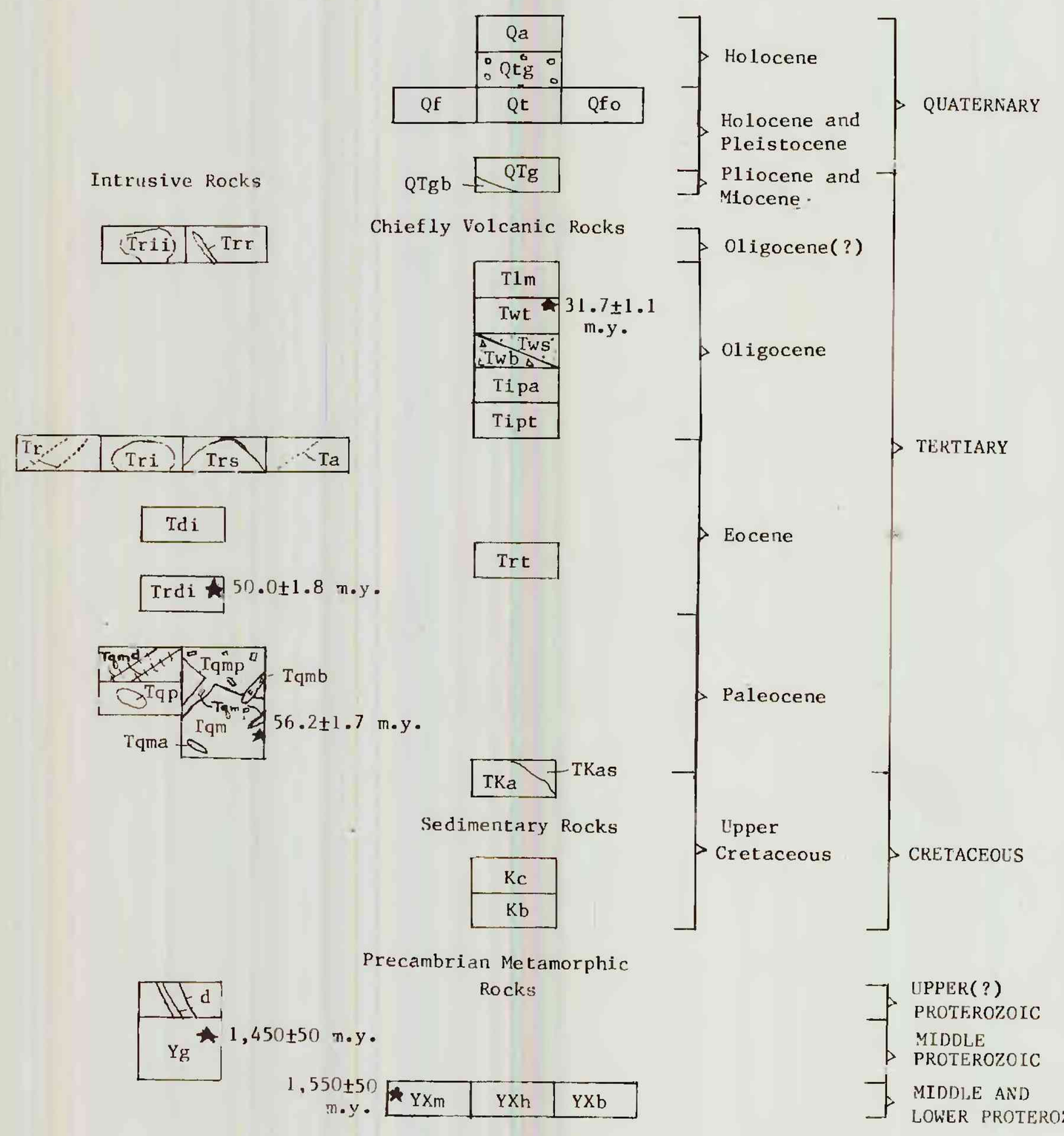
Base from U.S. Geological Survey White Signal, Burro Peak, Tyrone, and Wind Mountain quadrangles, 1:24,000, 1950

