-1.00	2
BAB0464	31.919	111.683	Baboquivari Mts	TKsc	dac,met	0.0	-1.0	-1.00	-1.00	-1.00	2
SEL1244	31.874	111.832	Artesia Mts	Tvs	dac,prph	25.1	-1.0	-1.00	-1.00	-1.00	2
CMP0944	32.334	112.396	Cimarron Mts	Tvs	dac,prph	150.8	-1.0	-1.00	-1.00	-1.00	2
COM0612	32.053	111.803	Combabi Mts	Ka	dac,prph	0.0	-1.0	-1.00	-1.00	-1.00	2
MTA0712	32.198	112.666	Gunsight Valley	Tvi	dac,prph	25.1	-1.0	-1.00	-1.00	-1.00	2
SCM0944	32.278	112.682	Pozo Redondo Mts	Tvi	dac,prph	25.1	-1.0	-1.00	-1.00	-1.00	2
QTM1624	32.051	112.175	Quijotoa Mts	Tvs	dac,prph	0.0	-1.0	-1.00	-1.00	-1.00	2
COM0634	32.167	111.838	North Combabi Mts	TKg	dac,prph,arg	0.0	-1.0	-1.00	-1.00	-1.00	2
SCM0957	32.260	112.719	Pozo Redondo Mts	Tvi	dac,prph,arg	75.4	-1.0	-1.00	-1.00	-1.00	2
MTA0962	32.219	112.717	Gunsight Valley	Tvi	dac,prph,plag	44.0	-1.0	-1.00	-1.00	-1.00	2
COM0613	32.100	111.817	North Combabi Mts	Ts	dacp	0.0	-1.0	-1.00	-1.00	-1.00	2
VKM1174	32.582	112.165	Vekol Mts	Ts	dacp	175.9	-1.0	-1.00	-1.00	-1.00	2
SCM0979	32.309	112.547	Sikort Chuapo Mts	Tb	dacp,bi,plag	94.2	-1.0	-1.00	-1.00	-1.00	2
GAC1328	32.252	112.187	Window Valley	Mzsv	dacp,epd	0.0	-1.0	-1.00	-1.00	-1.00	2
SCM0936	32.253	112.612	Sikort Chuapo Mts	Tvi	dacp,plag	50.3	-1.0	-1.00	-1.00	-1.00	2
COM0622	32.132	111.854	North Combabi Mts	TKgn	dacp,prplt	0.0	-1.0	-1.00	-1.00	-1.00	2
GRP0337	32.316	113.060	Growler Mts	QTb	dio	22.6	-1.0	2.78	2.80	2.32	1
UNK369	32.000	111.000	Antelope Hills	Mzsv	g	461.2	-1.0	2.66	2.68	1.99	1
AZH0315	32.772	113.481	Aztec Hills	Mzg	g	727.6	-1.0	2.64	2.65	0.55	1
AGM0487	32.739	113.431	Aztec Hills	Mzg	g	33.9	-1.0	2.81	2.88	7.48	1
SIA0810	32.244	113.209	Cabeza Prieta Mts	Mzg	g	27.6	-1.0	2.61	2.62	1.28	1
CPP0801	32.382	113.894	Cabeza Prieta Mts	Mzsc	g	329.2	-1.0	2.72	2.74	2.37	1
CPP0793	32.391	113.799	Cabeza Prieta Mts	Mzsc	g	174.7	-1.0	2.74	2.76	1.93	1
CPP0787	32.338	113.788	Cabeza Prieta Mts	Mzg	g	207.3	-1.0	2.61	2.65	4.25	1
R8M0732	32.910	114.003	Castle Dome Mts	Mzsc	g	30.2	-1.0	2.70	2.71	1.27	1
GUA0959	32.461	112.098	Cimarron Mts	TKg	g	894.7	-1.0	2.67	2.68	1.35	1
COM0969	32.055	111.755	Comobabi Mts	TKgm	g	310.4	-1.0	2.65	2.69	4.16	1
COM0980	32.165	111.860	Comobabi Mts	TKg	g	41.5	-1.0	2.66	2.69	2.83	1
WSE0780	32.528	114.023	Copper Mts	Mzg	g	197.3	-1.0	2.66	2.67	1.03	1
CPP0789	32.454	113.995	Copper Mts	Mzg	g	412.2	-1.0	2.56	-1.00	-1.00	1

