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GEOLOGY OF WINSTON 7 1/2' QUADRANGLE, SIERRA COUNTY, NEW MEXICO

Richard W. Harrison
108 Belle
Truth or Consequences, N.M. 87901

LEGEND

Qal — Quaternary alluvium. Restricted to presently active stream valleys.

Qc — Quaternary colluvium. Unconsolidated deposits on hill slopes and valley bottoms; typically mapped only when bedrock geology is totally obscured.

QTsf — Quaternary-Tertiary Santa Fe Group. Sedimentary deposits of Santa Fe Group that have apparent Quaternary or late-Tertiary age, i.e. deposits that cover mid-Tertiary structures.

Tsf — Tertiary Santa Fe Group. Conglomerates, sandstones, mudstones, and minor beds of volcanic ash; basin-fill of Winston graben, a structural feature related to the Rio Grande rift. In Winston quadrangle, clasts in Santa Fe Group consist exclusively of Tertiary extrusive and intrusive rocks.

Twa — Winston andesite. Dense to finely vesicular and scoriaceous flows and flow breccias. Contains sparse, small phenocrysts of plagioclase, pyroxene, biotite, and hornblende. Outcrops of Winston andesite are confined to Winston graben, where it is unconformably interbedded within Santa Fe Group sediments. K-Ar age dated by Seager and others (1984) at 18.3 $\pm$ 0.4 Ma. As much as 200 m thick.

Tsft — Ash-flow tuff and air-fall tuff beds intercalated with Santa Fe Group conglomerate and sandstone beds. Found only in southeastern quarter of Winston ouadrangle, principally along South Fork of Cuchillo Negro drainage. Strong zeolite alteration (clinotilolite). Approximately 25-30 m thick.

Tvp — Vicks Peak tuff (Deal and Rhodes, 1976). Moderately welded, crystal-poor ash-flow tuff. Phenocrysts consist of 1-3% sanidine and trace amounts of quartz. Pumice are large and conspicuous, with a granular texture derived from vapor-phase mineralization. Mean 40Ar/39Ar age date of 28.46 Ma from McIntosh and others (1986) and Kedzie and others (1985). In Winston quadrangle, Vicks Peak Tuff crops out only within the Winston graben and lies with angular unconformity upon older units. A near vertical section of Vicks Peak Tuff in the southeast corner of section 14, T. 11 S., R. 8 W. probably represents a gravity slide block shed into the Winston graben from Sierra Cuchillo Range to the east. This slide block of Vicks Peak Tuff is overlain with strong angular unconformity by Winston andesite, placing a minimum age on the slide event of about 18.3 ma. Aside from the slide area, Vicks Peak Tuff is only about 20 m thick in Winston quadrangle.

Tsc Tuff of Stiver Canyon (Woodard, 1982). Poorly to moderately welded, moderately crystal-rich, rhyolite ash-flow tuff. Phenocrysts consist of approximately 15% sanidine, 5% quartz, and trace amounts of biotite. Plagioclase is notably rare, as is pumice. The solitary occurrence of this unit in the Winston quadrangle is in south-central section 14, T. 12 S., R. 8 W. where it is about 15 m thick.

Tmj Rhyolite of Moccasin John (Ericksen and others, 1970). Crystal-poor, vitrophyric and flow-banded rhyolite lava with 2-4% quartz, sanidine, and biotite phenocrysts. In the southwestern corner of the Winston quadrangle two dikes, thin lava flows, and a small portion of a more extensive, rhyolitic flow-dome complex crop out. The main vent area for rhyolite of Moccasin John encompasses Moccasin John Mountain and Cobb Mountain, immediately to the southwest of Winston quadrangle, and is associated with a wide zone of argillic alteration. A thickness of >120 m is present in the area of doming.

Tlmc Tuff of Little Mineral Creek (Woodard, 1982). Crystal-poor, lithic-rich, poorly to non-welded ash-flow tuff. Lithic fragments are very abundant (commonly > 30% of rock volume) and consist exclusively of rhyolite of Moccasin John. Phenocrysts vary from 2-5%, are commonly broken, and consist of quartz, sanidine, and biotite. Lithics are poorly sorted, subangular, and both red and gray in color. This unit also contains thin, pumice-rich sedimentary intervals derived from weathering of ash-flow beds. As much as 200 m of tuff of Little Mineral Creek occur in the Winston graben; thinning to 50 m or less along the western margin of Winston quadrangle. This unit represents episodes of vent-clearing eruptions and hiatuses preceding extrusion of rhyolite of Moccasin John.

Tpc Basaltic andesite of Poverty Creek (Elston and others, 1973; Coney, 1976). Sequence of dark lava flows of intermediate composition; commonly intercalated with thin volcaniclastic sedimentary beds. Individual flows typically have flow-top breccias and massive cores. Most flows are aphanitic, although a few upper beds and most vent areas contain as much as 15 % phenocrysts of plagioclase, pyroxene, hornblende, and quartz. Volcaniclastic intervals are typically fine-grained, greenish or reddish, composed of intermediate detritus; and are probably locally derived. An intrusive dome complex in sec. 2, T. 12 S., R. 8 W. and sec. 35, T. 11 S., R. 8 W. is one local source area for basaltic andesite of Poverty Creek; most of the intermediate dikes found throughout the Winston quadrangle are also believed to be feeders. The above mentioned dome yielded a K-Ar age date of 28.8 $\pm$ 0.7 Ma (C.E. Chapin, personal communication). Woodard (1982) reports a K-Ar age date of 28.3 $\pm$ 0.6 Ma for this unit along

Poverty Creek in the adjoining Sawmill Peak quadrangle. In the Winston quadrangle, this unit varies in thickness from as little as 30 m to as much as 200 m.

