The Geology of the Aguila Mountains Quadrangle, Yuma, Maricopa, and Pima Counties, Arizona

by

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Abstract

The Aguila Mountains quadrangle is located in Yuma, Maricopa, and Pima Counties, Arizona. The northern part of the Aguila Mountains is a basalt-capped plateau underlain by tuffs and pyroclastics. The jagged peaks of the central part of the Aguila Mountains are deposits of tuff and pyroclastic rock, and flows and dikes of dacite, latite, and rhyolite. An area of breccia in the center of the highest peaks represents the main eruptive vent of the mountain range. Scattered hills at the south end of the range are largely latite and rhyolite-capped tuff. A prominent peak near the east edge of the area is tuff capped by an andesite flow remnant. The hills southwest of the Aguila Mountains are composed of schist and other metamorphic rock with granite at the southern end.

The alluvial apron surrounding the Aguilas reflects the characteristics of the source rocks. Volcanic gravel takes on a dense, black desert varnish on the older alluvium pavements. Granitic alluvium weathers into its constituent mineral grains that do not accumulate a varnish coating, causing early Holocene and older alluvium to be light toned. Pleistocene and older alluvium is generally found close to the mountains where it has become isolated by the slow downcutting of the streams. In the valleys surrounding the Aguila Mountains, where the gradient is less than 20 feet/mile, deposits of eolian silt predominate.

The structure of the Aguila Mountains is dominated by closely spaced, northwest-trending horsts and grabens, which are an expression of the regional Basin-and-Range structure. The geomorphology of the Aguilas indicates that the range has been tectonically inactive at least since the end of the Tertiary.

Introduction

The Aguila Mountains quadrangle is located in the Luke Air Force Range of southwestern Arizona. The Aguila Mountains are about 29 km southwest of the village of Sentinel, 64 km west-southwest of Gila Bend and 129 km east of Yuma. The north part of the range consists of a dissected plateau, tilted northward about 10 degrees (Bryan, 1925). Jagged peaks and hills dominate the central part of the range. These hills gradually decrease in size and become more scattered to the south. Also lying within the area of the quadrangle are the north end of the Granite Mountains and a few low hills at the southeast end of the Aztec Hills.

The geology of the Aguila Mountains was mapped at a scale of 1:62,500. The map will be published by the U.S. Geological Survey as a miscellaneous field studies map (Tucker and Tosdal, in press). Figure 1 is a reduced-scale version of the geologic map.

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Description of Lithologic Units

Q4 *Recent Alluvium:* unconsolidated gravel, sand, and silt. Stream channel structures are preserved. Soil development is totally lacking.

Qe *Eolian Deposits:* unconsolidated silt and fine sand. There are a few small dune groups near the western edge of the quadrangle. In other areas where the gradient is less than 20 feet/mile and the drainage basin area is too small to maintain stream channels, the eolian material accumulates around bushes and grasses, forming dunelike patterns.

Qp *Playa Deposits:* lacustrine clay and silt of recent accumulation. Near the eastern

DESCRIPTION OF MAP UNITS

Q4 RECENT ALLUVIUM--Unconsolidated gravel, sand and silt derived from bedrock and older alluvium. Stream channel structures are preserved. Soil development lacking.

Qe EOLIAN DEPOSITS--Unconsolidated silt and fine sand transported and deposited primarily by wind action.

Qp PLAYA DEPOSIT--Lacustrine clay and silt of recent accumulation.

Q3 HOLOCENE ALLUVIUM--Unconsolidated gravel, sand and silt. Surface characterized by bar-and-swale topography. Soils are Torrifluvents to Camborthids.

Qdf DEBRIS FLOW DEPOSITS--Stabilized deposits of coarse gravel that show evidence of mass movement. Located on or at the foot of steep slopes.

Q2 LATE PLEISTOCENE ALLUVIUM--Unconsolidated gravel, sand and silt. The surface is a smooth desert pavement with no bar-and-swale features. Soils are Haplargids.

Q2a MIDDLE PLEISTOCENE ALLUVIUM-- Moderately indurated gravel and sand. Surface morphology is a lag gravel composed of cobbles of volcanic rock and pieces of caliche. Upper soil horizons have been removed by erosion leaving only the Cca horizon. Outcrops only in the southeast quadrant of the map.

Q1 EARLY PLEISTOCENE ALLUVIUM--Indurated gravel and sand. Upper soil horizons removed by erosion leaving only the petrocalcic Cca horizon. Exposed only along the cut bank of a stream just west of Thompson Tank on the west side of the Aguila Mountains.

QTb BASALT OF THE SENTINEL VOLCANIC FIELD--Dark bluish-gray, fine-grained olivine basalt. Occurs only in the northeast corner of the map. Radiometric ages for basalt of the Sentinel volcanic field range from late Pliocene to very early Pleistocene (Eberly and Stanley, 1978).

Tb4 BASALT 4--Coarse grained, dark gray to black andesitic basalt with plagioclase phenocrysts up to 1 cm. Occurs only in the northeast corner of the map.

Tb3 BASALT 3--Medium grained, medium gray iddingsite basalt. Occurs north of the Aguila Mountains. Has apparently not been subjected to basin-and-range faulting.

Tb2 BASALT 2--Fine grained, medium gray iddingsite basalt that occurs as two moderately-preserved spatter cones with surrounding flows atop the north-tilted plateau at the north end of the Aguila Mountains. Youngest unit within the area of the map to have been ruptured by basin-and range faulting.