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
WSE0781	32.511	114.006	Copper Mts	Mzg	g	260.1	-1.0	2.69	2.71	1.68	1
THE0130	32.811	112.854	Gila Bend Plain	Pcg	g	4.8	0.0	2.55	2.60	4.85	1
GRM0371	32.355	113.264	Granite Mts	Mzg	g	56.5	-1.0	2.63	2.64	1.35	1
GRM0367	32.297	113.280	Granite Mts	Mzg	g	740.2	-1.0	2.73	2.74	0.88	1
GRM0369	32.445	113.294	Granite Mts	Mzg	g	20.1	-1.0	2.63	2.66	2.56	1
GRM0399	32.390	113.276	Granite Mts	Mzg	g	182.2	-1.0	2.65	2.67	1.71	1
GRM0497	32.375	113.316	Granite Mts	Mzg	g	39.0	-1.0	2.71	2.75	3.62	1
GRM0411	32.447	113.347	Granite Mts	Mzg	g	45.2	-1.0	2.67	2.70	3.10	1
MTA1533	32.146	112.580	Gunsight Hills	TKg	g	0.0	-1.0	-1.00	-1.00	-1.00	2
QUI1716	31.942	113.011	La Abra Plain	Mzg	g	81.7	-1.0	2.65	2.66	1.21	1
EST0196	32.914	112.366	Maricopa Mts	Pcg	g	4.0	1.3	2.55	2.62	7.27	1
EST0202	32.942	112.443	Maricopa Mts	Pcg	g	51.5	-1.0	2.64	2.66	1.57	1
MSW0482	32.575	113.647	Mohawk Mts	Mzg	g	41.5	-1.0	2.65	2.68	2.76	1
MSE0434	32.540	113.583	Mohawk Mts	Mzsc	g	30.2	-1.0	2.66	2.70	3.91	1
ONH0492	32.198	113.390	Mohawk Valley	Mzsc	g	155.8	-1.0	2.64	2.65	1.09	1
CPP0783	32.463	113.908	Mohawk Valley	Mzg	g	177.2	-1.0	2.64	2.65	1.24	1
ONH0458	32.111	113.369	Oneill Hills	Mzgn	g	1043.0	-1.0	2.66	2.69	2.71	1
PAM0742	33.009	113.687	Palomas Mts	Mzg	g	100.5	-1.0	2.65	2.76	10.66	1
LUK0874	31.982	112.880	Puerto Blanco Mts	Mzsc	g	50.3	-1.0	2.71	2.73	1.68	1
QUM981#2	32.139	112.166	Quijotoa Mts	Mzg	g	17.6	-1.0	2.67	2.70	2.85	1
EST188b	32.797	112.409	Sand Tank Mts	Tkg	g	2.3	0.0	2.56	2.59	3.40	1
HAT0061	32.749	112.520	Sand Tank Mts	Pcg	g	1435.1	61.8	2.57	2.61	4.46	1
EST188a	32.797	112.409	Sand Tank Mts	TKg	g	139.5	0.3	2.74	2.74	0.36	1
ONH0494	32.233	113.483	Sierra Pinta	Mzsc	g	754.0	-1.0	2.69	2.72	2.72	1
ONH0493	32.198	113.458	Sierra Pinta	Mzsc	g	599.4	-1.0	2.68	2.70	1.82	1
ONH0466	32.165	113.411	Sierra Pinta Mts	Mzsc	g	103.0	-1.0	2.65	2.67	2.11	1
PAPNE#7	33.332	111.473	Waterman Mts	Os	g	838.2	-1.0	2.68	2.77	9.30	1
BAB1439	31.917	111.692	Baboquivari Hills	TKsc	gd	12.6	-1.0	-1.00	-1.00	-1.00	2
PAP0190	32.397	112.171	Crater Mts	TKg	gd	35.2	0.1	2.53	2.59	5.95	1
MID0125	32.690	112.983	Crater Mts	TKg	gd	1.5	0.0	2.35	2.47	12.31	1
AJO0159	32.331	112.931	Little Ajo Mts	Mzg	gd	138.0	2.8	2.69	2.72	2.87	1
KOV512b	31.948	112.302	Quijotoa Valley	TKgn	gd,chlz	12.6	-1.0	-1.00	-1.00	-1.00	2
SSM1705	32.347	111.782	Aguirre Valley	TKi	gd,fgr,lalt	0.0	-1.0	-1.00	-1.00	-1.00	2
MTA0724	32.153	112.651	Gunsight Hills	TKg	gd,pegt	75.4	-1.0	-1.00	-1.00	-1.00	2
AGD0435	32.013	113.157	Agua Dulce Mts	Mzgn	gn	1107.1	-1.0	2.76	2.77	1.46	1
ONH0370	32.189	113.282	Antelope Hills	Mzgn	gn	453.6	-1.0	2.64	2.67	2.87	1
MOW0829	32.575	113.968	Copper Mts	Mzgn	gn	497.6	-1.0	2.74	2.75	1.32	1
GRP0364	32.259	113.238	Granite Mts	Mzgn	gn	599.4	-1.0	2.77	2.78	1.45	1
AGD0466	32.131	113.189	Growler Valley	Mzgn	gn	348.1	-1.0	2.67	2.69	2.02	1
M000044	32.352	112.919	Little Ajo Mts	pCcg	gn	122.4	102.0	-1.00	-1.00	-1.00	3
M000002	32.351	112.900	Little Ajo Mts	pCcg	gn	39.8	2.3	-1.00	-1.00	-1.00	3
M000027	32.354	112.887	Little Ajo Mts	pCcg	gn	397.1	194.0	-1.00	-1.00	-1.00	3
M000043	32.351	112.913	Little Ajo Mts	pCcg	gn	2.4	492.0	-1.00	-1.00	-1.00	3
ONH0451	32.117	113.300	Mohawk Valley	Mzgn	gn	4890.8	-1.0	2.86	2.87	1.31	1
QUI0870	31.976	113.041	Quitobaquito Hills	Mzgn	gn	295.3	-1.0	2.66	2.70	3.98	1