Basaltic andesite of Poverty Creek is part of regionally extensive stratigraphic interval found throughout the southeastern portion of the Mogollon-Datil volcanic field. Other units within this interval include: Razorback Formation of Elston (1957) in southern Black Range, Mimbres Valley, and southern Cobre Mountains; Alum Mountain Formation of Elston (1968) and Elston and others (1968, 1970) in Copperas Mountains, Gila Canyon, Pinos Altos Mountains, and western Black Range; and T4ba unit of Seager and others (1982) in southern Black Range and Cooke's Range.

Tkw Upper tuff of Koko Well (Eggleston, 1987; Eggleston and Harrison, 1989). Crystal-poor, poorly welded, pumice-rich, rhyolite ash-flow tuff. This unit contains about 5% phenocrysts of sanidine and trace amounts of quartz and biotite. Tuff of Koko Well crops out in limited exposures in northwestern corner of Winston quadrangle where it has a maximum thickness of 20 m and lies upon either sandstone of Monument Park or Kneeling Nun Tuff. Upper tuff of Koko Well is probably correlative to Rockhouse Canyon Tuff of Osburn and Chapin (1983) in northeastern Mogollon-Datil volcanic field.

Tms Sandstone of Monument Park (Woodard, 1982). Thinnly bedded, poorly indurated volcaniclastic rocks consisting predominantly of fine-grained sandstones and siltstones, with minor conglomerates. Sandstones contain grains of plagioclase, sanidine, quartz, and biotite; conglomerates contain clasts of Kneeling Nun Tuff. In the Winston quadrangle, sandstone of Monument Park is limited to sparse outcrops in the northwestern corner. This unit is slightly more extensive to the west of Winston quadrangle in the adjoining Lookout Mountain and Sawmill Peak quadrangles, where it fills shallow paleovalleys and surrounds intercalated Caballo Blanco Tuff (Elston, 1957; Ericksen and others, 1970) and tuff of Koko Well (Eggleston and Harrison, 1989). Maximum thickness in Winston quadrangle is about 15 m.

Tcnl,cns Cuchillo Negro complex. Vent and near-vent volcanic complex located in southeastern corner of Winston quadrangle and southwestern corner of adjacent Chise quadrangle (secs. 12 & 13, T. 12 S., R. 8 W.). Tcnl-lava member, 5-10% phenocrysts of quartz and plagioclase, commonly flow-banded and massive, in part amygdaloidal, as much as 100 m thick. Tcns-sedimentary and ash-flow tuffs member: upper, tan, non-welded, lithic-rich ash-flow tuff with 10-15% phenocrysts of plagioclase and biotite, as much as 15 m thick; poorly sorted, poorly bedded, heterolithic co-ignimbrite lag-fall deposit with pumiceous matrix, as much as 10 m thick; middle, whitish, non-welded, lithic-poor ash-flow tuff with 5-10% phenocrysts of plagioclase and biotite, 2-4 m thick with a 15 cm thick basal sandstone;

lower, tan, non-welded, lithic-rich ash-flow tuff with 5-10% phenocrysts of plagioclase and biotite, as much as 10 m thick; well-bedded, moderately sorted, heterolithic conglomerate, as much as 175 m thick. One K-Ar age date of 34.7 ± 0.7 Ma (C.E. Chapin, personal communication) has been obtained for rocks of Cuchillo Negro complex; however, there is no stratigraphic control on age restraints for this unit and the above age should be considered as tentative.

Tkn Kneeling Nun Tuff (Jicha, 1954). In the Winston quadrangle, Kneeling Nun Tuff consists of a basal, thinnly bedded, white, non-welded to poorly welded, very crystal-rich ash-flow tuff with 40--50 % phenocrysts of quartz, sanidine, plagioclase, and sparse biotite; and, an upper, moderately to densely welded, crystal-rich, quartz latite ash-flow tuff with approximately 15% quartz, 12% sanidine, 5% plagioclase, and 2% biotite phenocrysts in a vitroclastic matrix. An up-section trend of increasing biotite and decreasing quartz is observed in Kneeling Nun Tuff within the Winston quadrangle. Lithic fragments of intermediate volcanic rocks (generally aphanitic and from 3-7 cm in diameter) are common. Kneeling Nun Tuff is a major, regionally extensive ignimbrite sheet that provides a distinctive stratigraphic marker throughout the southeastern portion of the Mogollon-Datil volcanic field. In the Winston area, Kneeling Nun Tuff has yielded a 40Ar/39Ar age date of 34.9 ± 0.15 Ma (McIntosh, 1989). The basal member of Kneeling Nun Tuff is as much as 50 m thick and the upper member is as much as 200 m thick in the Winston quadrangle.

