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CENOZOIC IGNEOUS ROCKS, SIERRA BLANCA AREA, TEXAS

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INTRODUCTION

This paper presents some previously unpublished data, observations and inferences uninhibited by any detailed mapping by the author. Its major contribution is to place nine new chemical analyses on record (Table 1).

BASALTIC LAVA FLOW OF COX MOUNTAIN

Erosional remnants of a mafic flow mapped by King (1965) lie on a limestone-clast conglomerate of unknown age that is underlain by Lower Cretaceous Finlay Formation on Cox Mountain, approximately 25 km northeast of Sierra Blanca. The fine-grained porphyritic lava contains spherical to oblate vesicles exceeding 30 cm in diameter. Subhedral phenocrysts of olivine (slightly altered to bowlingite) and zoned plagioclase occur singly and in clumps, in a holocrystalline groundmass of plagioclase, clinopyroxene, apatite and opaque oxides. The mode (volume percent) is olivine 7.0, plagioclase 52.4, clinopyroxene 32.2, opaque oxides 7.0 and apatite 1.4. Results of the analysis (CXMT-1, Table 1) are typical for mafic flows of the Trans-Pecos province. The anorthite content of the normative plagioclase, and the Thornton-Tuttle (1960) differentiation index, indicate that the rock is hawaiite rather than basalt. The rock is slightly undersaturated with respect to silica, so that the norm contains olivine and hypersthene rather than quartz or nepheline.

The most significant feature of this isolated patch of volcanic rock is its unexpectedly young age. A whole-rock potassium-argon age of 16.3 ± 0.6 m.y. (McDowell, 1979) makes this the youngest igneous rock yet dated in the Trans-Pecos province. In composition and stratigraphic position the flow resembles the widespread lavas of the Rawls, Petan and Jones Basalt units that top the volcanic succession farther southeast. The Cox Mountain remnant shows that volcanic cover near the end of Trans-Pecos magmatism extended at least this far north on the Diablo Plateau, and that much of the late volcanic history may have been obliterated by erosion.

The other, more felsic, rocks treated in this note are typical of the "metalmagmatic" belt of the Trans-Pecos province (Barker, 1977) that parallels a belt of more alkalic rocks to the east (Barker and others, 1977).

QUITMAN MOUNTAINS INTRUSIVE ROCKS

Intrusive rocks in the northern Quitman Mountains (Huffington, 1943; Gieger, 1965) define an arcuate body that is thought to mark the bounding fractures of a caldera collapse. Altered volcanic rocks occur in the area that is partly surrounded by the presumed ring dike; whether these Square Peak volcanics are comagmatic with the intrusive rocks has yet to be proved or disproved.

Table 1 includes four new rock analyses (QB-1, QUIT-2, QM-2, QM-1) from the Quitman Mountains intrusive bodies and a presumed outlier. Rock names applied in the table follow the classification of Streckeisen and LeMaitre (1979). In addition to the quartz monzodiorite, monzonite, quartz monzonite and granite that are each represented by one analysis, diorite and syenite also appear in the Quitman Mountains intrusions.

However, this diversity of compositions does not reflect a "liquid line of descent" with successive fractionation stages but appears to result from the mixing, in various proportions, of plagioclase and alkali feldspar crystals with granitic liquid. Except for the granite at one extreme and diorite at the other, the intrusive rocks are texturally bimodal, containing coarse, commonly broken, feldspar crystals and aggregates in contrast with finer-grained granitic (quartz plus alkali feldspar) material that serves as groundmass or interstitial filling.

Figure 1 shows the variety of textures in the Quitman Mountains intrusive rocks. From A through E, plagioclase becomes progressively more thickly mantled with alkali feldspar while the granitic material changes from interstitial granophyre through aphanitic groundmass to coarser granophyre and mosaic textures in nonporphyritic rocks. This sequence does not correlate with the observed order of intrusion; most compositional and textural types somewhere can be found to cut the others, and are intimately mixed without chilled contacts. However, diorite and monzonite tend to occur most commonly as inclusions within rocks richer in quartz and alkali feldspar.

Modal proportions of quartz, alkali feldspar and plagioclase (fig. 2) further support the conjecture that most samples do not represent liquids but are mechanical mixtures between granitic liquid and disrupted aggregates of plagioclase and alkali feldspar.