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	wet Dens.	Poros.	Source Code
ONH0463	32.123	113.384	Sierra Pinta	Mzgn	gn	321.7	-1.0	2.13	2.15	2.01	1
TUM0823	32.213	113.826	Tule Mts	Mzgn	gn	693.7	-1.0	2.65	2.66	0.78	1
KOV0512	31.948	112.302	Quijotoa Valley	unk	gn,dio,bi	50.3	-1.0	-1.00	-1.00	-1.00	2
PRP1496	31.534	111.613	Baboquivari Mts	TKg	gn,g	0.0	-1.0	-1.00	-1.00	-1.00	2
MSE0330	32.555	113.557	San Christobal Valley	Mzsc	gn,g	30.2	-1.0	2.63	2.65	1.53	1
VAM664a	31.589	111.879	Morena Mtn	TKsc	gn,qm	138.2	-1.0	-1.00	-1.00	-1.00	2
GAC567b	32.458	112.198	Castle Mts	Tvi	l	119.4	-1.0	-1.00	-1.00	-1.00	2
SCM0827	32.418	112.659	Pozo Redondo Valley	Tvs	l,prph,bi	88.0	-1.0	-1.00	-1.00	-1.00	2
GAC0572	32.391	112.221	Castle Mts	Tvi	lp	31.4	-1.0	-1.00	-1.00	-1.00	2
COM1748	32.066	111.995	Ko Vaya Hills	Qs	lp	0.0	-1.0	-1.00	-1.00	-1.00	2
SRM0653	32.623	111.792	Saw Tooth Mts	Qs	lp	50.3	-1.0	-1.00	-1.00	-1.00	2
QUM0983	32.212	112.174	Brownell Mts	TKi	ls	144.5	-1.0	2.62	2.63	1.32	1
QUM0982	32.205	112.148	Brownell Mts	TKi	ls	37.7	-1.0	2.61	2.62	1.30	1
QUM0982	32.205	112.148	Brownell Mts	TKi	ls	37.7	-1.0	2.61	2.62	1.30	1
QUM0983	32.212	112.174	Brownell Mts	TKi	ls	144.5	-1.0	2.62	2.63	1.32	1
GRP0407	32.457	113.218	Growler Valley	QTb	ls	178.4	-1.0	2.69	2.69	0.22	1
SSM1684	32.498	111.942	Santa Rosa Valley	Qs	ls	0.0	-1.0	-1.00	-1.00	-1.00	2
PAPNE#4	32.340	111.514	Waterman Mts	Qb	ls	41.5	-1.0	2.63	2.66	3.38	1
GRP0407	32.457	113.218	Growler Valley	Ys	ls,mic	178.4	-1.0	2.69	2.69	0.22	1
GAC1324b	32.255	112.145	Brownell Mts	Mzsv	ls,red	25.1	-1.0	-1.00	-1.00	-1.00	2
PAPNE#42	32.216	111.732	Aguirre Valley	Tvi	mar	7.5	-1.0	2.64	2.67	2.93	1
QUM981#1	32.139	112.166	Quijotoa Mts	Mzg	mar	20.1	-1.0	2.63	2.64	1.42	1
PAPONE2	32.362	111.530	waterman Mts	Qs	mar	7.5	-1.0	2.64	2.67	2.93	1
PAPNE6#2	32.316	111.496	waterman Mts	unk	mar	17.6	-1.0	2.87	2.87	0.33	1
PAPNE#5	32.327	111.504	waterman Mts	Qts	mar	7.5	-1.0	2.70	2.71	0.62	1
COM0232	32.032	111.768	Combabi Mts	TKgn	peg	12.6	-1.0	-1.00	-1.00	-1.00	2
COC0595	32.011	111.478	Coyote Mts	unk	peg	0.0	-1.0	-1.00	-1.00	-1.00	2
QUI0869	31.999	113.070	Quitobaquito Hills	Mzsc	phy	84.2	-1.0	2.69	2.71	2.32	1
KAK0987	32.582	112.257	Sand Tank Mts	Tb	phy,tuff	1267.9	-1.0	2.67	2.68	0.74	1
M000004	32.359	112.861	Little Ajo Mts	Tcd	qd	21.4	30.6	-1.00	-1.00	-1.00	3
M000036	32.362	112.871	Little Ajo Mts	Tcd	qd	154.6	1.7	-1.00	-1.00	-1.00	3
M000006	32.356	112.863	Little Ajo Mts	Tcd	qd	402.1	16.2	-1.00	-1.00	-1.00	3
M000045	32.363	112.933	Little Ajo Mts	Tcd	qd	242.5	20.3	-1.00	-1.00	-1.00	3
VHL1404	32.420	111.605	Silver Bell Mts	Ka	ql,prph	0.0	-1.0	-1.00	-1.00	-1.00	2
LSM0692	31.651	112.076	Tecolote Valley	Qs	ql,prph	25.1	-1.0	-1.00	-1.00	-1.00	2
KOV0887	31.770	112.264	The Great Plain	Tvi	ql,prph	0.0	-1.0	-1.00	-1.00	-1.00	2
COM1747	32.056	111.995	Ko Vaya Hills	Ka	ql,silc	0.0	-1.0	-1.00	-1.00	-1.00	2
COM1481	32.213	111.844	Sil Nakya Hills	Qs	qlp	0.0	-1.0	-1.00	-1.00	-1.00	2
PRP1497	31.528	111.622	Baboquivari Mts	TKg	qm	175.9	-1.0	-1.00	-1.00	-1.00	2
GRM0375	32.252	113.347	Bryan Mts	Mzsc	qm	30.2	-1.0	2.63	2.65	1.53	1
M000007	32.354	112.866	Little Ajo Mts	Tcm	qm	97.1	2.1	-1.00	-1.00	-1.00	3
M000048	32.391	112.912	Little Ajo Mts	Tcm	qm	2.8	1.4	-1.00	-1.00	-1.00	3
M000018	32.367	112.863	Little Ajo Mts	Tcm	qm	13.4	2.3	-1.00	-1.00	-1.00	3
M000039	32.359	112.870	Little Ajo Mts	Tcm	qm	302.8	0.9	-1.00	-1.00	-1.00	3
M000047	32.382	112.898	Little Ajo Mts	Tcm	qm	11.8	3.9	-1.00	-1.00	-1.00	3