Rubio Peak Formation (Jicha, 1954). As used by Elston and others (1975), this early Tertiary formation consists of the volcanic and volcaniclastic sequence that lies below Kneeling Nun Tuff and above the regional unconformity that overlies pre-Cenozoic (non-volcanic) sedimentary rocks. While the upper members of the Rubio Peak Formation are well constrained by 40Ar/39Ar age dating (McIntosh and others, 1986) and by the paleontologic record (Lucas, 1986) as early Oligocene in age, lower members have little dating constraint and could well be late Cretaceous in age. Rubio Peak Formation in and around the Winston quadrangle was divided by Harrison (1986) into an upper, dominantly volcanic sequence and a lower, dominantly volcaniclastic sedimentary sequence. Both sequences contain numerous, local and regional disconformities.

Tdc Tuff of Dry Creek (Eggleston and Harrison, 1989). Poorly to moderately welded, moderately crystal-rich ash-flow tuff. Typically contains 10-15% phenocrysts of plagioclase, sanidine, and biotite. In Winston quadrangle, this unit is frequently altered and mineralized with varing amounts of pyrite or Fe-oxides after pyrite. Near Stone Ranch Well within the Winston graben (sec. 11, T. 12 S., R. 8 W.), this unit consists of: a lower, poorly welded, crystal-poor, moderately lithic-rich ash-flow tuff with 3-5% phenocrysts of feldspar and biotite; a thin fine-grained sedimentary interval; a middle, moderately welded, moderately crystal-rich ash-flow tuff with 12-15% phenocrysts of plagioclase, sanidine, and biotite; and, an upper, poorly welded, crystal-poor, ash-flow tuff with about 5% altered feldspar phenocrysts, traces of biotite, and small, dark (mafic?) pumice. Tuff of Dry Creek occupies the same stratigraphic interval as the regionally extensive Sugarlump Tuff of Jicha (1954) with which it is loosely correlated. Maximum thickness of tuff of Dry Creek in Winston quadrangle is about 80 m. Tuff of Dry Creek is stratigraphically and mineralogically similar to tuff of Victoria Tank in eastern Sierra Cuchillo.

Tcc — Sandstone of Cliff Canyon (Woodard, 1982). Fine-grained, well-sorted, thinnly bedded sandstones, siltstones, and shales. Siltstones and shales are generally purplish incolor; sandstones are generally reddish or whitish in color and contain grains of plagioclase, sanidine, and minor quartz. Basal conglomerates containing andesitic clasts are locally present. Lucas (1986) reports mammal fossils of early Chadronian age (about 36 ma) within siltstones of this unit approximately 5 miles north of the Winston quadrangle. As much as 150 m thick.

Trpa — Rubio Peak Andesite. Massive, dense, porphyritic andesite flows with 20-30% plagioclase phenocrysts and locally 2-5% hornblende phenocrysts. In the Chloride Creek-Mineral Creek area, two andesite flow horizons are present, serarated by as much as 80 m of volcaniclastic rocks. Elsewhere, only one flow horizon is recognized, as much as 200 m thick.

lower sedimentary sequence

Trp — Rubio Peak Formation volcaniclastic sedimentary rocks. Debris-flow, mudflow, sandstone, and minor lithic-rich ash-flow tuff deposits. Debris-flow and mudflow deposits volumetrically dominate the lower Rubio Peak Formation; occurring as massive, poorly to non-bedded, matrix-supported depositscontaining subrounded, heterolithic clasts of intermediate volcanic and Paleozoic sedimentary rock types. Clasts range from pebbles to large boulders (>10 m) in size. Interfingered with debris-flow and mudflow deposits are thick, horizontally bedded, poorly to moderately sorted sandstone deposits with subangular grains of plagioclase, hornblende, pyroxene, and biotite. These sandstone deposits frequently lack cross-stratification and other sedimentary features and perhaps are the product of hyperconcentrated flood flows. Mapped with these sedimentary deposits is a lithic-rich, crystal-poor, pumice-rich ash-flow tuff with 5-10% phenocrysts of plagioclase, sanidine, and biotite. This tuff is found in spotty outcrops in the Chloride Creek-Mineral Creek area, where it commonly displays blue-green alteration of pumice. Rubio Peak Foprmation volcaniclastic sedimentary unit is the thickest stratigraphic interval in the Winston quadrangle as much as 1000 m thick.

IPme Exotic blocks of Pennsylvanian Madera Limestone. These blocks are contained within Rubio Peak Formation volcaniclastic sedimentary interval, are several square kilometers in outcrop, and are interpreted to be of gravity-slide emplacement (first by Maxwell and Heyl, 1976). Within the Winston quadrangle, exotic blocks of Madera Limestone rest upon both debris-flow and sandstone deposits, clastic dikes frequently intrude upward into the blocks as much as 100 m, and fragments of petrified wood are concentrated below the blocks within sandstone deposits. Clastic to limestone ratios for the exotic blocks are about .45, sandstone to shale ratios are about .05. The blocks are as much as 150 m thick.

Trpba Rubio Peak Formation basaltic andesite. Aphanitic, laminated lava flows, domes, and dikes found only in southern quarter of Winston quadrangle. Intrusive into and interbedded with Rubio Peak Formation volcaniclastic sedimentary unit. As much as 120 m thick.