Geology by D. C. Hedlund, 1978 and 1979

Scale 1:32,000

1 0.5 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0.5 0 1 KILOMETER

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qa — ALLUVIUM (HOLOCENE)--Poorly sorted gravel, sand, and silt deposits; gravel contains chiefly fragments of Precambrian granite and Tertiary volcanic rock. Thickness probably exceeds 150 ft along Mangas Creek

Qtg — TERRACE GRAVEL (HOLOCENE)--Sorted cobble and gravel deposits consist of Precambrian granite and Tertiary volcanic rock. Gravels extensive along the north side of Gold Gulch where some of the gravels have been mined for placer gold. The gold was probably derived from the weathering of quartz-pyrite veins along and near the Sprouse-Copeland fault. Thickness about 25 ft

Qf — FAN DEPOSITS (HOLOCENE AND PLEISTOCENE)--Younger fan deposits contain chiefly subangular to angular, poorly sorted Precambrian granite and Tertiary volcanic rock fragments. Locally includes some small talus deposits. Deposited by sheet-flood processes. Maximum thickness about 60 ft

Qt — TALUS (HOLOCENE AND PLEISTOCENE)--Poorly sorted, unconsolidated, locally derived rock fragments deposited on or at the foot of a slope by gravity. Thickness commonly exceeds 15 ft

Qfo — OLDER FAN DEPOSITS (HOLOCENE AND PLEISTOCENE)--Fan and residual lag deposits that are partly derived from the underlying weathered Gila Conglomerate (QTg). Fans locally contain large lag boulders of Precambrian granite along the ridge crests within the Little Burro Mountains. Thickness commonly exceeds 30 ft

QTg — GILA CONGLOMERATE (PLEISTOCENE, PLIOCENE, AND MIOCENE)--Chiefly light-brown silt, sand, conglomerate, and fanglomerate deposits. Underlies older fan deposits throughout the region but is well exposed in road cuts along the Mangas valley highway. As much as 1,800 ft of Gila Conglomerate has been indicated by drilling

QTgb — Sedimentary breccia--Dusky-red to moderate-red, thick-bedded, poorly sorted, moderately indurated sedimentary rock containing abundant angular clasts of granite, quartz monzodiorite, rhyolite, and andesite. Locally contains intercalated, reddish-brown, coarse-grained, crossbedded sandstone beds of probable fluviatile origin. Sedimentary breccias are cemented by ferric oxides and chalcedonic quartz. Unit is mostly a fluviatile channel-fill deposit at the base of the Gila Conglomerate. Thickness ranges from 0 to 50 ft

Trii — RHYOLITE PLUG (OLIGOCENE(?))--White aphyric rhyolite intrusion with contorted fluxion laminae. Generally less than 10 percent phenocrysts of sanidine and bipyramidal quartz 1 to 2 mm across. Outcrops are about 1,000 ft north of Indian Peak in the Little Burro Mountains

Trr — RHYOLITE DIKE (OLIGOCENE(?))--Very light gray, aphyric rhyolite dike cuts bedded air-fall tuff (unit Tipa). Dike is about 15 ft thick

Tlm — DACITE AND ANDESITE FLOWS (OLIGOCENE)--Medium-gray to dark-gray, aphyric dacite and porphyritic andesite flows that are locally scoriaceous and commonly show a platy weathering habit. The andesite flows contain as much as 25 percent phenocrysts, chiefly 15 percent andesine (An_{43-45}), 8 percent oxyhornblende grains as much as 5 mm long, 1-2 percent clinopyroxene, and accessory amounts of iron oxides and apatite. The aphyric dacite flows contain less than 10 percent phenocrysts generally less than 1 mm across. Mapped unit is probably correlative with the lava flows along the Malpais Hills in the Werney Hill quadrangle to the south (Hedlund, 1978c). Flows have an aggregate thickness of about 150 ft