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
M000038	32.357	112.867	Little Ajo Mts	Tcm	qm	-1.0	0.4	-1.00	-1.00	-1.00	3
M000001	32.357	112.872	Little Ajo Mts	Kcv	qm	388.3	7.4	-1.00	-1.00	-1.00	3
M000005	32.355	112.861	Little Ajo Mts	Tcm	qm	203.6	3.9	-1.00	-1.00	-1.00	3
M000003	32.361	112.876	Little Ajo Mts	Tcm	qm	266.4	14.8	-1.00	-1.00	-1.00	3
M000015	32.370	112.880	Little Ajo Mts	Tcm	qm	2.1	0.2	-1.00	-1.00	-1.00	3
M000012	32.362	112.871	Little Ajo Mts	Tcm	qm	277.7	30.1	-1.00	-1.00	-1.00	3
M000042	32.381	112.880	Little Ajo Mts	Tcm	qm	70.7	475.0	-1.00	-1.00	-1.00	3
M000011	32.359	112.866	Little Ajo Mts	Tcm	qm	4.6	0.7	-1.00	-1.00	-1.00	3
M000034	32.363	112.863	Little Ajo Mts	Tcm	qm	147.0	3.5	-1.00	-1.00	-1.00	3
M000014	32.374	112.883	Little Ajo Mts	Tcm	qm	187.2	9.0	-1.00	-1.00	-1.00	3
PIS0768	32.006	112.363	Quijotoa Valley	Qtb	qm	50.3	-1.0	-1.00	-1.00	-1.00	2
MTA965b	32.189	112.685	Gunsight Valley	TKg	qm,chlz	88.0	-1.0	-1.00	-1.00	-1.00	2
COM0610	32.029	111.802	South Combabi Mts	TKsc	qm,lalt	0.0	-1.0	-1.00	-1.00	-1.00	2
QTM1757	32.088	112.122	Quijotoa Mts	TKg	qm,lchlz	0.0	-1.0	-1.00	-1.00	-1.00	2
CMP0992	32.345	112.401	Cimarron Mts	Mzg	qm,prplt	100.5	-1.0	-1.00	-1.00	-1.00	2
SSM1707	32.334	111.795	Aguirre Valley	TKi	rhy	0.0	-1.0	-1.00	-1.00	-1.00	2
DIP0906	31.958	112.688	Ajo Mts	Tvs	rhy	167.1	-1.0	2.64	2.67	2.60	1
GAC567a	32.458	112.198	Cimarron Mts	Tvi	rhy	0.0	-1.0	-1.00	-1.00	-1.00	2
KIP0928	32.192	112.968	Growler Mts	Kv	rhy	72.9	-1.0	2.57	2.74	16.58	1
GRP0345	32.407	113.087	Growler Mts	QTb	rhy	49.0	-1.0	2.55	2.91	35.90	1
CMP1576	32.321	112.491	Hickman Valley	Tb	rhy	50.3	-1.0	-1.00	-1.00	-1.00	2
M000030	32.356	112.855	Little Ajo Mts	Kcv	rhy	1.6	0.8	-1.00	-1.00	-1.00	3
M000033	32.362	112.860	Little Ajo Mts	Kcv	rhy	235.0	60.1	-1.00	-1.00	-1.00	3
M000029	32.350	112.860	Little Ajo Mts	Kcv	rhy	2.0	3.6	-1.00	-1.00	-1.00	3
M000022	32.350	112.863	Little Ajo Mts	Kcv	rhy	8.7	112.9	-1.00	-1.00	-1.00	3
M000024	32.354	112.867	Little Ajo Mts	Kcv	rhy	3.8	1.1	-1.00	-1.00	-1.00	3
M000025	32.351	112.869	Little Ajo Mts	Kcv	rhy	1.6	0.7	-1.00	-1.00	-1.00	3
SCM0208	32.488	112.686	Pozo Redondo Valley	Ti	rhy	178.4	-1.0	2.66	2.70	3.59	1
KAK0052	32.730	112.396	Sand Tank Mts	Ti	rhy	5.8	0.7	2.04	2.23	18.73	1
KAK0064	32.662	112.417	Sand Tank Mts	Ti	rhy	1.3	0.1	2.19	2.31	11.69	1
HAT0073	32.596	112.531	Sauceda Mts	Ti	rhy	7.0	1.7	2.03	2.26	22.52	1
CMP1337a	32.266	112.269	Sierra Blanca Mts	Pcg	rhy	0.0	-1.0	-1.00	-1.00	-1.00	2
SRM0387	32.745	111.787	Silver Reef Mts	Tvi	rhy	0.0	-1.0	-1.00	-1.00	-1.00	2
SVB0583	32.329	111.479	Waterman Mts	unk	rhy	0.0	-1.0	-1.00	-1.00	-1.00	2
KAK063c	32.702	112.400	Sand Tank Mts	Ti	ryd	147.0	13.8	2.32	2.42	10.08	1
KAK0058	32.668	112.449	Sand Tank Mts	Ti	ryd	22.1	10.0	2.28	2.38	9.52	1
HAT0068	32.644	112.529	Sauceda Mts	Ti	ryd	18.1	8.1	2.25	2.35	10.00	1
KAK0085	32.549	112.497	Sauceda Mts	Ti	ryd	36.2	26.9	2.22	2.36	13.62	1
COM0970	32.007	111.802	Comobabi Mts	TKg	sch	5806.9	-1.0	2.80	2.81	0.80	1
PAP0051	32.223	111.594	Javelina Mts	Pcm	sch	3.8	4.9	2.57	2.65	7.55	1
MNW0422	32.630	113.640	Mohawk Mts	Mzsc	sch	27.6	-1.0	2.77	2.78	1.46	1
MSE0423	32.596	113.604	Mohawk Mts	Mzsc	sch	6.3	-1.0	2.70	2.71	0.61	1
CPP0784	32.429	113.884	Mohawk Valley	Mzsc	sch	67.9	-1.0	3.10	3.14	3.53	1
ANP0986	32.783	112.145	Table Top Mts	Xsc	sch	28.9	-1.0	2.79	2.80	1.21	1
VEM0984	32.560	112.237	Vekol Mts	Xsc	sch	27.6	-1.0	2.71	2.71	0.31	1