Trph Rubio Peak Formation hornblende andesite. Massive and auto-brecciated andesitic lava flows and dikes containing 15-30% phenocrysts of plagioclase, hornblende, and minor augite. Intrusive into and interbedded with Rubio Peak Formation volcaniclastic sedimentary unit. As much as 25 m thick.

Trpc Rubio Peak Formation conglomerate. Poorly sorted, clast-supported, boulder to cobble conglomerate deposits with lesser sandstone deposits occurring at the base of the Rubio Peak Formation. These deposits contain rounded clasts of Permian Abo Formation, holocrystaline monzonitic rocks, porphyritic volcanic rocks of intermediate composition, and Paleozoic limestone. This unit is believed to be correlative to Starvation Draw Member of Rubio Peak Formation of Seager and others (1982) in Cooke's Range. As much as 100 m thick in the Winston quadrangle.

Trpm Tuff of Miranda Homestead. Strongly altered, moderately welded, lithic-rich, moderately crystal-rich ash-flow tuff with 10-15% phenocrysts of white- and flesh-colored feldspars, quartz, and biotite. Intertongued with Rubio Peak conglomerate unit and as much as 20 m thick.

Pa Permian Abo Formation. Fine- to coarse-grained sandstone, siltstone, and shale red beds with abundant cross-stratification. Within Winston quadrangle, Abo Formation contains a few, small 'red-bed type' occurrences of copper-uranium mineralization with associated whitish, reduced areas. As much as 120 m thick in the Winston quadrangle.

Pb Permian Bursum Formation. Fossiliferous, gray, calcareous shale and limestone; interbedded gray, green, and red shale and siltstone; and basal, nodular, limestone-conglomerate. In the Winston quadrangle, this formation is found only along the extreme southern margin, where it is as much as 40 m thick.

Pm — Pennsylvanian Madera Limestone. Fossiliferous limestone and shale beds with local jasperoid areas. As much as 100 m thick, with base not exposed in the Winston quadrangle.

Tia — Andesitic (intermediate) dikes of various ages. Both aphanitic and porphyritic varieties.

Tir — Rhyolitic dikes. Porphyritic dikes with phenocrysts of quartz, sanidine, and biotite. Aphanitic rhyolite dikes in the Winston quadrangle are referred to as rhyolite of Moccasin John.

STRUCTURE

Rocks within the Winston quadrangle have experienced three phases of Cenozoic faulting that have resulted in the development of four prominant structural trends: north-northeast, north-northwest, northwest, and northeast. Pre-Cenozoic structures are not apparent in the limited outcrops of Paleozoic rocks in the quadrangle.

The oldest phase of faulting within the Winston quadrangle was produced by an overall north-northeast-trending, dextral wrench-fault system. Multiple stands of this wrench-fault system cut through the west-central portion of the Winston quadrangle, displacing only the Rubio Peak Formation and older rocks. This deformation is believed to be Eocene in age and part of a major, dextral wrench-fault system active along the eastern margin of the Colorado Plateau described by Chapin and Cather (1981) and Chapin (1983). Dextral strike-slip offsets of 3.14 km are indicated on four strands that horizontally displace exotic limestone blocks in the Winston quadrangle (Harrison, 1989).

Near-vertical, thin, sharp, horizontally striated fault surfaces are found in areas of transpression; as is a minor-displacement thrust fault in sec. 20, T.11S., R.8W. that thrusts rocks of the Permian Abo Formation over rocks of the Rubio Peak Formation conglomerate unit (Trpc). In areas of transtension, wrench-fault related structures are intruded by syn-tectonic dikes of hornblende andesite (Trph unit) and aphanitic basaltic andesite (Trpba unit). Figure 1 shows a compass-rose diagram of syn-tectonic dikes in the Winston quadrangle. Presumedly, these dikes intruded primarily along planes of extension, parallel to maximum principal stress. It is interpreted that these dike orientations are indicative of a shift in maximum principal stress from northeast to north-northeast.

While the overall trend of wrench faulting in the Winston quadrangle is north-northeast, individual strands are braided along north-northeast, north-northwest, and north-south strikes. These strands are interpreted as primary shears (X), R shears, and P shears in a dextral wrench-fault system (Harrison, 1989). In addition, antithetic northeast-trending wrench faults (R' shears) are found along the eastern side of the system. Some strands of the wrench-fault system in the Winston quadrangle appear to have been very slightly re-activated by younger normal faulting, with a left-lateral sense of motion.

A second phase of deformation in the Winston quadrangle occurred as high-angle, normal and oblique-slip faults that were subsequently filled with epithermal, quartz-calcite-sulfide-feldspar vein mineralization. Feldspar separates from this mineralization have yielded K-Ar age dates of 28.9 ± 1.1 Ma at Bald Eagle mine, 26.9 ± 2.0 Ma at Hoosier mine, and 26.5 ± 1.1 Ma at St. Cloud mine (Harrison, 1986). The dominant trend of epithermal-vein structures in the Winston quadrangle is northwesterly, with a subsidiary north-northwest to north trend where older wrench faults are mineralized. Primary structural control of mineralized shoots within these veins are confined to intersections with the older wrench faults (Harrison, 1988a). Offset on vein-filled faults is relatively minor, with only 150 m of dip-slip as the greatest amount of displacement. Timing and orientation of vein-filled faults in the Winston quadrangle are consistant with the earliest development of the southern Rio Grande rift as described by Chapin and Seager (1975).