Twt — ASH-FLOW TUFF OF WIND MOUNTAIN (OLIGOCENE)--Pale-red, light-brownish-gray, and white ash-flow tuff contains 25 to 35 percent crystals as much as 4 mm across. Tuff is densely welded, devitrified, and contains very light gray compressed pumice lapilli. Distinctive large (3-4 mm) quartz crystals comprise 12 to 20 percent of the tuff; sanidine 3-6 percent; calcic oligoclase-sodic andesine (An_{27-33}) 5-8 percent; and biotite less than 1 percent. The groundmass in the upper part of the ash-flow tuff is white, locally spherulitic, and moderately recrystallized suggesting a gas phase alteration. Maximum thickness of this persistent ash-flow sheet is about 170 ft. Sanidine from this unit has yielded a K-Ar age of 27.1±0.9 m.y., whereas the biotite has yielded a K-Ar age of 31.7±1.1 m.y. (R. F. Marvin, A. H. Mehnert, and V. M. Merritt, written commun., 1978)

VOLCANICLASTIC ROCKS OF WIND MOUNTAIN (OLIGOCENE)

Tws — Tuffaceous sandstone--Very light brown, thin-bedded to laminated, fine- to medium-grained sandstone. Discontinuous unit varies from 0 to 20 ft thick

Rhyolite breccia--Very light gray, thick-bedded to massive, poorly sorted sedimentary breccias containing about 60 percent angular rholite-dacite fragments as much as 4 cm across in a matrix of coarse sand-size rhyolite grains. Discontinuous unit varies from 0 to 75 ft thick

Tipa — AIR-FALL TUFF OF INDIAN PEAK (OLIGOCENE)--White to pale-pinkish-gray, laminated to thin-bedded, poorly indurated air-fall tuff. Locally contains thin interbeds of crossbedded tuffaceous sandstone. Thickness varies from 70 to 350 ft

Tipt — ASH-FLOW TUFF OF INDIAN PEAK (OLIGOCENE)--Pinkish-gray to grayish-orange-pink, nonwelded, devitrified, ash-flow tuff contains 3 to 5 percent crystals. Tuff is indurated and contains abundant nondeformed, devitrified ash shards; an eutaxitic structure is absent. Tuff contains as much as 2 percent sanidine, 1-2 percent quartz, and accessory amounts of biotite. Thickness varies from 0 to 100 ft

RHYOLITIC DIKE SWARMS, PLUGS, AND SILL (EOCENE)

Tr — Rhyolite dikes--Rhyolite dike swarms with as many as 13 to 20 dikes per kilometer. The rhyolite is very light gray to medium light gray and contains about 10 percent phenocrysts of sanidine, bipyramidal quartz, and altered biotite. Sparse amounts of disseminated molybdenite and pyrite occur in some sericitized dikes. Generally the rhyolite is flow laminated parallel to the dike walls. Most dikes are less than 100 ft thick

Tri — Rhyolite plugs--Very light gray rhyolite containing about 10 percent phenocrysts of sanidine and bipyramidal quartz. Flow laminae are commonly contorted and thin fractures are commonly lined with specularite. The rhyolite dikes are locally expanded into elongate plugs in the Three Sisters area and near Tullock Peak. The rhyolite dikes have also served as feeder dikes to the Saddle Mountain sill and the Shrine plug

Trs — Rhyolite sill of Saddle Mountain--A sheet-like intrusion, possibly an unroofed sill, with a lower intrusive contact with Precambrian granite. Sill dips to northeast and has an area of about 1 mi^2. The rhyolite contains numerous autobreccia zones along the contact with the granite, and within the sill there are locally numerous anastomosing veinlets of specularite. The rhyolite is generally aphyric with less than 10 percent phenocrysts of sanidine and bipyramidal quartz

Ta — ANDESITE PORPHYRY DIKES (EOCENE)--Dark-greenish-gray to black, porphyritic dikes with andesine (An_{40-42}) phenocrysts in a pilotaxitic groundmass that is commonly altered to chlorite, sericite, calcite, and ferric oxides. Maximum thickness about 20 ft. Locally mineralized at the Foster Zinc mine (98)

Tdi — RHYODACITE PLUGS (EOCENE)--Light-gray, porphyritic rhyodacite plugs of sec. 15, T. 20 S., R. 15 W. are cut by rhyolite dikes (Tr). Phenocrysts are of oligoclase-sodic andesine (An_{29-33}), sanidine, bipyramidal quartz, and chloritized biotite; accessory minerals are hornblende, apatite, epidote, and iron oxides