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
EST0191	32.783	112.323	White Hills	Pcm	sch	643.4	14.6	3.02	3.03	0.98	1
QUM981#3	32.139	112.166	Quijotoa Mts	Mzg	sch,grnsch,tuff	62.8	-1.0	3.16	3.19	2.70	1
CMP1337b	32.266	112.269	Sierra Blanca Mts	Pcg	skn,diops	50.3	-1.0	-1.00	-1.00	-1.00	2
VAM0664	31.589	111.879	Morena Mtn	TKsc	skn,diops	25.1	-1.0	-1.00	-1.00	-1.00	2
CMP1599a	32.380	112.331	Cimarron Mts	Mzg	ss,ironst	0.0	-1.0	-1.00	-1.00	-1.00	2
GAC1324a	32.255	112.145	Brownell Mts	Mzsv	ss,qtz	0.0	-1.0	-1.00	-1.00	-1.00	2
AGC0670	32.986	113.357	Agua Caliente Mts	Qb	tuff	996.5	-1.0	2.67	2.86	19.06	1
AGM0391	32.562	113.303	Aguila Mts	QTb	tuff	865.8	-1.0	2.63	2.76	12.74	1
DIP0891	31.995	112.684	Ajo Mts	Mzg	tuff	552.9	-1.0	2.60	2.75	15.39	1
MTA0889	32.055	112.700	Ajo Mts	Tvs	tuff	218.7	-1.0	2.57	2.62	4.99	1
DIP894	31.991	112.631	Ajo Mts	Tvs	tuff	1143.5	-1.0	2.77	2.80	2.81	1
SEL0966	31.869	111.908	Artesa Mts	Tksc	tuff	52.8	-1.0	2.74	2.74	0.36	1
KIP0934	32.110	112.998	Bates Mts	Qtb	tuff	414.7	-1.0	2.60	2.70	10.23	1
KIP0929	32.132	112.941	Bates Mts	Qtb	tuff	795.5	-1.0	2.72	2.84	11.82	1
KIP0930	32.116	112.905	Bates Mts	Qtb	tuff	449.9	-1.0	2.65	2.68	3.45	1
KIP0935	32.114	112.939	Bates Mts	Qtb	tuff	581.8	-1.0	2.69	2.83	14.10	1
KIP0932	32.090	112.943	Bates Mts	Kv	tuff	907.3	-1.0	2.73	2.74	1.31	1
CPP0819	32.255	113.774	Cabeza Prieta Mts	Qb	tuff	1019.1	-1.0	2.66	2.70	4.40	1
CPP0803	32.280	113.798	Cabeza Prieta Mts	Qb	tuff	637.1	-1.0	2.53	2.54	1.34	1
CPP0805	32.270	113.709	Cabeza Prieta Mts	Qb	tuff	301.6	-1.0	2.64	2.74	10.09	1
COM0971	32.073	111.801	Comobabi Mts	TKg	tuff	42.7	-1.0	2.64	2.66	2.25	1
GRP0352	32.359	113.103	Growler Mts	QTb	tuff	299.1	-1.0	2.81	2.82	0.68	1
GRP0339	32.258	113.019	Growler Mts	QTb	tuff	475.0	-1.0	2.87	2.90	3.32	1
GRPs345	32.407	113.087	Growler Mts	QTb	tuff	1662.5	-1.0	2.78	2.84	5.78	1
CHV0381	32.518	113.179	Growler Mts	QTb	tuff	197.3	-1.0	2.80	2.81	0.79	1
KIP0353	32.218	112.988	Growler Mts	QTb	tuff	806.8	-1.0	2.80	2.83	3.32	1
GRPs344	32.447	113.077	Growler Mts	QTb	tuff	1398.6	-1.0	2.75	2.85	9.86	1
GRM0397	32.441	113.259	Growler Valley	QTb	tuff	852.0	-1.0	2.82	2.83	0.68	1
CHV0385	32.538	113.237	Growler Valley	QTb	tuff	942.5	-1.0	2.81	2.85	4.38	1
CPP0832	32.293	113.991	Lechuguilla Desert	Qb	tuff	452.4	-1.0	2.69	2.96	27.45	1
ONH0467	32.232	113.407	Mohawk Valley	Mzsc	tuff	60.3	-1.0	2.63	2.64	0.88	1
ONH0467	32.232	113.407	Mohawk Valley	Mzsc	tuff	61.6	-1.0	2.63	2.64	0.88	1
SEN0843	32.953	113.014	Painted Rock Mts	Qb	tuff	26.4	-1.0	2.50	2.54	3.55	1
LUK0871	31.998	112.928	Puerto Blanco Mts	Mzsc	tuff	69.1	-1.0	2.93	2.94	0.93	1
SRO0960	32.412	111.847	Santa Rosa Mts	Tksc	tuff	580.6	-1.0	2.69	2.98	29.00	1
GUA0957	32.390	112.080	Santa Rosa Valley	Mzsc	tuff	76.7	-1.0	2.82	2.84	1.91	1
SEN0642	32.985	113.150	Sentinel Plain	Qb	tuff	1112.1	-1.0	2.97	3.11	14.02	1
SEN0643	32.953	113.113	Sentinel Plain	Qb	tuff	409.7	-1.0	2.95	3.07	12.36	1
SEN0320	32.757	113.167	Sentinel Plain	Qb	tuff	21.4	-1.0	2.62	2.63	1.50	1
AGC0655	32.928	113.301	Stanwix Flats	Qb	tuff	325.5	-1.0	3.00	3.11	10.66	1
ANP0984	32.797	112.092	Table Top Mts	Qtb	tuff	1151.1	-1.0	2.91	2.97	5.83	1
ONH0460	32.011	113.436	Tule Desert	Qb	tuff	932.4	-1.0	2.92	3.02	9.73	1
ONH0462	32.106	113.480	Tule Desert	Qb	tuff	5649.8	-1.0	2.86	2.88	1.95	1
VAH0978	32.292	111.728	Vaca Hills	Qtb	tuff	291.5	-1.0	2.77	2.94	16.54	1
KIP1739	32.060	112.786	Valley of the Ajo	Tvs	tuff	598.2	-1.0	2.63	2.74	11.01	1