Virtually all vein-filled structures in the Winston quadrangle were re-activated by a younger phase (or phases) of normal and oblique-slip faulting. In addition, numerous, non-mineralized faults that cut vein structures occur throughout the Winston quadrangle along north-northwesterly, northeasterly, and northwesterly trends. These post-mineralization faults cut rocks of all ages and contain slickenside striations that indicate an east-west-directed least principal stress orientation (Harrison,1987). The major structural feature in the Winston quadrangle related to this youngest phase of deformation is the relatively narrow (7.2 km wide) Winston graben, the western margin of which bisects the quadrangle. There is approximately 1.6 km of stratigraphic separation along the western margin of the Winston graben.

The southeastern corner of the Winston quadrangle contains several northeast-trending faults that are a small portion of a regionally extensive northeast-trending transfer fault zone [referred to by Harrison (1986, 1987) as the Chise lineament]. This fault zone is believed to have been active during all phases of deformation described above.

MINERALIZATION

The Winston quadrangle occupies the southeastern extent of the Chloride mining district and hosts the most productive mineral deposits of this district to date. Base and precious metal mineralization occur in structurally controlled shoots along epithermal vein systems. Economically, silver is the most important metal in these deposits, followed by copper, gold, zinc, and lead. Production from the old mines in the Winston quadrangle (Dreadnaught, Hoosier-Apache-Nana, Wall Street, U.S. Treasury, Colossal, Midnight, King, and Bald Eagle) totaled only a few hundred thousand dollars from 1880 to 1932 (Harley, 1934); and from 1932 thru 1982, mines in the Winston quadrangle had even less production. However, from 1982 thru 1987, St. Cloud, U.S. Treasury, and Midnight mines produced just over two million ounces of silver, nine thousand ounces of gold, three thousand tons of copper, and many thounsands of tons each of lead, zinc, and high-silica smelter flux.

Two stages of sulfide mineralization are recognized in this portion of the Chloride mining district (Harrison, 1986). The earliest stage of sulfide mineralization consists of galena, sphalerite, chalcopyrite, and minor gold, bornite, and molybdenite. This stage is very poor in silver content. Second-stage sulfide mineralization is a high copper-silver stage consisting of bornite, digenite, chalcocite, covellite, jalpaite, stromeyerite, and betehkenite with sphalerite and minor galena. Silver contentin this second stage is very high and largely contained within primary copper minerals as latice substitutions. Gold occurs erratically in second-stage mineralization as the native element. Both stages of mineralization are notably poor in iron content.

Gangue mineralization in epithermal vein deposits occurs as multiple pulses of dominant quartz, lesser calcite, and very minor manganese carbonates and oxides. A hydrothermal stage of open-space filling and replacement calc-silicate mineralization occurs with sulfide mineralization in limestone-hosted depositson the Hoosier vein (Neal and Larsen, 1986), St. Cloud vein, and Midnight vein. Calc-silicate minerals are dominantly calcium-manganese-rich pyroxenes, lesser iron-rich garnets, epidote, and prehnite.

More detailed descriptions of epithermal mineralization in the Winston quadrangle are given by Bahr (1988), Harrison (1988a, 1988b, 1986), and Neal and Larsen (1986).

ALTERATION

Rocks of intermediate composition in the lower Rubio Peak Formation show mild to pervasive propylitic alteration throughout the Winston quadrangle. This alteration assemblage consists of epidote, calcite, chlorite, plus or minus pyrite. More silicic rock types below tuff of Little Mineral Creek commonly have only fracture-coatings of epidote and calcite. Rocks west of the Winston graben, in the area of epithermal vein deposits, have a much stonger degree of propylitic alteration than do rocks within the graben. Tuff of Dry Creek and Kneeling Nun Tuff locally display mild argillic alteration with sparse pyrite disseminations.

Volcanic and volcaniclastic wall rocks adjacent to epithermal vein systems contain varying degrees of silicification and potassic and argillic alteration. Limestone wall rocks within a few inches of vein systems frequently are altered to wollastonite and tremolite.

Within the Winston graben, tuff of Little Mineral Creek and tuff beds intercalated with Santa Fe Group sediments are extensively altered to clinoptilolite. Clinoptilolite most likely formed either as a diagenetic reaction with alkaline/saline waters, or by alteration from low-temperature hydrothermal fluids (Bowie and Barker, 1986).