Trt — OLDER ASH-FLOW TUFF (EOCENE)--Very light gray, crystal-poor, devitrified, welded ash-flow tuff. Tuff contains abundant compressed pumice lapilli that are highly deformed. Crystals comprise less than 5 percent of the tuff and include sanidine, bipyramidal quartz, and accessory biotite. Sporadic lithic fragments of quartzite and rhyolite are locally present. Erosional remnants of the ash-flow sheet are less than 100 ft thick and are locally intruded by rhyolite dikes and rhyodacite plugs

Trdi — RHYODACITE SILL OR STOCK (EOCENE)--Light-brownish-gray rhyodacite intrusion containing 25-38 percent phenocrysts as much as 6 mm across set in a cryptocrystalline groundmass. Phenocrysts are 25 to 38 percent zoned oligoclase (An_{17-28}), 0-2 percent alkali feldspar, 2-4 percent quartz, 2-4 percent biotite, and accessory amounts of sphene, apatite, and iron oxides. Locally the rock is highly faulted and altered and shows extensive sericitization of the groundmass; the large quartz phenocrysts persist in the altered porphyry. A biotite concentrate has yielded a K-Ar age of 50.0±1.8 m.y. (R. F. Marvin, A. H. Mehnert, and E. L. M. Brandt, written commun., 1984)

Tqmd — QUARTZ MONZODIORITE PORPHYRY DIKES (PALEOCENE)--Pinkish-gray porphyry dikes contain about 30-35 percent phenocrysts up to 1 cm across set in a recrystallized cryptocrystalline groundmass. Phenocrysts are 25-30 percent oligoclase (An_{25-28}), 10 percent bipyramidal quartz, and accessory hornblende, biotite, and iron oxides. Numerous dikes occur along the northwest margin of the Tyrone stock. Some dikes intrude the stock in the vicinity of the Ohio mine and in an area just south of Sugarloaf Mountain

Tqmp — QUARTZ MONZODIORITE PORPHYRY PLUGS (PALEOCENE)--Elongate and irregularly shaped plug-like bodies that are probably synchronous with the intrusion of porphyritic phases of the Tyrone stock. Conspicuous bipyramidal quartz phenocrysts up to 1 cm across

Tqp — QUARTZ PORPHYRY (PALEOCENE)--Very light gray porphyry containing as much as 10 percent quartz phenocrysts up to 1 cm across. Plug is locally sericitized and cut by numerous quartz veinlets. Poorly twinned and sericitized plagioclase and minor alkali feldspars comprise about 30-35 percent of the rock. Small plug is probably coeval with the intrusion of the Tyrone stock

INTRUSIVES OF THE TYRONE STOCK (PALEOCENE)

Tqmp — Quartz monzodiorite porphyry--Very light brownish gray porphyry to highly altered sericitized light-gray porphyry. Kolessar (1982, p. 330) has recognized five porphyry types, an older intensely altered fine-grained porphyry that is the host for most of the sulfide ore and younger more coarse-grained porphyries and intrusive breccias. The coarser grained porphyries contain 30 to 40 percent phenocrysts up to 2 cm across that are set in a cryptocrystalline groundmass. The phenocrysts are 27-32 percent zoned oligoclase (An_{28-36}), 0-5 percent alkali feldspar, 5-10 percent resorbed and pitted quartz grains, 1-2 percent biotite, and accessory amounts of hornblende, chlorite, sericite, and sphene. The large oligoclase phenocrysts are poikilitic and contain zonal concentrations of biotite. The porphyries crop out at the northeast end of the stock

Tqmb — Intrusive breccia--Reddish-brown breccia pipes that contain subangular to angular to rounded fragments of granite and quartz monzodiorite porphyry. Fragments are set in a comminuted matrix of feldspars, quartz, sulfides, and diverse rock fragments that display varying degrees of argillization, silicification, and hematite staining. Three breccia pipes have been mapped by geologists of the Phelps Dodge Corporation; one is in Precambrian granite near the old Chemung orebody; the other two are in quartz monzodiorite porphyry. Some breccia pipes have a fragmented pyrite matrix which is coated with supergene chalcocite (Kolessar, 1982, p. 330)