The most mafic analyzed sample that seems to be linked to the Quitman Mountains is QB-1 of Table 1. This rock was previously mapped as Quaternary basalt overlying bolson fill west of the Quitman Mountains. However, the whole-rock potassium-argon age is 33.3 ± 0.6 m.y. (McDowell, 1979). F. W. McDowell (personal communication, 1980) reports a preliminary potassium-argon age of 35.5 m.y. for biotite from quartz monzonite in the roadside park on Interstate 10 at the northwest edge of the Quitman Mountains. The composition of QB-1, and the similarity of ages, indicates that the rock is probably a chilled outlier of the Quitman Mountains intrusions.

QB-1 is a fine-grained porphyritic rock, with phenocrysts of olivine (partly replaced by iddingsite) in a groundmass of plagioclase, clinopyroxene, opaque oxides, and interstitial brown devitrified glass. In spite of the olivine phenocrysts, the rock is silica-oversaturated.

The following hypothesis is proposed to stimulate more detailed field and laboratory study of the Quitman Mountains: magma in a subjacent pluton was largely crystallized, then the crystalline aggregates were disrupted (by caldera collapse?) and mingled with residual granitic liquid before or during emplacement at the present level of erosion. If the Square Peak lavas and ash-flow tuffs are products of this collapse, they should show heterogeneity like that of the intrusive rocks. (See Hobbs and Hoffer, this guidebook.)

SIERRA BLANCA INTRUSIVE CLUSTER

Five kilometers northeast of the northern Quitman Mountains lies a group of dikes, sills and laccoliths mapped by Albritton and Smith (1965). These are represented in Table 1 by four new analyses (TRIP-1, LRT-2, RT-1, and BLANCA-1) and one (TEXAN-1)

published by Ingerson (1952). All five analyzed samples are intrusive rhyolites strongly depleted in Ti, Fe, Mg and P.

More mafic rocks do occur in the Sierra Blanca cluster, but have not been analyzed. These resemble rocks of the northern Quitman Mountains in containing phenocrysts of zoned plagioclase, brown-green hornblende, and clinopyroxene. Dikes and sills in the Finlay Mountains, 10 km west of the Sierra Blanca cluster, are also petrographically similar to the mafic, plagioclase-rich rocks, suggesting that the Finlays, Sierra Blanca cluster, and northern Quitmans are all underlain by the same large pluton or by very similar plutons.

Another similarity between the Sierra Blanca cluster and the northern Quitmans is the presence (in the Texan Mountain sills and at Dyke Top west of the Sierra Blanca Peak laccolith) of abundant inclusions of diorite and monzonite closely resembling the swarms of inclusions in the quartz monzonite of the northern Quitmans.

The rhyolites of the Sierra Blanca cluster (figs. 3 and 4) are tightly grouped on projections of normative Q + Ab + Or and An + Ab + Or; the one analyzed sample of granite from the Quitmans also plots with these rhyolites, but these similarities cannot be taken as proof that the Sierra Blanca rhyolites are comagmatic with the

Table 1. Chemical analyses and CIPW norms (weight percent), Sierra Blanca area.