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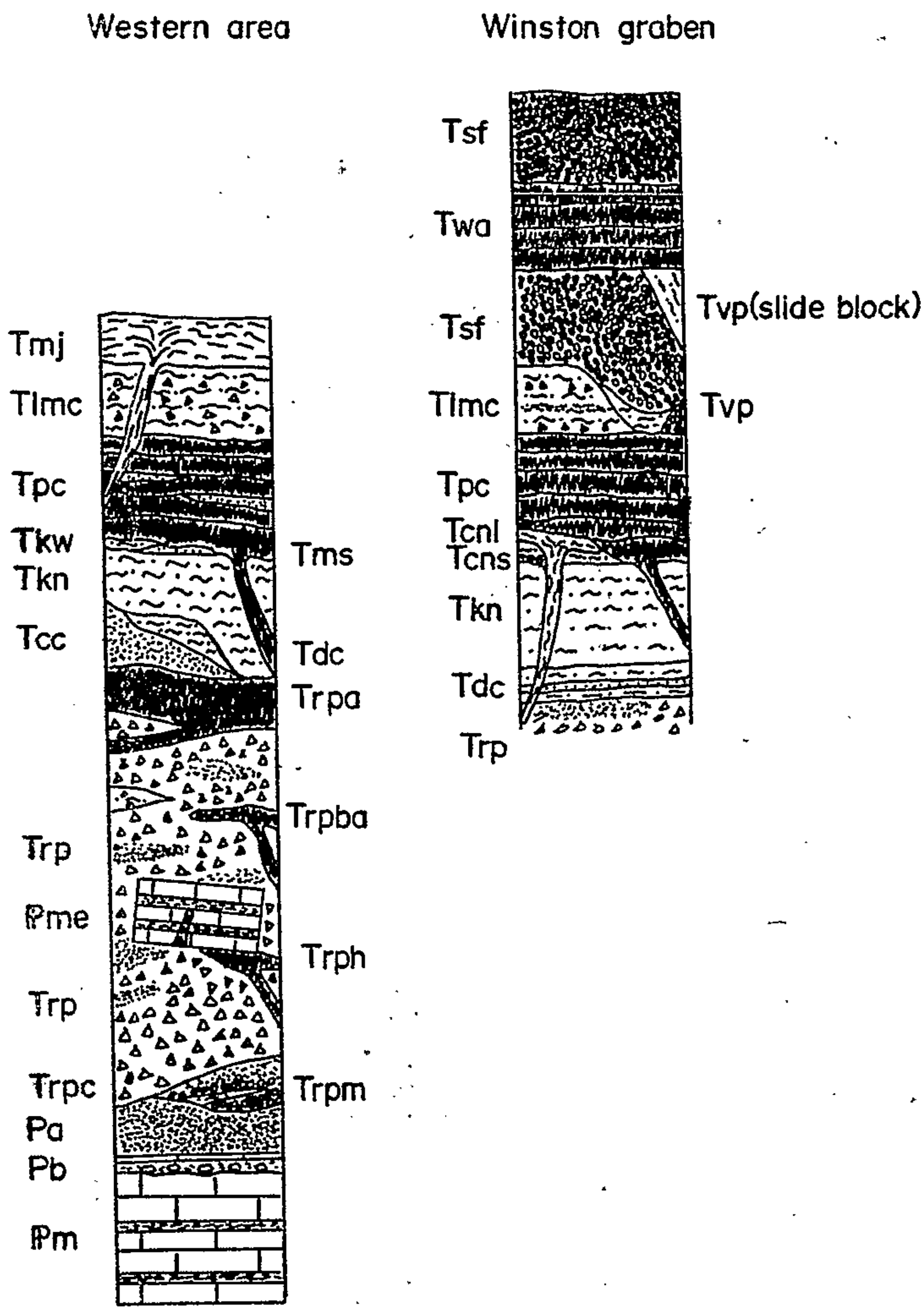
Legend of map symbols

- strike & dip of bedding
- strike & dip of foliation
- strike & dip of fracture or joints
- geologic contact
- 67 strike & dip of normal fault, arrow and number indicate angle below horizontal of striations and mullions in the plane of fault
- strike-slip fault (wrench fault)
- quartz vein

Schematic stratigraphic sections for Winston quad.