Tqm — Quartz monzodiorite--Medium-light-gray, medium-grained, hypidiomorphic-granular, massive to weakly foliated quartz monzodiorite comprises the largest part of the Tyrone stock. Rock typically contains 14-16 percent alkali feldspar, 55-65 percent oligoclase (An_{26-29}), 6-20 percent quartz, 1-4 percent biotite, and commonly less than 1 percent hornblende, sphene, apatite, and iron oxides. The oscillatory-normal zoned calcic oligoclase shows several stages of overgrowth. The alkali feldspar is typically late and fills the interstices between the plagioclase laths and also mantles some of the plagioclase grains. A biotite concentrate from the quartz monzodiorite has yielded a K-Ar age of 56.2±1.7 m.y. (McDowell, 1971, p. 12)

Tqma — Aplitic dikes and segregations--Pinkish-gray, very fine grained, xenomorphic-granular segregations in the holocrystalline quartz monzodiorite. Aplite typically contains 45-50 percent orthoclase, 20 percent oligoclase (An_{24-26}), and 35 percent quartz, with accessory amounts of biotite and iron oxides. Most of the aplite bodies are less than 10 ft wide and only the larger bodies are shown

ANDESITE (PALEOCENE AND (OR) UPPER CRETACEOUS)

TKas — Andesitic sedimentary breccia--Dark-olive-gray breccia or mudflow contains angular clasts of silicified shale, siltstone, and quartzite fragments as much as 12 cm across. The matrix consists of coarse-grained comminuted andesite clasts. The breccias locally rest on shale of the Colorado Formation (Kc) but also on andesite (TKa). Forms remnant channel-fill sediments that are as much as 90 ft thick

TKa — Andesite flows--Dark-olive-gray to grayish-brown andesite that weathers purplish gray to reddish brown. The rock is porphyritic and contains about 25 percent phenocrysts of andesine (An_{35-37}) and 4 percent clinopyroxene grains. Magnetite-ilmenite composite grains have inclusions of andesine microlites. Some of the andesine phenocrysts have overgrowths of late stage plagioclase, suggesting some disequilibria during crystallization. Thickness ranges from 0 to 350 ft. Unit is probably correlative with the Saddle Rock Canyon Formation of Damon and others (1968) and Wargo (1959). Zircon from the Saddle Rock Canyon Formation has yielded fission-track age of 58.4±4.0 m.y. (C. W. Naeser, written commun., 1981)

Kc — COLORADO FORMATION (UPPER CRETACEOUS)--Light-brown to reddish-brown to dark-gray, laminated to thin-bedded, very fine to fine-grained silty sandstone and shale. Lowermost 15 to 25 ft consists predominantly of black, highly fissile shale with minor thin interbeds of light-brown silty sandstone. Limestone nodules as much as 10 cm across are locally present within thin yellowish-gray siltstone layers. Total thickness about 450 ft

Kb — BEARTOOTH QUARTZITE (UPPER CRETACEOUS)--Light-gray, light-brownish-gray, and light-brown, medium-bedded, fine- to medium-grained sandstone with very minor beds of gray chert-pebble conglomerate in the lower part of the formation. The sandstone is locally tightly cemented and quartzitic. Plant impressions are locally present. Maximum thickness about 450 ft

PRECAMBRIAN ROCKS

d — DIABASE DIKES AND PLUGS (UPPER(?) PROTEROZOIC)--Medium-light-gray to medium-gray, spheroidal-weathering diabase. Rock has subophitic to intersertal texture and consists of about 65 percent euhedral labradorite (An_{50-52}) laths, 30 percent interstitial to partly enclosing augite grains, 1 percent biotite, 4 percent magnetite-ilmenite grains, and accessory chlorite, apatite, calcite, and secondary quartz. Maximum thickness about 100 ft. Commonly chloritized adjacent to quartz-pyrite veins in the White Signal district