	CXMT-1	QB-1	QUIT-2	TEXAN-1	QM-2	TRIP-1	LRT-2	RT-1	BLANCA-1	QM-1
SiO ₂	48.00	53.00	54.50	63.48	67.10	71.00	73.00	74.40	75.60	76.00
TiO ₂	1.92	1.87	1.97	0.63	0.03	0.22	0.00	0.00	0.09	0.00
Al ₂ O ₃	15.20	15.19	17.29	15.35	16.60	15.62	13.92	13.72	14.00	13.10
Fe ₂ O ₃	2.95	5.09	4.65	2.70	1.48	2.34	1.01	1.03	0.49	0.91
FeO	8.12	4.30	3.60	0.77	1.60	0.18	0.38	0.36	0.30	0.32
MnO	0.17	0.14	0.11	0.07	0.05	0.05	0.14	0.08	0.06	0.01
MgO	8.21	4.73	3.03	1.10	0.92	0.19	0.03	0.01	0.02	0.32
CaO	8.19	7.23	5.22	3.42	1.74	1.14	1.09	0.70	0.34	0.30
Na ₂ O	3.27	4.10	4.88	3.85	5.20	4.55	5.12	4.84	4.86	5.20
K ₂ O	1.69	1.99	2.98	4.16	3.80	4.87	3.80	3.92	3.90	3.50
H ₂ O ⁺	2.14	0.67	0.44	1.60	—	0.40	0.49	0.28	0.24	—
H ₂ O*	0.15	0.35	0.10	0.55	0.22	0.22	0.11	0.08	0.08	0.29
P ₂ O ₅	0.70	0.86	0.86	0.16	0.00	0.07	0.00	0.00	0.00	0.00
CO ₂	0.08	0.08	0.32	2.00	—	0.30	0.01	0.03	0.02	—
BaO	—	—	—	0.26	—	—	—	—	—	—
loss on ignition	—	—	—	—	0.29	—	—	—	—	0.34
TOTAL	100.79	99.60	99.95	100.10	99.03	101.15	99.10	99.45	100.00	100.29
q	—	3.96	1.07	21.88	16.41	24.16	26.60	29.44	31.65	30.96
c	—	—	—	3.31	0.77	1.65	—	0.31	1.21	0.21
or	9.99	11.76	17.61	24.58	22.46	28.77	22.45	23.16	23.04	20.68
ab	27.67	34.69	41.29	32.58	44.00	38.50	43.33	40.96	41.12	44.00
an	21.81	17.17	16.47	3.28	8.63	3.30	3.78	3.28	1.56	1.49
di	11.11	9.86	1.44	—	—	—	0.39	—	—	—
wo	—	—	—	—	—	—	0.46	—	—	—
hy	1.19	8.03	10.41	3.24	4.05	0.53	—	0.83	0.16	1.40
ol	17.01	—	—	—	—	—	—	—	—	—
mt	4.28	7.38	6.25	0.88	2.15	0.11	1.46	1.42	0.71	1.06
il	3.65	3.55	3.74	1.20	0.06	0.42	—	—	0.17	—
hm	—	—	0.34	2.09	—	2.27	—	0.05	—	0.18
ap	1.66	2.04	2.04	0.38	—	0.17	—	—	—	—
cc	0.18	0.18	0.73	4.55	—	0.68	0.02	0.07	0.05	—
an/(an + ab)	44.08	33.10	28.52	9.14	16.40	7.90	8.02	7.42	3.66	3.27
Differentiation Index										
(Thornton and Tuttle, 1960)	37.66	50.41	59.97	79.04	82.86	91.44	92.38	93.56	95.82	95.64

CXMT-1. Hawaite flow, top of Cox Mountain (31°18'N, 105°07'W). Analyst G. K. Hoops. Whole-rock K-Ar age 16.3 ± 0.6 m.y. (McDowell, 1979).

QB-1. Fine-grained quartz monzodiorite plug in Quitman Bolson. Sample from quarry on southeast side of main hill, Reed Ranch (31°11'N, 105°36'W), Silver King Canyon 7.5' quadrangle. Analyst G. K. Hoops. Whole-rock K-Ar age 33.3 ± 0.6 m.y. (McDowell, 1979).

QUIT-2. Monzonite autolith in main phase quartz monzonite of northern Quitman Mountains intrusion (31°11.5'N, 105°29.5'W), Lasca 7.5' quadrangle. Analyst G. K. Hoops.

TEXAN-1. Rhyolite of lowermost sill, Texan Mountain (31°10.3'N, 105°22'W), Sierra Blanca 7.5' quadrangle. Analyst W. W. Brannock (Ingerson, 1952).

QM-2. Quartz monzonite, northern Quitman Mountains intrusion near Bonanza Mine (31°11.3'N, 105°30'W), east edge of Silver King Canyon 7.5' quadrangle. Analyst J. Etheredge.

TRIP-1. Intrusive rhyolite, Triple Hill (31°16'N, 105°23'W), Triple Hill 15' quadrangle. Analyst G. K. Hoops.

LRT-2. Intrusive rhyolite, Little Round Top (31°17'N, 105°27'W), Triple Hill 15' quadrangle. Analyst G. K. Hoops.

RT-1. Intrusive rhyolite, Round Top (31°16'N, 105°28'W), Triple Hill 15' quadrangle. Analyst G. K. Hoops.

BLANCA-1. Intrusive rhyolite, Sierra Blanca (31°15.5'N, 105°26.5'W), Triple Hill 15' quadrangle. Analyst G. K. Hoops.

QM-1. Granite, Granite Hill, Quitman Mountains (31°06.5'N, 105°26.7'W), Sierra Blanca SW 7.5' quadrangle. Analyst J. Etheredge.