Tb1 BASALT 1--Dark gray, fine-grained olivine basalt without iddingsite alteration. Caps the entire north plateau of the Aguila Mountains. The upper surface of the basalt has eroded to form a coarse lag gravel of basalt and petrocalcic caliche.

Tt TUFF AND PYROCLASTIC ROCK--Light yellowish-brown to light reddish brown unsorted lithic tuff composed of ash to block-sized angular clasts of latite and rhyolite. Includes violently erupted pyroclastic material with blocks up to 8 m in size. Veins of gypsum and psilomelane, barite crystals, and celadenite alteration occur in the tuff.

Tr RHYOLITE AND LATITE--Light gray to purplish-gray to reddish-brown porphyritic rhyolite and latite. Groundmass very fine grained, but not glassy. Phenocrysts of feldspar and biotite are found in both rock types. Very small quartz phenocrysts, under 0.5 mm, are present in the rhyolite.

Ta ANDESITE--Purplish-gray porphyritic andesite. Subhedral phenocrysts of andesine are about 1 mm and the groundmass is very fine grained, almost glassy. No quartz is visible even in microscopic examination of thin-sections. The rock has a slightly trachytic texture. Caps the peak just south of the playa (Qp) near the east edge of the map.

Tec ERUPTIVE COMPLEX--Highly complex and chaotic collection of breccia, deformed rhyolite and latite flows, tuff, agglomerate, and pyroclastic rocks. Accidentals of granitic rock (Mzg) and sandstone (Ts) are present.

Td DACITE--Dark purplish-gray to gray to bright brownish-red, coarsely porphyritic dacite. Plagioclase phenocrysts are uniformly large (5 to 15 mm) and white to brown to red in color. Some phenocrysts show sericite alteration. Groundmass is about 20% quartz. Occurs as thick, vesicular flows in the northwest quadrant of the Aguila Mountains. Elsewhere it is massive, non-vesicular, and apparently intrusive.

Twt WELDED TUFF--Brownish-red, porphyritic welded tuff with small (2 to 10 cm long and 1 cm thick) lenses of pink, devitrified glass. Sanidine phenocrysts are small (1 mm). Occurs only on the west side of the range beneath the dacite flows.

Ts SANDSTONE--Light purplish-brown, fine-grained, moderately indurated, friable sandstone. Sand grains, mostly quartz, are about 0.2 mm in diameter, subangular, and frosted. Broad, sweeping cross-beds suggest deposition in a dune environment. Interbedded with the dacite flows in places, but mostly deposited before the onset of volcanic activity.

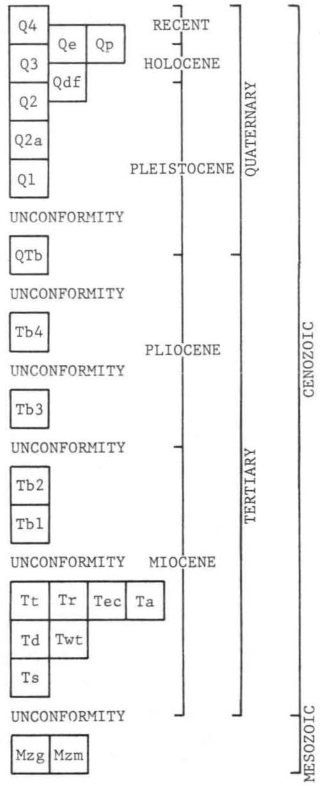
Mzg UNDIFFERENTIATED GRANITIC ROCKS--In the Granite Mountains and the southern part of the Aguila Mountains: Porphyritic quartz monzonite with large (5 - 10 mm) potassium feldspar phenocrysts. Biotite is altered to chlorite in places. The rock is highly fractured and unfoliated (Richard Tosdall, verbal communication, 1979).

Mzm METAMORPHIC ROCKS--Schist, amphibolite, and quartzite. Structure, foliation, and schistosity oriented more or less randomly. Quartz veins cut across the rock at an angle to the foliation. Outcrops in the Aztec Hills and the southwest part of the Aguila Mountains.