Yg — GRANITE OF BURRO MOUNTAIN (MIDDLE PROTEROZOIC)--Light-gray, medium-grained, hypidiomorphic-granular, two-feldspar granite containing 20-40 percent perthitic microcline, 30-50 percent sodic oligoclase, 30-38 percent quartz, and 2 percent biotite. Small bodies of granodiorite (not shown) locally intrude the granite in the northwest corner of the quadrangle. The granite has been dated by U-Pb methods on zircon as 1,450 m.y. (Stacey and Hedlund, 1983)

METAMORPHIC ROCKS OF BULLARD PEAK SERIES (HEWITT, 1959) (MIDDLE AND LOWER PROTEROZOIC)

YXm — Migmatite and quartz-biotite gneiss--Dark-gray, fine-grained, highly foliated biotite gneiss and migmatite with thin intercalated layers of quartzofeldspathic gneiss. Rocks typically contain as much as 50 percent micas of which about 40 percent is biotite and the remainder muscovite. Red garnet porphyroblasts are present but not common. Fibrolitic sillimanite is commonly present in the migmatite. Original sediments were highly pelitic. U-Pb and Pb-Pb isotopic ages from zircon indicate an age of about 1,550±50 m.y. (Stacey and Hedlund, 1983)

YXh — Gneissic amphibolite and hornblende schist--Dark-greenish-gray to greenish-black, medium- to fine-grained, foliated rock composed of 60-65 percent hornblende, 10-35 percent calcic oligoclase, 1-5 percent quartz, and variable amounts of epidote. Original sediments were probably marls

YXb — Biotite schist--Dark-gray, fine-grained, highly foliated biotite schist layers interlense with hornblende schist and amphibolite layers. Schist contains as much as 50 percent biotite and red garnet porphyroblasts are locally common

SYMBOLS

CONTACT--Dashed where approximately located

FAULT--Showing dip where known. Dashed where approximately located; dotted where concealed; queried where inferred. U, upthrown side; D, downthrown side. Bar and ball symbols on smaller faults where displacement is known

STRIKE AND DIP OF INCLINED BEDS

STRIKE AND DIP OF COMPACTION FOLIATION IN TUFFS

STRIKE AND DIP OF FOLIATION IN IGNEOUS AND METAMORPHIC ROCKS
- Vertical
- Inclined

JOINTS
- Inclined
- Vertical

AREAS OF ALTERATION
- Quartz "flooding"
- Sericitic alteration

VEINS

GOLD PLACERS

SITE OF K-AR DATED SAMPLE

MINE WORKINGS OR DEVELOPMENT
- Open pit
- Rock waste or tailings
- Shaft
- Adit
- Prospect pit
- Drill hole site

Locations of mineral deposits with number guide

(Numbers accompanying symbols on map correspond to deposit or group of deposits described in pamphlet (table 5). Larger symbol denotes mine with known production greater than $1 million. Dot in symbol denotes mine or prospect active in 1979 or 1980.)

Hydrothermal deposit
- Porphyry copper deposit
- Cu-bearing base-metal vein
- Quartz-molybdenite vein
- Area of Mo geochemical anomalies and (or) visual identification of molybdenite in veins or rhyolite dikes
- Quartz-specularite veins with precious- and base-metal deposits
- Quartz-pyrite veins with uranium
- Au-Ag-base-metal veins with uranium
- Au-Ag-base-metal veins with uranium and bismuth
- Bismuth-bearing base-metal vein
- Silver (Ag) vein
- Fluorite vein
- Turquoise vein