Figure 1. Photomicrographs (cross-polarized light), intrusive rocks of the northern Quitman Mountains.

- A. Monzonite inclusion in quartz monzonite (analyzed sample QUIT-2 of Table 1). An anhedral zoned plagioclase phenocryst is surrounded by orthoclase, clinopyroxene, biotite, opaque oxides, apatite, and a trace of quartz. Shorter dimension of photomicrograph is 2.0 mm.
- B. Quartz monzonite, south slope of Pinnacle Peak. Zoned plagioclase (center) is mantled by orthoclase. "Radiating fringe" granophyre (Smith, 1974, p. 584) fills interstices. Also present but not shown are clinopyroxene, amphibole, biotite, and opaque oxides. Shorter dimension of photomicrograph is 0.5 mm.
- C. Syenite, showing size contrast between feldspar phenocrysts and groundmass. Note the broken phenocryst of anorthoclase with a plagioclase core. Shorter dimension of photomicrograph is 0.5 mm.
- D. Granite from same exposure is analyzed sample QM-1 of Table 1. "Insular" granophyre (Smith, 1974, p. 584) contains skeletal, optically continuous, quartz in and between large grains of microperthite (mostly at extinction). Shorter dimension of photomicrograph is 2.0 mm.
- E. Granite (with first-order red plate inserted). The rock is a nearly equigranular mosaic of equant anhedral quartz and alkali feldspar (the latter intensely vacuolized). Shorter dimension of photomicrograph is 2.0 mm.

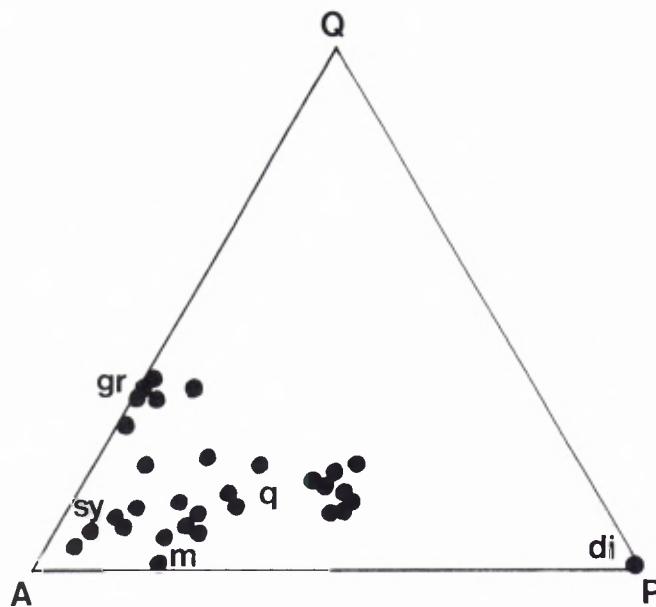


Figure 2. Modal proportions (by volume) of quartz (Q), alkali feldspar (A), and plagioclase (P) in Quitman Mountains intrusive rocks. gr = granite, di = diorite, m = monzonite, q = quartz monzonite, sy = syenite. Data from Gieger (1965).

rocks of the northern Quitman Mountains. Isotopic and trace element data, together with microprobe analyses of the phenocryst phases, are needed.

Sparingly porphyritic, the rhyolites contain phenocrysts of plagioclase, generally thickly mantled with anorthoclase (fig. 5), and more rarely of anhedral embayed quartz paramorphs after beta quartz. Biotite is a microphenocryst phase in some samples. The groundmass is a very fine-grained aggregate of anhedral equant quartz, vacuolized alkali feldspar, green phengitic mica, opaque oxides, fluorite, zircon and rutile. In many samples, particularly from Little Round Top, groundmass quartz contains a concentric