Contact

Fault

CORRELATION OF MAP UNITS



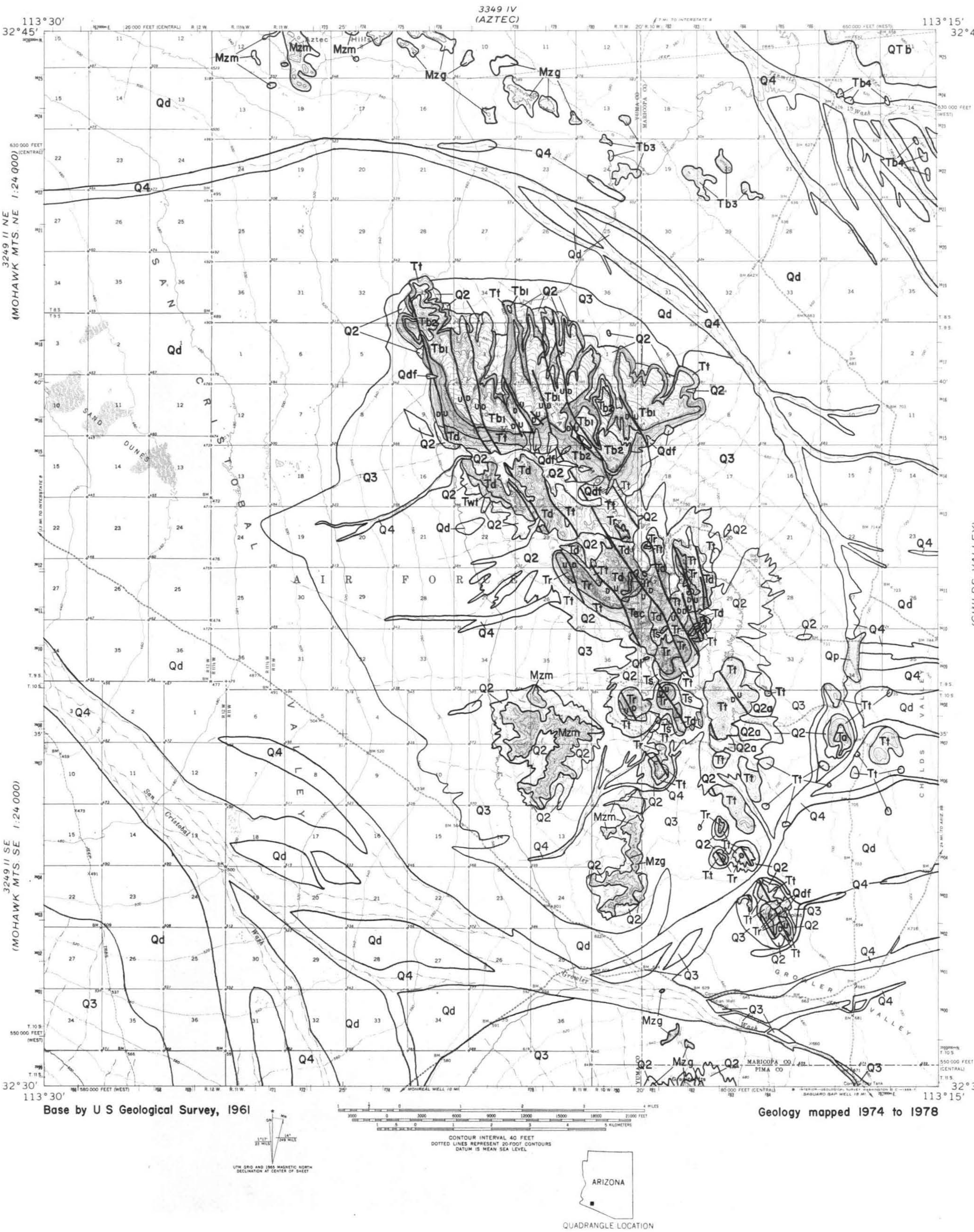


Fig. 1. Geologic map of the Aguila Mountains Quadrangle, Arizona.

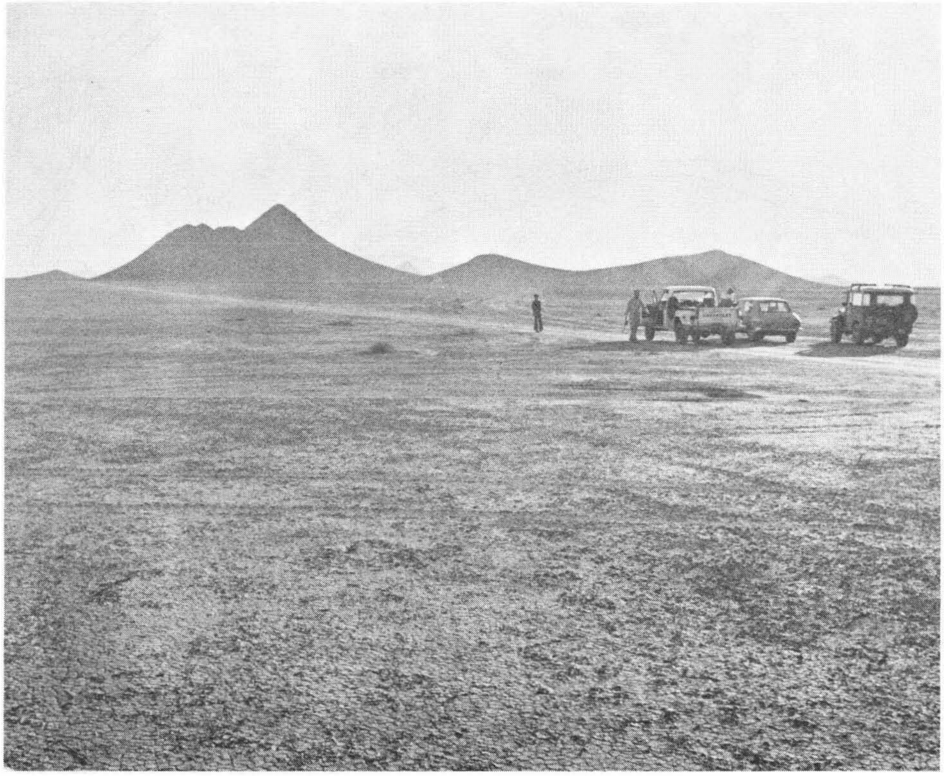


Fig. 2. Playa near the east edge of the Aguila Mountains quadrangle. Playa Peak is in the background.

Fig. 3. Q3b surface on the east side of the Aguila Mountains. Note bar-and-swale topography.

edge of the quadrangle is a playa, which is a little more than 1 km long and 0.3 km wide (Fig. 2). This playa is not the product of interior drainage; rather, it is situated on a divide. When runoff from Childs Valley reaches the divide, the thick growth of phreatophytes temporarily dams up the water and forms the playa. The surface of the playa is very smooth and has closely spaced desiccation cracks.