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
PAPNE#1	32.373	111.540	Waterman Mts	Qtb	tuff	2199.1	-1.0	2.75	2.76	1.12	1
PAPNE#3	32.352	111.521	Waterman Mts	Qb	tuff	297.8	-1.0	2.76	2.77	1.46	1
COC0602	32.063	111.473	Aguirre Valley	TKr	tuff,ashf	0.0	-1.0	-1.00	-1.00	-1.00	2
KOV0890	31.823	112.280	Gu Vo Hills	Tvs	tuff,ashf	0.0	-1.0	-1.00	-1.00	-1.00	2
KOV0733	31.997	112.448	Mesquite Mts	Tvs	tuff,ashf	12.6	-1.0	-1.00	-1.00	-1.00	2
KOV0772	31.949	112.433	Mesquite Mts	Tvs	tuff,ashf	25.1	-1.0	-1.00	-1.00	-1.00	2
KOV0886	31.781	112.270	The Great Plain	Qs	tuff,ashf	0.0	-1.0	-1.00	-1.00	-1.00	2
KOV0885	31.792	112.271	The Great Plain	Qs	tuff,ashf	0.0	-1.0	-1.00	-1.00	-1.00	2
LSM0671	31.637	112.000	Vamori Valley	Qs	tuff,ashf	25.1	-1.0	-1.00	-1.00	-1.00	2
GAC1319	32.269	112.118	Brownell Mts	TKi	tuff,ashf,silc	0.0	-1.0	-1.00	-1.00	-1.00	2
SEN0840	32.884	113.141	Sentinel Pk	Qi	tuff,bas	59.1	-1.0	2.86	3.18	31.73	1
SEN0841	32.930	113.127	Sentinel Pk	Qi	tuff,bas	503.9	-1.0	2.98	3.16	17.73	1
ANP0985	32.754	112.125	Table Top Mts	Tb	tuff,bas	1897.5	-1.0	2.88	2.98	9.73	1
COC605c	32.130	111.491	Aguirre Valley	Qs	tuff,scor	138.2	-1.0	-1.00	-1.00	-1.00	2
CMP1650	32.376	112.490	Hickman Valley	Qs	tuff,scor	125.7	-1.0	-1.00	-1.00	-1.00	2
CMP1593	32.464	112.306	Kaka Valley	Qs	tuff,scor	125.7	-1.0	-1.00	-1.00	-1.00	2
CMP1577	32.322	112.486	Quijotoa Valley	Qs	tuff,scor	90.5	-1.0	-1.00	-1.00	-1.00	2
KAK0074	32.616	112.491	Sauceda Mts	Tvs	tuff,silc	51.8	12.3	2.31	2.40	9.06	1
HAT0182	32.556	112.676	Sauceda Mts	Ts	tuff,ss	39.2	13.6	2.28	2.35	7.48	1
DZP1541	31.979	112.640	Central Ajo Range	Tvs	tuff,volcbx	0.0	-1.0	-1.00	-1.00	-1.00	2
LSM0703	31.698	112.224	Vamori Valley	Qs	tuff,volcbx	12.6	-1.0	-1.00	-1.00	-1.00	2
PAPNE#49	32.146	111.577	Aguirre Valley	Ka	tuff,weld	453.6	-1.0	2.63	2.67	4.48	1