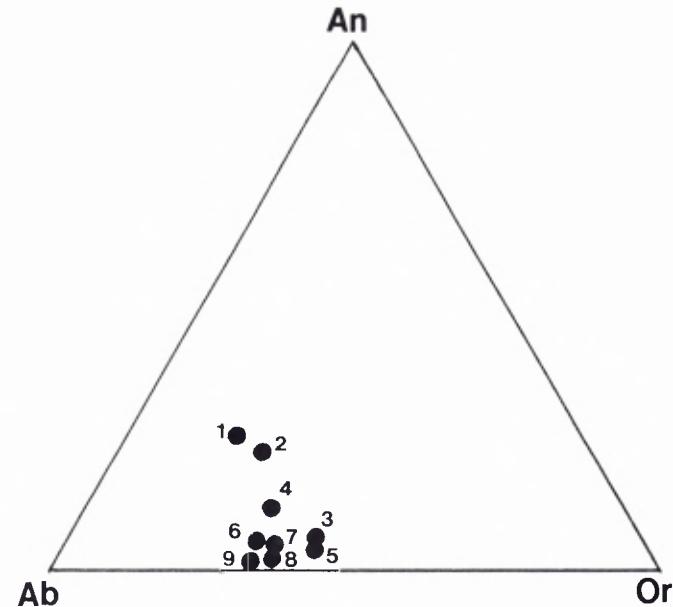


Figure 4. Normative proportions (by weight) of anorthite, albite, and orthoclase in analyzed felsic rocks listed in Table 1. Symbols as in Figure 3.

array of fluid inclusions (fig. 6). These inclusions are subhedral negative crystals containing unidentified solid daughter phases but no discernible gas bubbles. Apparently these fluid inclusions were trapped when additional quartz grew syntactically upon euhedral quartz that was already present in the liquid. Like other aspects of the igneous petrology of the Sierra Blanca area, the inclusions deserve further study.

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Figure 5. Photomicrograph (cross-polarized light), intrusive rhyolite of Sierra Blanca Peak (analyzed sample BLANCA-1 of Table 1). A subhedral microphenocryst of anorthoclase with a plagioclase core is surrounded by a very fine-grained groundmass of quartz, alkali feldspar, pale green phengitic mica, and accessory fluorite. Shorter dimension of photomicrograph is 2.0 mm.

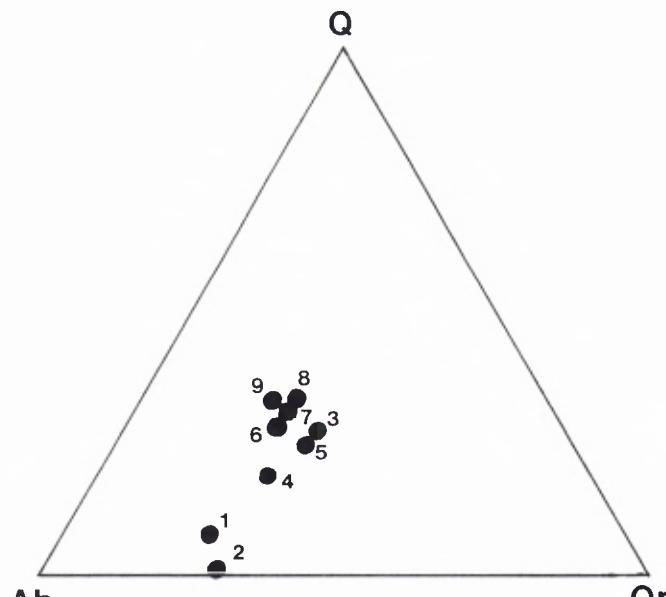


Figure 3. Normative proportions (by weight) of quartz, albite, and orthoclase in analyzed felsic rocks of Table 1. 1 = QB-1; 2 = QUIT-2; 3 = TEXAN-1; 4 = QM-2; 5 = TRIP-1; 6 = LRT-2; 7 = RT-1; 8 = BLANCA-1; 9 = QM-1.