Q3 *Holocene Alluvium:* unconsolidated gravel, sand, and silt. This unit can be separated into three members based on surface morphology and soils (Fleischhauer, 1978). Q3c, youngest Holocene alluvium, has a partially formed desert pavement with sand and silt mixed with gravel on the surface and no soil development other than an incipient A horizon. Q3b, middle Holocene alluvium, has bar-and-swale topography (Fig. 3), fully developed pavement, and an A-C soil profile with no $CaCO_3$ accumulation. On aerial photography Q3b shows a distinctive plumose or braided texture. The Q3b surfaces are the youngest that preserve the Indian trails that mark the Hohokam occupation of this area, which apparently ended some 1,000 years ago (based on artifacts associated with the trails). Q3a, oldest Holocene alluvium, has subdued, barely visible remnants of bars and swales on an otherwise smooth pavement surface. The soil profile is still A-C, although the C horizon shows a concentration of $CaCO_3$. The lack of an argillic soil horizon indicates that Q3 alluvium has not experienced the more humid climate of the Pleistocene. The scale of mapping precluded fully distinguishing the three members of Holocene alluvium. Due to the difficulty in separating Q3a surfaces from older Pleistocene surfaces on aerial photography, Q3a was mapped as Q2. Q3b and Q3c were mapped together as Q3.

Qdf *Debris Flow Deposits:* stabilized deposits of coarse gravel that show evidence of mass movement. The debris flows are mostly located on slopes capped by basalt. They display levees of boulders marking the margins of the flows and lobate deposits of boulders and coarse gravel at the foot of the slopes. The boulders are uniformly coated with dense, black varnish and exhibit weathering rinds 5 to 10 mm deep, indicating that they have been subjected to weathering for a considerable period of time. The debris flows of the Aguilas are probably relics of the climatic change from the Pleistocene to the Holocene when the relatively rapid reduction in vegetative cover left the talus-covered slopes more vulnerable to mass movement.

Q2 *Late Pleistocene Alluvium:* unconsolidated gravel, sand, and silt. The surface of the alluvium is a smooth pavement with no trace of bar-and-swale features. The gravel that makes up the pavement has a dense coating of varnish with black on the upper surfaces and orange on the under surfaces except in alluvium derived from granite. The soil of Q2 alluvium has well-developed A, B, and C horizons. There has been clay illuviation to form cambic or argillic horizons.

Q2a *Middle Pleistocene Alluvium:* moderately indurated gravel and sand. This unit crops out only in one small area around the tuff hills in the southeast quadrant of the area. The surface morphology is a lag gravel composed of cobbles up to 30 cm in diameter and gravel-sized pieces of caliche. The source of most of the gravel was the tuff and pyroclastics unit (Fig. 1) as indicated by the lithology of the gravel and the large quantity of clear to milky chalcedony that is found on the surface. The A and B soil horizons have been removed by erosion and the calcic C horizon is at the present-day surface.

Q1 *Early Pleistocene Alluvium:* indurated gravel and sand. The one outcrop of this unit found in the area is exposed by the deeply incised stream about 50 m west of Thompson Tank on the west side of the Aguilas in the W½ sec. 31, T. 9 S., R. 11 W. At this exposure the Q1 is overlain by about 1 m of Q2 alluvium. All of the upper soil horizons of the Q1 alluvium have been removed leaving only the petrocalcic Cca horizon. The Q1 alluvium probably underlies most of the alluvium surrounding the mountains.

QTb *Basalt of the Sentinel Volcanic Field:* dark bluish-gray, fine-grained olivine basalt, vesicular in places. The flows of the Sentinel volcanic field lap onto the northeast corner of the quadrangle. Radiometric ages for the Sentinel basalt are 1.75 m.y. for Sentinel Peak and 3.0 m.y. for the flows just south of the Gila River (Eberly and Stanley, 1978) located, respectively, to the north and north-northwest of the quadrangle.

Tb4 *Basalt 4:* coarse-grained, dark-gray to black andesitic basalt. This basalt is characterized by large (up to 1 cm) phenocrysts of plagioclase in a granular groundmass. It occurs in the quadrangle area only as scattered low hills in the northeast corner near the edge of the Sentinel basalt flows. A hill of basalt, identical in mineralogy to Tb4 occurs about 9 km to the north within the Sentinel volcanic field. The age of this basalt is probably Pliocene. The age estimates of this and the other basalts within the area of the quadrangle are based on their relationship to the mid-Miocene block-faulting episode (Eberly and Stanley, 1978) and the relative preservation of their volcanic structures such as flows and spatter ramparts.

Tb3 *Basalt 3:* medium-grained, medium-gray iddingsite basalt. The alteration of olivine to iddingsite is constant throughout this basalt. The rusty grains of iddingsite and the granular nature of the groundmass are diagnostic of this unit. The black hills north of the Aguila Mountains appear to be a southeastward extension of the Aztec Hills and are composed entirely of basalt 3. The age is probably Pliocene and slightly older than basalt 4. Basalt 3 shows no evidence of faulting.

Tb2 *Basalt 2:* fine-grained, medium-gray iddingsite basalt. This unit is found in two areas on the basalt-capped plateau of the northern part of the Aguila Mountains. At the southeast corner of the plateau at Eagle Peak (Eagle triangulation point, elevation 1,800 feet (656 m), see Fig. 8), basalt 2 occurs as an ill-defined semicircular ridge open to the east. At the northwest corner of the plateau basalt 2 occurs as a fairly well preserved crater with an inner rampart and outer slopes of angular blocks and bombs of vesicular basalt. On aerial photography basalt 2 has a medium-gray tone with a smooth, almost velvety texture. Even though the unit apparently erupted from two separate locations, the identical lithologies suggest that the magma must have been from a common source. Basalt 2 is the youngest unit in the quadrangle that has been ruptured by faulting.