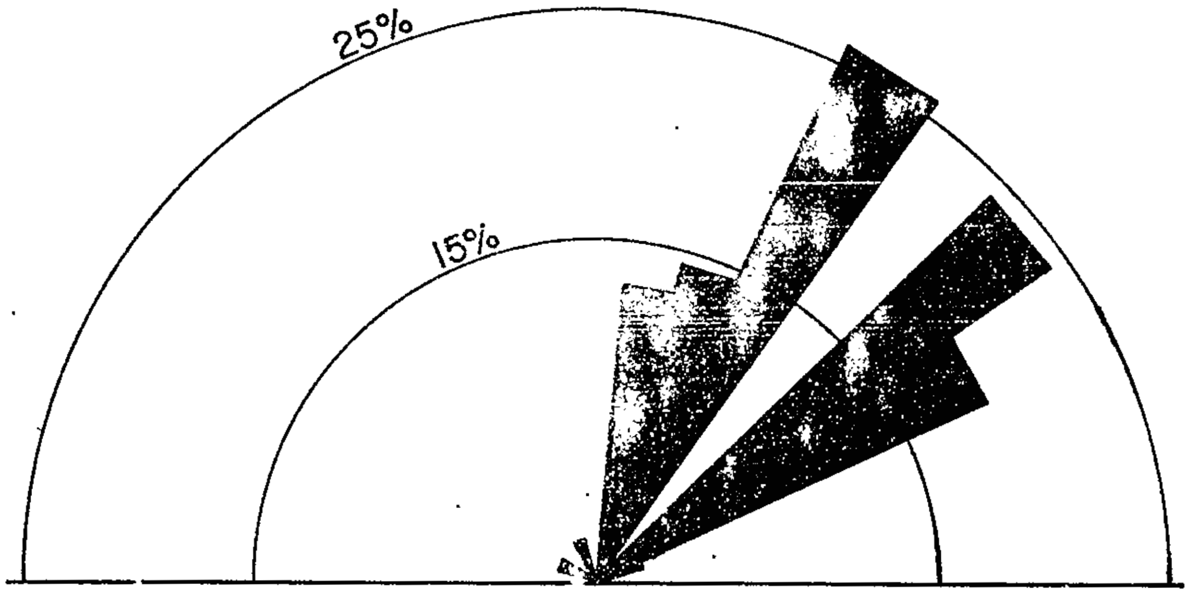


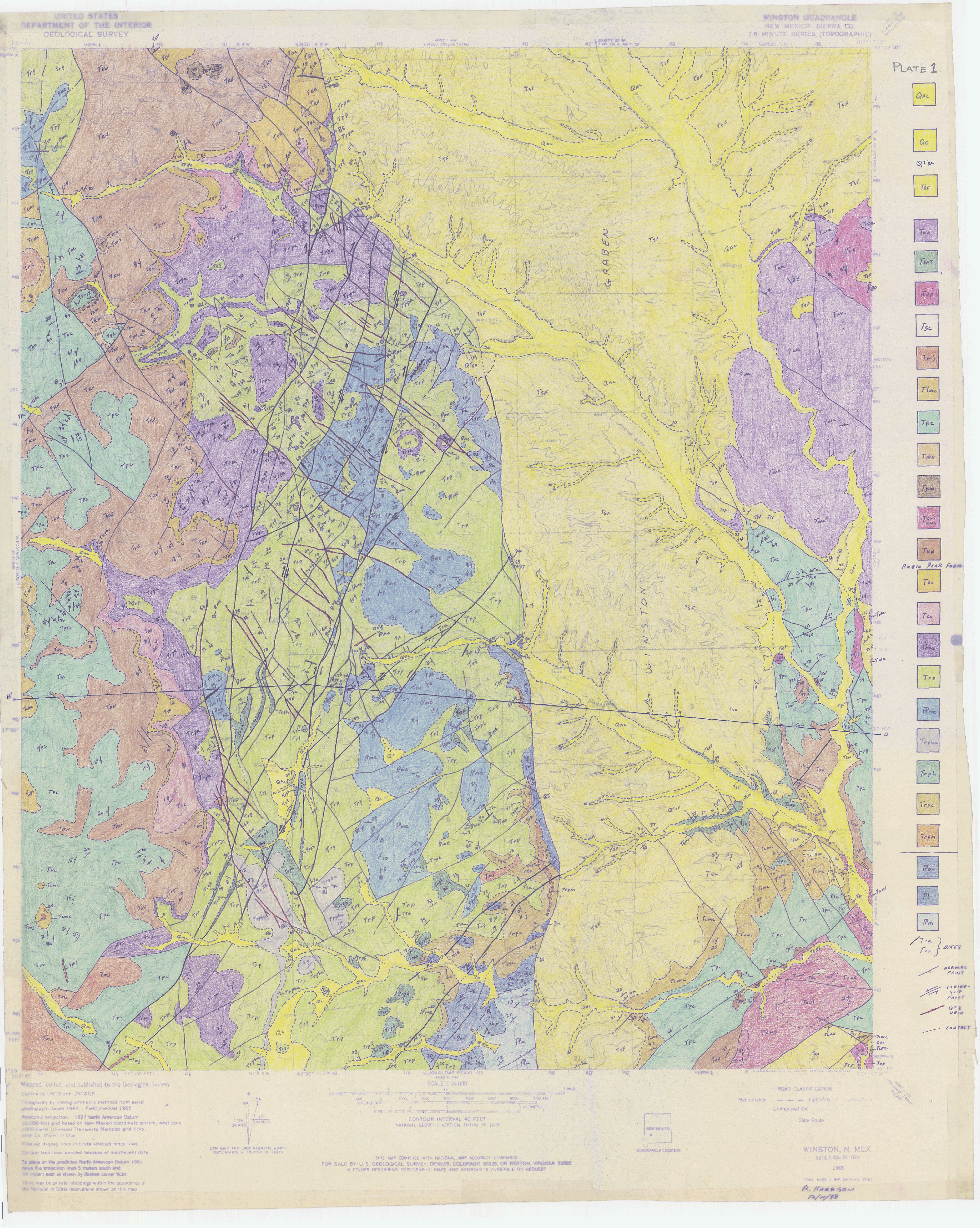
Figure I. Compass-rose diagram for approximately 10,700 meters of dikes believed to be syn-tectonic with Eocene wrench faults in Winston quadrangle.

TABLE 1. X-RAY FLUORESCENCE ANALYSES

	1	2	3	4	5	6	7	8	9	10
unit	Tvp	Tlmc	Tmj	Tmj	Tcnl	Tcnl	Tcnl	Tcns	Tcns	Tcns
SiO_2	78.07	75.52	75.14	74.99	69.65	70.54	72.25	65.16	66.78	65.25
Al_2O_3	10.62	11.70	12.90	12.87	13.77	13.70	13.79	14.85	14.45	14.18
Fe_2O_3	1.50	1.03	1.37	1.34	3.19	3.16	3.27	3.30	2.02	2.89
MgO	.55	2.17	.58	.30	1.25	1.07	.37	1.53	1.20	1.69
CaO	.15	1.77	.66	.65	1.98	1.70	1.08	2.55	2.90	2.23
Na_2O	2.78	1.54	3.48	3.49	2.80	2.72	3.15	2.15	1.94	1.77
K_2O	5.49	4.13	5.17	5.21	5.73	5.71	5.73	5.61	3.89	4.64
TiO_2	.16	.14	.18	.17	.56	.60	.60	.55	.34	.46
P_2O_5	.03	.02	.01	.01	.10	.10	.11	.13	.04	.76
MnO	.07	.05	.05	.05	.05	.05	.05	.05	.04	.04
LOI	.93	2.76	.76	.76	.75	.91	.92	4.52	4.72	4.29
Total	100.35	100.83	100.30	99.84	99.83	100.26	101.32	100.40	98.32	98.20