PAPNE34	32.375	111.682	Aguirre Valley	Ka	tuff,weld	23.9	-1.0	2.65	2.69	3.58	1
DIP0893	31.961	112.643	Ajo Mts	TKi	tuff,weld	231.2	-1.0	2.61	2.64	2.61	1
CPP0802	32.319	113.810	Cabeza Prieta Mts	Mzg	tuff,weld	1339.6	-1.0	2.64	2.70	5.53	1
GRP0406	32.478	113.209	Growler Valley	QTb	tuff,weld	320.4	-1.0	2.65	2.69	3.53	1
SEN0844	32.918	113.014	Painted Rock Mts	Qb	tuff,weld	262.6	-1.0	2.54	2.56	1.69	1
QUM981#4	32.139	112.166	Quijotoa Mts	Mzg	tuff,weld	56.5	-1.0	2.77	2.78	0.76	1
COM0972	32.247	111.855	Sil Nakya Hills	Tvs	tuff,weld	62.8	-1.0	2.60	2.62	1.51	1
SRM1108	32.661	111.824	Silver Reef Mts	Qtb	tuff,weld	12.6	-1.0	-1.00	-1.00	-1.00	2
AGD0433	32.010	113.092	Agua Dulce Mts	Mzsv	unk	31.4	-1.0	2.61	-1.00	-1.00	1
PAPNE6#1	32.316	111.496	Waterman Mts	Mzgn	unk	1897.5	-1.0	2.69	2.73	4.17	1
GAC1323	32.284	112.147	Quijotoa Mts	Mzsv	unk,silc,calstr	25.1	-1.0	-1.00	-1.00	-1.00	2
GRPs341	32.253	113.067	Growler Valley	Kv	volc	916.1	-1.0	2.80	2.82	1.97	1
GRP0341	32.253	113.067	Growler Valley	Kv	volc	49.0	-1.0	2.67	2.68	0.59	1
MTA0799	32.052	112.574	Gu Vo Hills	Qtb	volc	37.7	-1.0	-1.00	-1.00	-1.00	2
M000013	32.348	112.878	Little Ajo Mts	Kcv	volc	4.8	1.0	-1.00	-1.00	-1.00	3
M000008	32.359	112.876	Little Ajo Mts	Kcv	volc	607.0	76.1	-1.00	-1.00	-1.00	3
M000017	32.357	112.875	Little Ajo Mts	Kcv	volc	629.6	9.7	-1.00	-1.00	-1.00	3
M000032	32.355	112.870	Little Ajo Mts	Kcv	volc	633.3	2.3	-1.00	-1.00	-1.00	3
M000019	32.367	112.862	Little Ajo Mts	Kcv	volc	3.0	9.6	-1.00	-1.00	-1.00	3
M000035	32.363	112.862	Little Ajo Mts	Kcv	volc	427.3	11.5	-1.00	-1.00	-1.00	3
M000037	32.355	112.871	Little Ajo Mts	Kcv	volc	761.5	67.8	-1.00	-1.00	-1.00	3
M000009	32.356	112.878	Little Ajo Mts	Kcv	volc	47.5	40.1	-1.00	-1.00	-1.00	3
M000026	32.350	112.873	Little Ajo Mts	Kcv	volc	3.0	12.7	-1.00	-1.00	-1.00	3