Tb1 *Basalt 1:* dark-gray, fine-grained olivine basalt without iddingsite alteration. This basalt caps the entire north plateau of the Aguila Mountains. It underlies basalt 2 and has been deposited directly atop the uppermost volcanic alluvium of the tuff-pyroclastic unit. Most of basalt 1 is highly vesicular and occurs as several individual flows each about 2 m thick. The greatest thickness, just south of Eagle Peak, is about 15 m. The flows dip toward the north at a fairly uniform 10 degrees. The upper surface of the basalt is littered with weathered cobbles and boulders of basalt and gravel and cobbles of petrocalcic caliche. There is no trace of the original flow-top surface. The mixture of basalt and caliche gives the unit a light-gray, speckled appearance on aerial photographs. Basalt 1 has been broken by numerous high-angle, normal faults and displays clearly the horst-and-graben nature of the faulting (Fig. 4).

Tt *Tuff and Pyroclastic Rock:* light yellowish-brown to light reddish-brown unsorted lithic tuff composed of ash- to block-sized angular clasts of latite and rhyolite. This unit is found throughout the Aguila Mountains. The rock is almost totally without sorting,

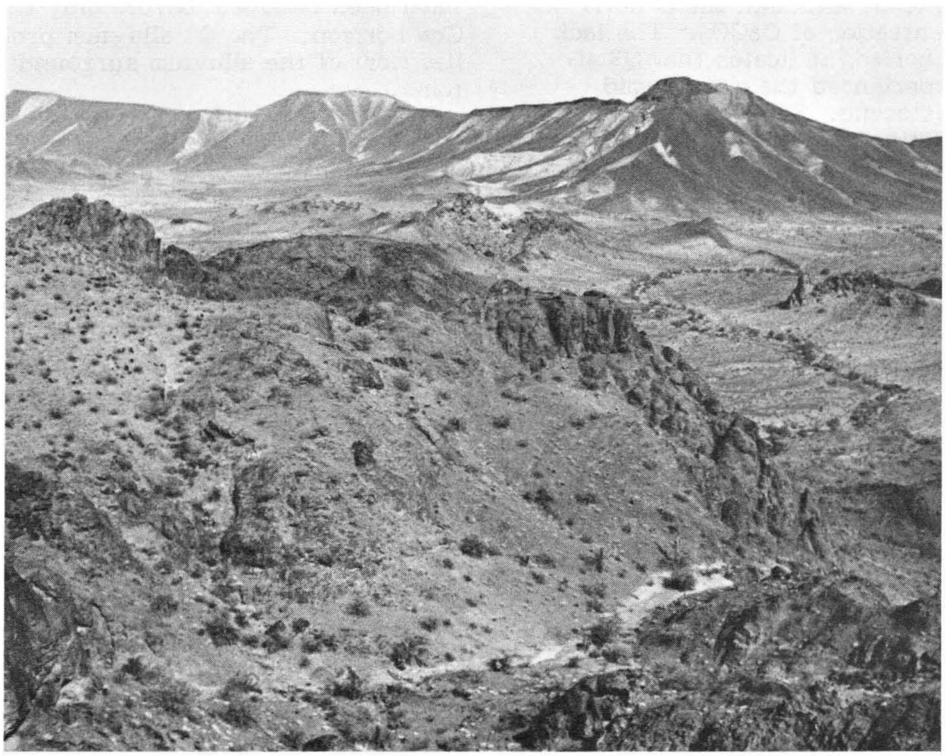


Fig. 4. View across dacite outcrops toward the south-facing scarp of the basalt-capped plateau. The faulting of the basalt can be seen. Eagle Peak is on the right skyline.

grading, or bedding of clasts. In some places it is an air-fall tuff with mostly fine-grained (under 4 mm) clasts. In other places it is violently erupted pyroclastic material composed of highly angular, brecciated rock with blocks up to 8 m. In places the unit is shot through with small (1 to 5 cm) veins of gypsum and psilomelane. Where the northwest-trending faults cut through the pyroclastics, the rock is not only sheared and mylonitic but also has an accumulation of light-green celadonite. Grayish barite crystals occur along some of the faults. Chunks of colorless to milky chalcedony up to 10 cm across are found throughout the unit. On aerial photography this unit is light toned and forms rounded hills. Where the rock is welded it can form cliffs and rugged, if somewhat rounded, landforms.

Tr *Rhyolite and Latite:* light-gray to purplish-gray to reddish-brown porphyritic rhyolite and latite. Groundmass is very fine grained but not glassy. Phenocrysts are feldspar and biotite in both rock types, and quartz crystals occur in the rhyolite. Phenocrysts are small, never larger than 1 mm for the feldspar and 2 mm for the biotite. Quartz phenocrysts are smaller than 0.5 mm and are barely recognizable with a hand lens. Feldspar phenocrysts are sanidine for the rhyolite and plagioclase for the latite. The latite and the rhyolite are mapped together as one unit because of the difficulty in telling the two rocks apart due to their similar color and small phenocrysts and the virtual impossibility of discriminating between them on aerial photography. Both rock types occur as flows and intrusions and both display the same jagged, vertically faced outcrops (Fig. 5). The tops of flows are vesicular and brecciated. Individual flows are between 10 and 30 m thick. The rock is slightly altered in places, but there has been very little postdepositional mineralization.