Sedimentary deposit
- Gold placer deposit

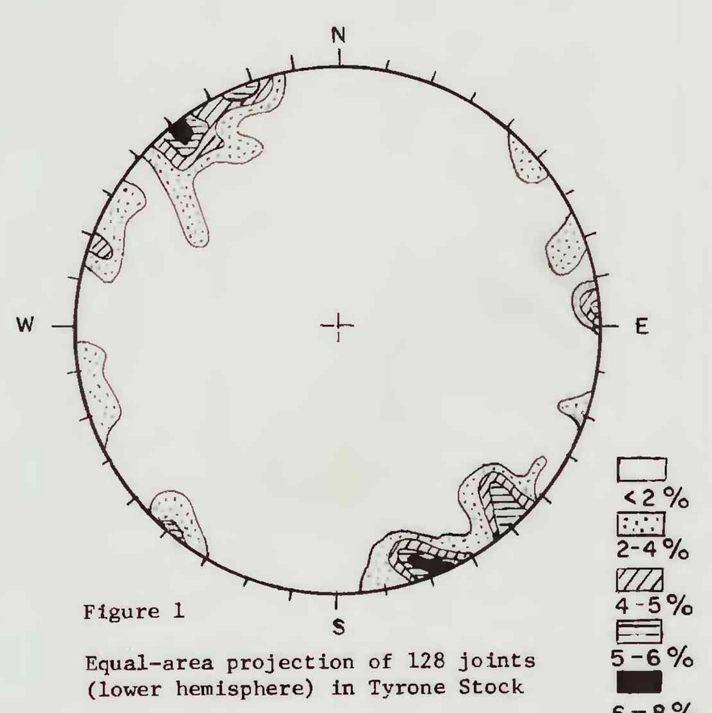


Figure 1

Equal-area projection of 128 joints (lower hemisphere) in Tyrone Stock

GRANITE OF BURRO MOUNTAIN

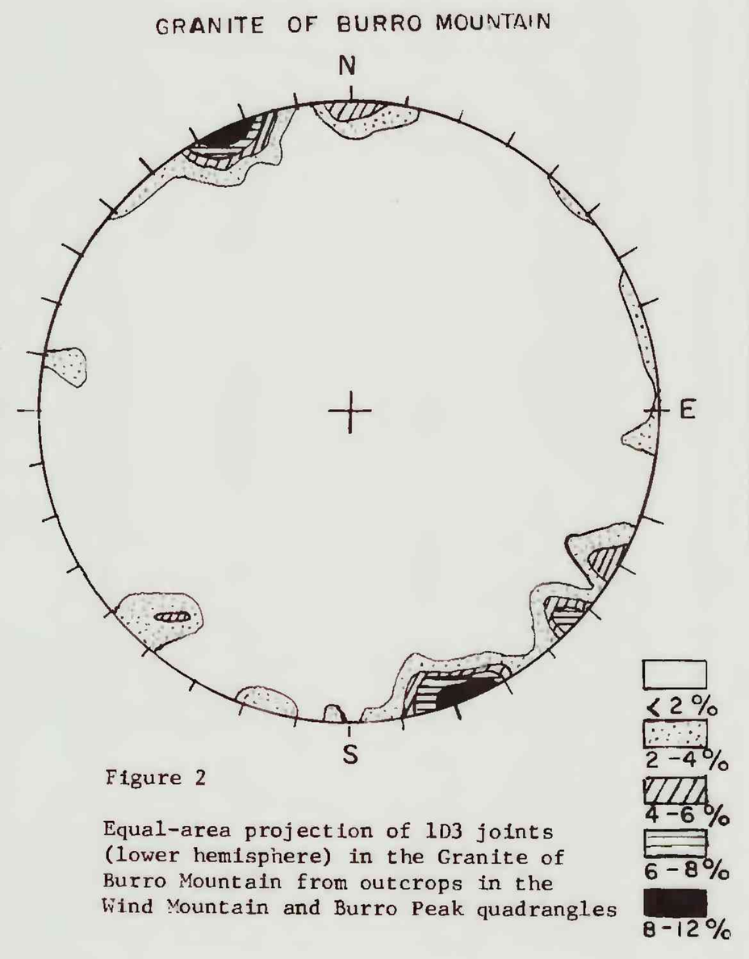
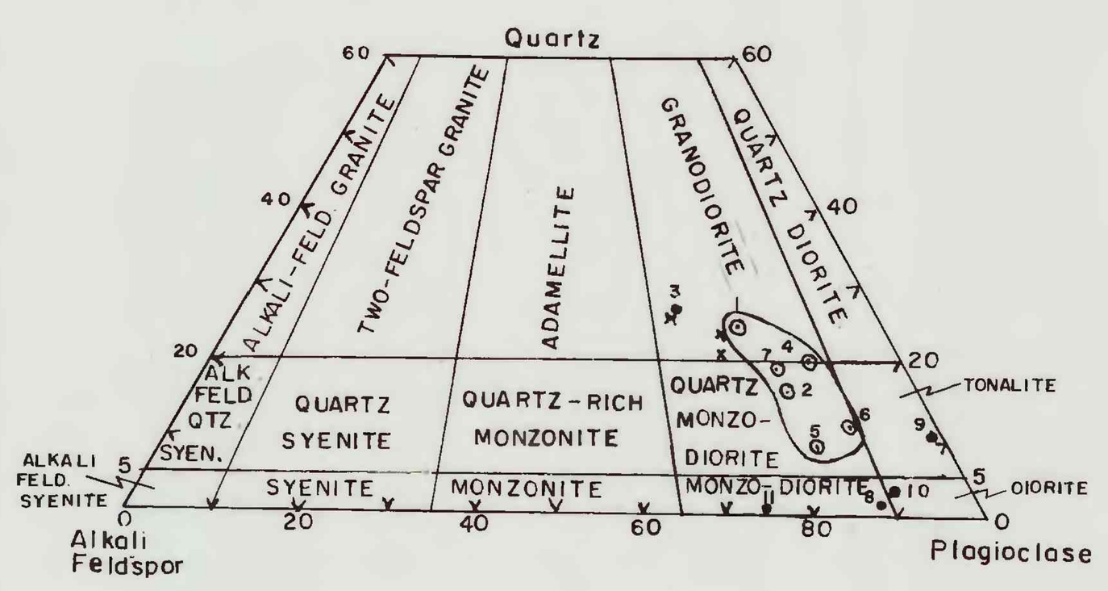
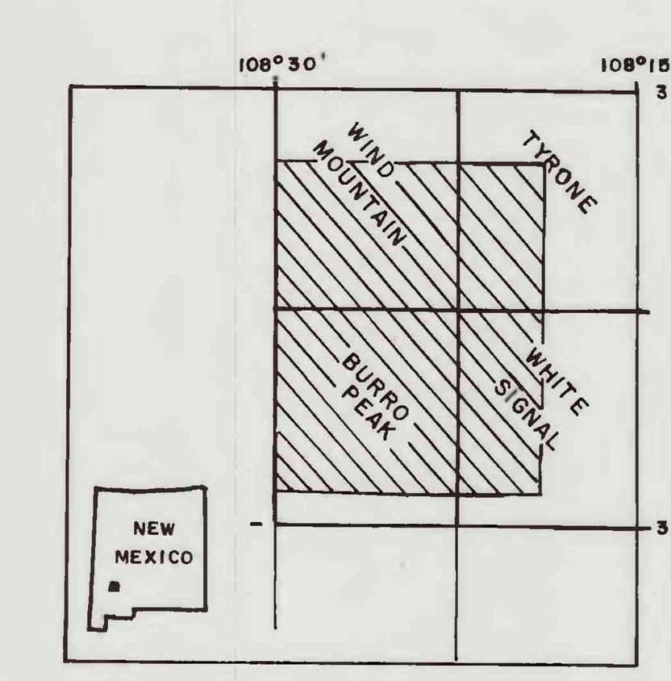


Figure 2

Equal-area projection of 103 joints (lower hemisphere) in the Granite of Burro Mountain from outcrops in the Wind Mountain and Burro Peak quadrangles



Ternary diagram, showing modal quartz, alkali feldspar, and plagioclase content of rocks from the Tyrone stock. Circles represent holocrystalline phases; dots are porphyritic rocks with phenocryst content represented; three (3) x-values are normative compositions for comparison purposes (all albite values for the normative composition are assigned to plagioclase). Note that most modes fall within the IUGS classification as quartz monzodiorite, monzodiorite, and granodiorite



This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

GEOLOGY, MINES, AND PROSPECTS OF THE TYRONE STOCK AND VICINITY, GRANT COUNTY, NEW MEXICO

By

D. C. Hedlund

1985