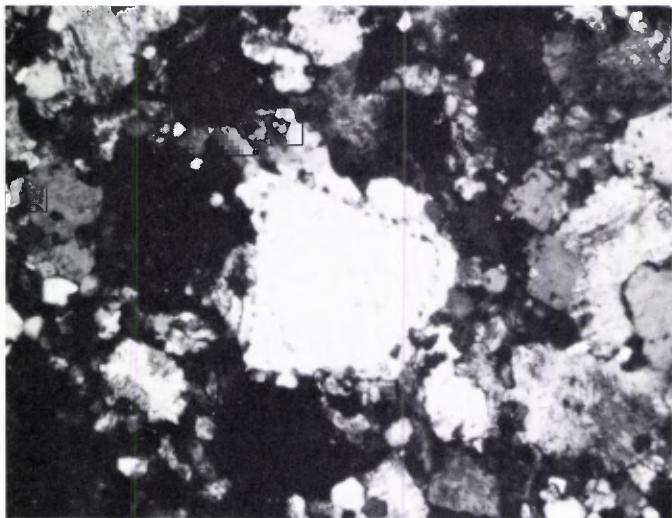
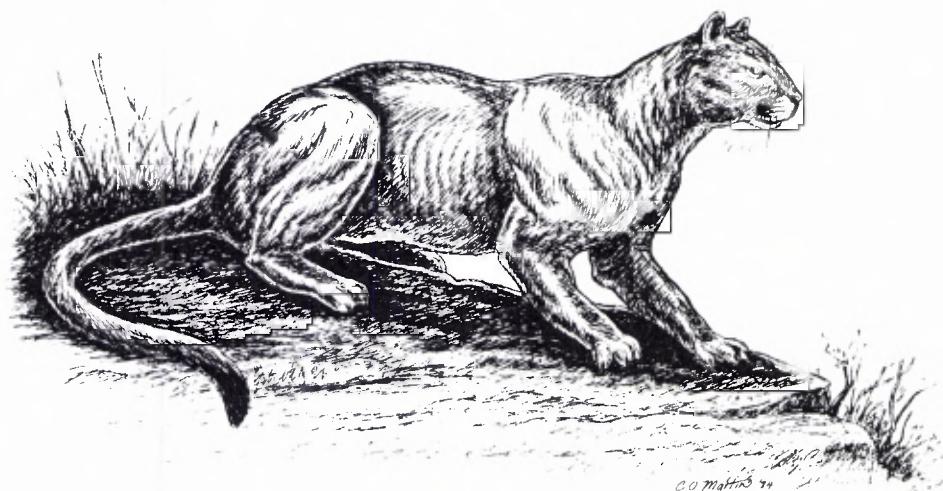


Figure 6. Photomicrograph (cross-polarized light), intrusive rhyolite of Little Round Top (analyzed sample LRT-2 of Table 1). A groundmass quartz grain shows a concentric array of fluid inclusions. Note pseudoradial and "hourglass" structure in alkali feldspar. Shorter dimension of photomicrograph is 0.5 mm.

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REFERENCES

- Albritton, C. C., Jr. and Smith, J. F., Jr., 1965, Geology of the Sierra Blanca area, Hudspeth County, Texas: U.S. Geological Survey Professional Paper 479, 131 p.
- Barker, D. S., 1977, Northern Trans-Pecos magmatic province: Introduction and comparison with the Kenya Rift: Geological Society of America Bulletin, v. 88, p. 1421-1427.
- Barker, D. S., Long, L. E., Hoops, G. K. and Hodges, F. N., 1977, Petrology and Rb-Sr isotope geochemistry of intrusions in the Diablo Plateau, northern Trans-Pecos magmatic province, Texas and New Mexico: Geological Society of America Bulletin, v. 88, p. 1437-1446.
- Gieger, R. M., 1965, Quitman Mountains intrusion, Hudspeth County, Texas (M.S. thesis): University of Texas, Austin, 85 p.
- Huffington, R. M., 1943, Geology of the northern Quitman Mountains, Trans-Pecos Texas: Geological Society of America Bulletin, v. 54, p. 987-1048.
- Ingerson, E., 1952, Twinning frequency in feldspar phenocrysts from a quartz latite sill at Sierra Blanca, Texas: American Journal of Science, v. 250A (Bowen volume), p. 189-202.
- King, P. B., 1965, Geology of the Sierra Diablo region, Texas: U.S. Geological Survey Professional Paper 480, 185 p.
- McDowell, F. W., 1979, Potassium-argon dating in the Trans-Pecos Texas volcanic field, in Walton, A. W. and Henry, C. D., editors, Cenozoic geology of the Trans-Pecos volcanic field of Texas: Texas Bureau of Economic Geology, Guidebook 19, p. 10-18.
- Smith, J. V., 1974, Feldspar minerals, vol. 2: Chemical and textural properties: New York, Springer-Verlag, 690 p.
- Streckeisen, A. L. and Le Maitre, R. W., 1979, A chemical approximation to the modal QAPF classification of the igneous rocks: Neues Jahrbuch für Mineralogie, Abhandlungen, v. 136, p. 169-206.
- Thornton, C. P. and Tuttle, O. F., 1960, Chemistry of igneous rocks. I. Differentiation index: American Journal of Science, v. 258, p. 664-684.



Mountain lion, *Felis concolor*.



Slim tridens plant and spikelet, *Tridens muticus* var. *muticus*.