Ta *Andesite:* purplish-gray porphyritic andesite. The groundmass is extremely fine grained, almost glassy. Phenocrysts are also small, about 1 mm, and are subhedral plagioclase. The rock has a slightly trachytic texture. A thin section of the rock shows no quartz in either phenocrysts or groundmass. Within the study area, this unit is found at only one location, on the upper half of Playa Peak, the 1,200-foot (437 m) (above sea level) hill just south of the playa on the eastern edge of the quadrangle (Fig. 2).

Tec *Eruptive Complex:* breccia, deformed rhyolite and latite flows, tuff, agglomerate, and pyroclastic rocks. This unit represents the eruptive center of the Aguila Mountains. Angular chunks of granite and sandstone are present within the eruptive complex (Fig. 6). There is no dacite anywhere within the eruptive complex even though dacite surrounds it on two sides. This suggests that the dacite

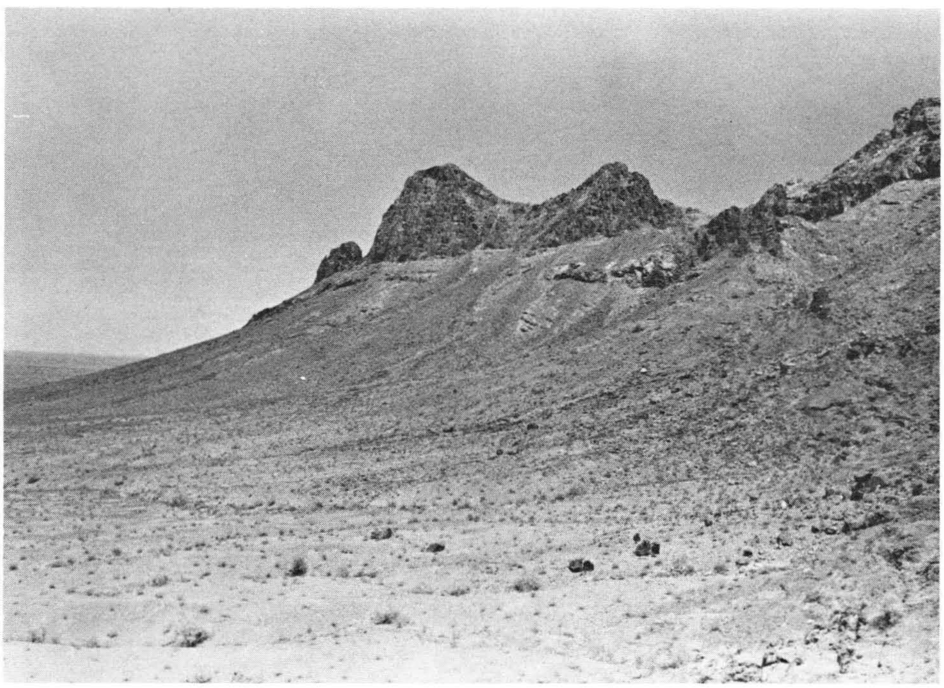


Fig. 5. Latite flows atop tuff and pyroclastic rock. West edge of the Aguila Mountains, 2 km northwest of Thompson Tank.

Fig. 6. Breccia from the eruptive complex. Sandstone accidental beneath head of hammer.

Fig. 7. Pre-volcanic sandstone showing cross-bedding. West edge of the Aguila Mountains, 300 m south of Thompson Tank.

is older and was completely removed from the area of the eruptive complex during the explosive eruptions that produced the rhyolite, latite, and pyroclastic rock of the Aguila Mountains. Aerial photographs show clearly the chaotic nature of this unit.

Td *Dacite:* coarsely porphyritic dacite occurring in a variety of colors. Dark purplish-gray rock with large (5 to 15 mm) white plagioclase phenocrysts is the most common variety of the dacite. Pockets of altered dacite are found throughout the outcrop area with both groundmass and phenocrysts bright brownish-red. In the central and southern parts of the outcrop area the dacite is massive, has widely spaced joints, and appears to be intrusive. It is in this area that there are numerous natural tanks worn into the rock allowing the catchment of rainwater. To the northwest the dacite forms at least two distinct flows with brecciated bases, vesicular tops, and interiors that display, through closely spaced joints, a swirling flow structure. Flow tops are red, oxidized, and vesicular. A discontinuous layer of fine-grained, light purplish-brown sandstone, containing clasts of vesicular dacite, is found between the two dacite flows. In a hand specimen the rock appears to be andesite, but a thin section of the rock shows the groundmass to be about 20 percent quartz. The phenocrysts are roughtly 60 percent andesine, some of which have been altered to sericite. Quartz is also found as euhedral crystals filling cavities in the rock. On aerial photographs the dacite is recognized by its dark tone and rounded form.

Twt *Welded Tuff:* brownish-red porphyritic welded tuff with small (2 to 10 cm) lens-shaped bodies of pink aphanitic material. Small (1 mm) phenocrysts of sanidine are scattered throughout the darker portion of the rock. The groundmass and the pink portions of the rock have a dull, glassy texture. The welded tuff appears to be a single flow unit with an average thickness of around 25 m. The welded tuff occurs only along the west edge of the Aguila Mountains about 2 km south of the basalt-capped plateau in the SE¼ sec. 15, T. 9 S., R. 11 W.

Ts *Sandstone:* light purplish-brown, fine-grained, moderately indurated sandstone. Sand grains are about 0.2 mm in diameter, subangular, and frosted. The sand is mostly quartz, but some feldspar and other minerals are present. The rock has broad, sweeping cross beds but appears to be more or less horizontal (Fig. 7). The sandstone contains no volcanic detritus except where it is interbedded with the dacite flows. The sandstone shows no signs of alteration or mineralization. No fossils or organic remains have been found in this unit. The sandstone crops out in only a few places, and it is not readily identifiable on aerial photography.