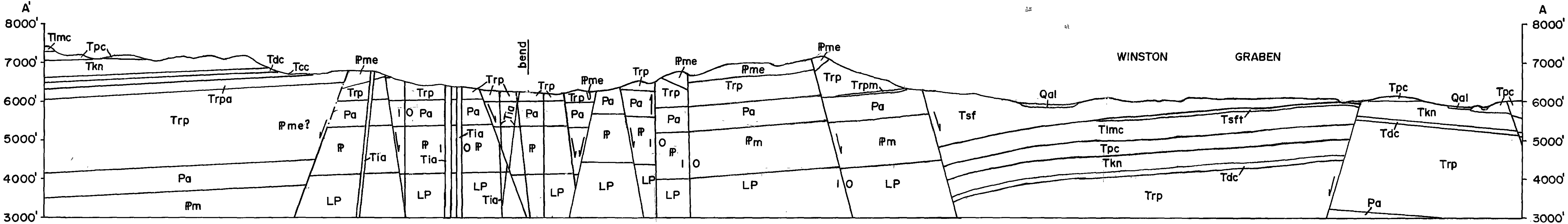
	11	12	13	14	15	16	17
unit	Tkn	Tkn	Tdc	Tdc	Trpa	Trp	Tia
SiO_2	69.22	70.38	70.21	67.11	61.49	59.15	55.61
Al_2O_3	15.19	14.66	14.31	15.09	15.99	16.04	16.30
Fe_2O_3	2.82	3.06	1.91	2.45	6.27	6.39	6.91
MgO	.68	.59	.30	.35	2.19	3.97	2.84
CaO	1.72	1.54	2.23	1.00	4.15	6.49	5.70
Na_2O	3.92	4.00	2.51	4.04	4.65	4.06	4.20
K_2O	4.16	4.24	6.93	6.29	3.23	1.86	2.95
TiO_2	.47	.48	.37	.48	.96	1.01	.91
P_2O_5	.14	.12	.06	.07	.25	.41	.58
MnO	.05	.04	.04	.05	.07	.08	.11
LOI	.94	1.03	2.34	1.48	1.35	2.40	4.76
Total	99.31	100.14	101.21	98.41	100.60	101.86	100.87

1) Vicks Peak Tuff, Coyote Canyon, east-center, sec. 23, T.12S., R.8W.
2) Tuff of Little Mineral Creek, Coyote Canyon, center sec. 23, T.12S., R.8W.
3) Rhyolite of Moccasin John, flow-banded lava, unsurveyed, SW corner of Winston quad.
4) Rhyolite of Moccasin John, vitrophyre, unsurveyed, SW corner of Winston quad.
5) Cuchillo Negro Complex, flow-banded lava, Cuchillo Negro Cr., NE1/4, sec. 14, T.12S., R.8W.
6) Cuchillo Negro Complex, flow-banded lava, Cuchillo Negro Cr., NE1/4, sec. 14, T.12S., R.8W.
7) Cuchillo Negro Complex, Flow-banded lava, Cuchillo Negro Cr., SE1/4, sec. 11, T.12S., R8W.
8) Cuchillo Negro Complex, upper ash-flow tuff, Cuchillo Negro Cr., NE1/4, sec. 14, T.12S., R8W.
9) Cuchillo Negro Complex, middle ash-flow tuff, Cuchillo Negro Cr., NE1/4 sec. 14, T.12S. R.8W.



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WINSTON QUADRANGLE
NEW MEXICO–SIERRA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
PLATE 1
IRON MOUNTAIN
GRABEN
WINSTON
RUBIO PEAK FORM.
DIKES
NORMAL FAULT
STRIKE-SLIP FAULT
QTZ VEIN
CONTACT
(SUGARLOAF PEAK)
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1964. Field checked 1965
Polyconic projection. 1927 North American Datum
10,000-foot grid based on New Mexico coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue
Fine red dashed lines indicate selected fence lines
Certain land lines omitted because of insufficient data
To place on the predicted North American Datum 1983 move the projection lines 5 meters south and 56 meters east as shown by dashed corner ticks
There may be private inholdings within the boundaries of the National or State reservations shown on this map
UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24 000
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
NEW MEXICO
QUADRANGLE LOCATION
ROAD CLASSIFICATION
Medium-duty
Light-duty
Unimproved dirt
State Route
WINSTON, N. MEX.
33107-C6-TF-024
1965
R. HARRISON
12/11/88

PLATE 2 NMBM&MR OFR 358



Geologic Cross Section of the Winston 7.5' Quadrangle

by Richard W. Harrison, 1989