Sample	Lat. N.	Long. W.	Physiographic Location	Map Unit	Rock Type	Magn. Suscept.	Reman. Magn.	Dry Dens.	Wet Dens.	Poros.	Source Code
M000010	32.357	112.875	Little Ajo Mts	Kcv	volc	575.5	13.2	-1.00	-1.00	-1.00	3
M000041	32.354	112.883	Little Ajo Mts	Kcv	volc	325.5	663.0	-1.00	-1.00	-1.00	3
KOV0552	31.829	112.327	Quijotoa Valley	Qs	volc	175.9	-1.0	-1.00	-1.00	-1.00	2
COC602b	32.063	111.473	Aguirre Valley	TKr	volc,mudf	25.1	-1.0	-1.00	-1.00	-1.00	2

APPENDIX C

Tabulation of petrographic identification of selected rock specimens. Fifty-nine samples are listed according to primary rock types. The sample location identification is listed without the three letter prefix of Appendix B that identifies the area or quadrangle. Petrographic identification of commercially prepared thin sections was by Robin Bradley (USGS, Menlo Park).

Primary Rock Type and Sample Location Identification	Petrographic Identification
andesite	
176	cryptocrystalline hornblende andesite
178	pilotaxitic hornblende andesite
124b	pilotaxitic hornblende andesite
120	mesocratic hornblende dacitic andesite
636	mesocratic pyroxene-amphibole andesite
83	biotite-hornblende-pyroxene andesite
121	pilotaxitic pyroxene-amphibole andesite
53	hornblende andesite
86a	pyroxene basaltic andesite
175	pyroxene-hornblende andesite
basalt	
60	olivine basalt
186	olivine basalt
124A	vesicular pilotaxitic olivine basalt
124A	vesicular pilotaxitic olivine basalt
116	pyroxene-olivine basalt
138	vesicular olivine basalt
135	vesicular pyroxene-olivine basalt
150	vesicular pilotaxitic pyroxene basalt
W20	vesicular pyroxene-olivine basalt
35	vesicular pilotaxitic pyroxene basalt
151	pilotaxitic pyroxene-olivine basalt
157	vesicular pilotaxitic olivine basalt
65	vesicular pilotaxitic olivine basalt
30	vesicular pilotaxitic olivine basalt
17	vesicular olivine basalt
174	porphyritic olivine basalt
57	vesicular olivine basalt
70	vesicular pilotaxitic olivine basalt
49b	vesicular pilotaxitic olivine basalt
49a	vesicular pilotaxitic olivine basalt
8	vesicular olivine basalt
215	vesicular pyroxene-olivine basalt
86b	porphyritic olivine basalt
95	vesicular olivine basalt
63a	microcrystalline olivine-pyroxene basalt

dacite

78	biotite-hornblende dacite

granite

196	slightly foliated leucocratic biotite granite
130	slightly lineated leucocratic hornblende-biotite granite
125	slightly cataclastic leucocratic biotite granite
61	slightly foliated leucrocratic biotite granite
188	leucocratic granite
188a	leucocratic granite

granodiorite

125	leucocratic biotite granodiorite
190	retrograde deuteric metamorphosed chlorite-epidote-greenshist granodiorite
159	muscovite-biotite granodiorite

rhyodacite

73	cryptocrystalline hornblende rhyodacite
68	leucocratic biotite rhyodacite
58	leucocratic biotite rhyodacite
85	leucocratic hornblende-biotite rhyodacite
63c	leucocratic biotite rhyodacite

rhyolite

64	biotite-hornblende rhyolite
52	biotite-hornblende rhyolite with extensive calcite
73	biotite-hornblende rhyolite

schist, gabbro, sandstone and quartzite (or tuff)

51	sericite-biotite schist
191	amphibole-epidote-quartz-sericite greenschist
193	hornblende-asgirine-augite gabbro
182	siliceous ash-fall tuffaceous sandstone
74	medium-well-sorted subrounded quartzite (or siliceous tuff) - poor slide