Mzg *Undifferentiated Granitic Rocks:* There are only a few occurrences of granitic rocks within the Aguila Mountains quadrangle: the southern part of the Aztec Hills and the north end of the Granite Mountains and its extension north of Growler Wash. The Granite Mountains are actually porphyritic quartz monzonite with phenocrysts of potassium feldspar. The biotite shows some chlorite alteration in places. The rock is highly fractured and foliated (Richard Tosdal, oral communication, 1979). The mapping of granite within the Aztec Hills is based on the photo-interpretive criteria for granitic rocks elsewhere in the quadrangle: light-toned bedrock, sharp ridge crests, even and steep slopes, and surrounding light-toned alluvial surfaces. All of the granitic rock within the area of the quadrangle is considered to be part of the Gunnery Range batholith of Laramide age (Richard Tosdal, oral communication, 1979).

Mzm *Metamorphic Rocks:* schist, amphibolite, and quartzite. Orientation of foliation and schistosity is random. Quartz veins cut through the rock at an angle to the foliation but have no systematic arrangement. All of the rock shows considerable metamorphism and alteration, but no unusual or potentially economic mineralization was noted. The most recent metamorphism was probably coincident with the emplacement of the Gunnery Range batholith. The outcrop area is the hills at the southwest corner of the Aguilas and part of the south end of the Aztec Hills.

Ages and Correlation of the Lithologic Units

The Gunnery Range batholith, which crops out across much of southwestern Arizona, has been considered to be Mesozoic in age (Wilson, Moore, and Cooper, 1969). Recent radiometric dating of these rocks tends to confirm this estimate (Daniel Lynch, oral communication, 1979). The geologic record is missing until the deposition of the eolian, prevolcanic sandstone probably in the early Miocene. The first stage of volcanic activity, which formed the Aguila Mountains, was the eruption of the dacite and welded tuff. These rocks were formed at approximately the same time. The deposition of eolian sand continued while these flows were being erupted. The eruption of rhyolite and latite flows, pyroclastics, and tuff followed next. This was a separate period of volcanism from the dacite and welded tuff, but there is no evidence that any great interval of time passed between the two episodes. The andesite that caps Playa Peak appears to have been erupted at the same time as this second episode. Correlation of these two closely spaced periods of volcanic rock formation with radiometric ages of similar rock types in southwestern Arizona would put their formation at 20 to 25 m.y. B.P. (Eberly and Stanley, 1978). An unknown period of time then followed during which the volcanic mass of the Aguila Mountains was eroded and streams deposited volcanic sand and gravel on the pyroclastic debris north of the mountains. Two series of basalt flows, the latter being more restricted areally and having a slightly different chemical makeup, covered the area north of the mountains. The major pulse of basaltic volcanism in southwestern Arizona was, on the average, slightly later than the rhyolitic and andesitic volcanism (Eberly and Stanley, 1978). This would give the basalt flows of the northern part of the Aguila Mountains an age of 15 to 20 m.y. The Basin-and-Range faulting in southwestern Arizona, which occurred after the second series of basalt flows, has been dated as occurring between 10.5 and 13 m.y. ago and is referred to as the late Miocene block-faulting episode (Eberly and Stanley, 1978). Well after the block faulting had ceased and the rate of sediment accumulation in the basins had slowed, there were two minor events of basaltic volcanism probably about 5 m.y. ago. The Sentinel volcanic field, which was formed after these events, has been dated at 1.75 to 3.0 m.y. B.P. (Eberly and Stanley, 1978).

Five samples have been submitted to the Laboratory of Isotope Geochemistry at The University of Arizona. These are listed in Table 1. Figure 8 shows the location of the samples.

Table 1. Samples Submitted for Age Dating

	Sample	Number
Tb2	Iddingsite basalt	UAKA-79055*
Td	Dacite (intrusive)	UAKA-79056
Twt	Welded tuff	UAKA-79057
Td	Dacite (extrusive)	UAKA-79058
Tb3	Iddingsite basalt	UAKA-79059

*For radiometric age determinations and data, see Shafiqullah and others (this volume, Table 1, No. 131).

Structure and Tectonics

The structure of the Aguila Mountains is dominated by closely spaced, northwest-trending horsts and grabens. The basalt-capped plateau of the north half of the range affords an opportunity to observe the sense and degree of faulting that is almost unique among the mountain ranges of southwestern Arizona. This faulting reflects the structural grain of the region and its northwest-trending mountain ranges. The other ranges of southwestern Arizona are composed of either plutonic or metamorphic rocks in which there is little or no evidence of the nature of the faulting or rhyolitic and andesitic flows and dikes in which the morphology of the faulting is lost in the resulting chaotic landscape. The few faulted, basalt-capped plateaus other than the Aguila Mountains are so small in area that their structural picture is incomplete and inconclusive. It is likely that the structure displayed in the Aguila Mountains extends across the region and that the late Miocene Basin-and-Range faults are closely spaced, high-angle, normal faults with the basins being predominantly grabens and the ranges predominantly horsts.

Geophysical surveys across the area tend to confirm the presence, suggested by present-day topography, of northwest-trending basins and ranges. The Bouguer gravity anomaly map of Arizona (West and Sumner, 1973) shows a pronounced gravity-low anomaly over the San Cristobal Valley, indicating a deep, alluvium-filled basin. However, there is no such gravity-low anomaly over Childs Valley to the east of the Aguilas, which suggests that the valley is not a deep alluvium-filled basin like most of the valleys of southwestern Arizona. There are no gravity indications of a structural basin between the Aguila Mountains and the Aztec Hills to the north. Neither is there any apparent structural separation between the granite and metamorphic rocks of the southwest corner of the Aguilas and the Granite Mountains to the south. The free-air gravity map of Arizona by Aiken, Schmidt, and Sumner (1976) indicates that the area has not yet fully isostatically recovered from the Basin-and-Range faulting. This could account for the relatively frequent low-magnitude earthquakes that have occurred within the Luke Air Force Range (U.S. Bureau of Reclamation, 1976). The residual aeromagnetic map of Arizona by Sauck and Sumner (1970) shows a rising magnetic gradient from the Aguila Mountains to the Crater Mountains to the east. This is accounted for by the volcanic rocks of these two ranges and the numerous volcanics between the two ranges and the area to the north. To the west and south of the Aguilas the residual magnetic variation is low and there is only a very low gradient so that there must be little difference in magnetite content between the granitic and metamorphic ranges and the intervening alluvium-filled basins.

The Aguila Mountains show no evidence for any tectonic activity during the Quaternary. The mountain fronts are highly sinuous, indicating a considerable erosional retreat from any mountain-bounding structures. The ages of the alluvium exposed around the Aguilas indicate that sediment accumulation on the

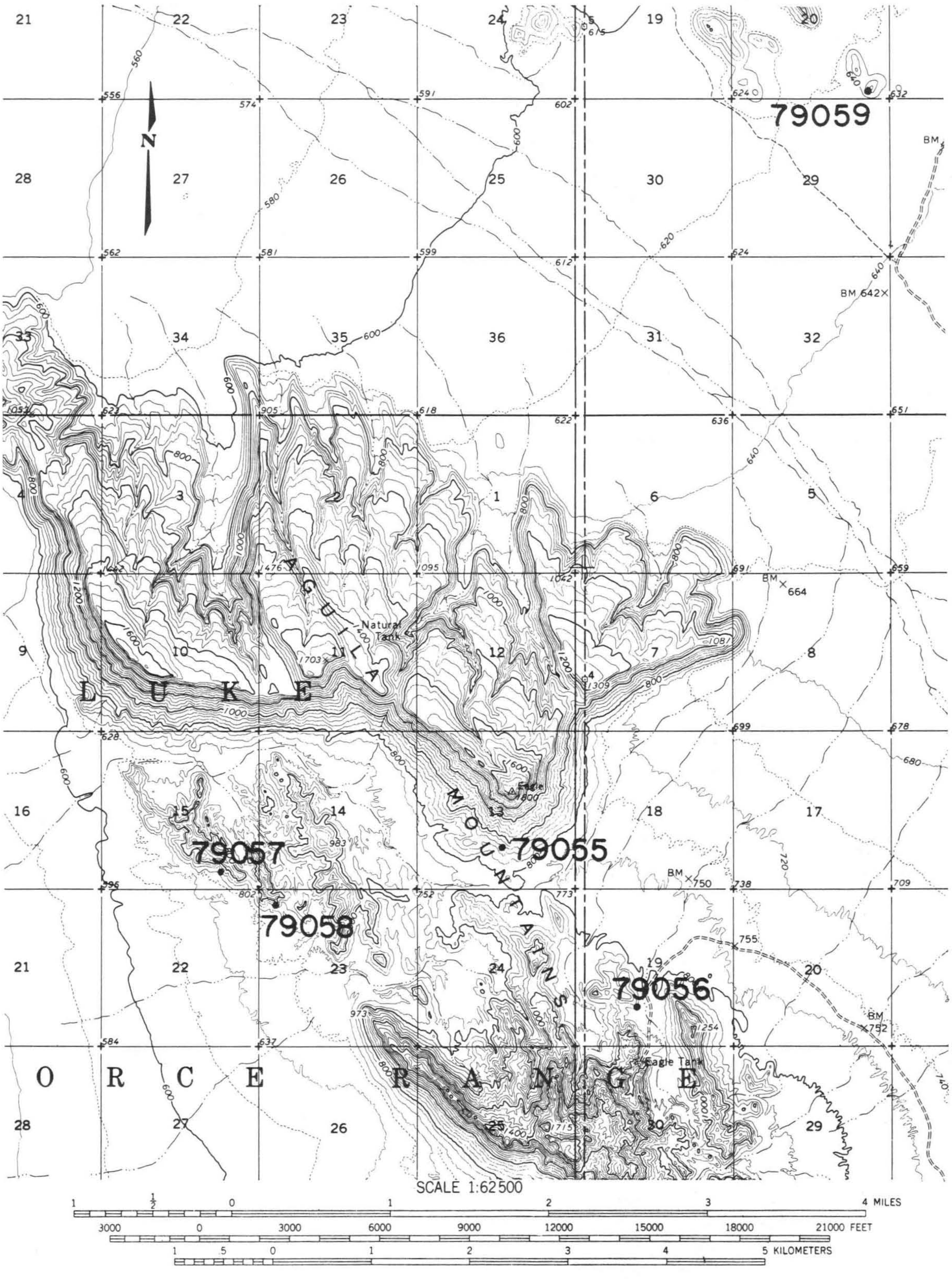


Fig. 8. Location of samples for dating.

piedmont has been fairly continuous but not at a rate high enough to suggest a tectonic lowering of piedmont stream base levels.

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