Geologic Map of the Little Horn Mountains 30' x 60' Quadrangle, southwestern Arizona

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Scale 1:100,000

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MAP UNITS

Quaternary sedimentary deposits

All Quaternary units except talus (Qt) and undivided surficial deposits (Qs) that are shown on the map were defined by *Demsey* (1990) and descriptions of these units given here are repeated verbatim or condensed from her report. Deposits were classified by Demsey based on the estimated time since the end of deposition, which was inferred based on degree of channel entrenchment, erosional degradation and rounding of channel margins, height of surfaces above channel bottoms, and degree of development of soils and desert varnish. Contacts between Quaternary map units and bedrock were determined by Demsey largely by aerial photograph analysis and were generalized so that they could be represented at 1:100,000 scale. More recent detailed maps of bedrock, primarily at 1:24,000 scale, show that many areas outlined as bedrock by Demsey are in fact Quaternary surficial deposits. It was thus necessary to assign Quaternary map units to areas of surficial deposits that were depicted as bedrock by *Demsey* (1990). These areas typically consist of canyon bottoms and flanking talus where various Quaternary units are complexly intermixed, and are commonly represented on this map as undivided surficial deposits (Qs). In other areas units identified by Demsey were extended to include adjacent areas previously depicted as bedrock, and in a few areas aerial photograph analysis was used to map previously unmapped surficial deposits.

Qs **Undivided surficial deposits** ***(Quaternary)***--Primarily areas that were not surveyed by *Demsey* (1990) and are complex mixtures of several surficial map units in canyons and on the flanks of bedrock exposures.

Qyc **Active alluvium** ***(late Holocene, ≤1 ka)***--Active and recently active channel deposits of major drainages. Primarily unconsolidated silt, sand and gravel and, in the Gila River bed, coarse gravel and cobbles. Clasts are not varnished.

Qy **Young alluvium** ***(Holocene, 0-10 ka)***--Young unconsolidated alluvial fan deposits, active deposits, low terraces of small channels, and terraces of major drainages. Deposits are primarily silt, sand, and fine gravel, with local coarser gravels and cobbles. Clasts are typically unvarnished but basalt clasts may be slightly varnished.

Qye **Eolian deposits** ***(Holocene, 0-10 ka)***--Eolian sand and silt typically forming small sand dunes and hummocky or corrugated surfaces.

Qt **Talus** ***(Holocene to late Pleistocene)***

Qm_2 **Younger middle alluvium** ***(late Pleistocene, 10-250 ka)***--Typically gravelly sand and silty sand that form channel terrace and alluvial fan deposits. Surfaces are generally planar with local incision to depths of ≤2 m and may be capped by gravely to cobbly pavement. Surface clasts are typically lightly to very darkly varnished.

Qm_1 **Older middle alluvium** ***(middle Pleistocene, 250-790 ka)***--Typically gravelly to extremely gravelly sand and silty sand that form terrace and alluvial fan deposits. Surfaces are generally planar with local incision generally to depths of ≤3 m, and locally to ≤5 m, along interfluves that have erosionally rounded margins. Surfaces are generally capped by gravely to cobbly pavement, and surface clasts are typically lightly to very darkly varnished.

Qm **Middle alluvium, undivided** ***(late to middle Pleistocene, 10-790 ka)***--Units Qm_1 and Qm_2, undivided. This designation was used in areas where subunits were complexly intermixed and subdivision was difficult at the map scale, or because of uncertainty in applying subdivision. Unit is widely shown in agricultural areas of the Harquahala Plains where mapping is based primarily on Soil Conservation Service soil survey maps.

Qmo Older middle to older alluvium ***(middle to early Pleistocene)***--Generally gravelly to extremely gravelly axial-valley terraces and alluvial fan deposits. Abundant very darkly varnished clasts and pedogenic carbonate fragments (≤ about 3 cm thick) characterize surfaces. Interfluves are generally 2-4 m deep, locally up to 10 m deep, and margins are moderately rounded by erosion. Pavement is generally moderately to poorly preserved and color is generally intermediate between very dark Qm_1 and light Qo surfaces. The age of this unit was estimated at 500-1000 ka by *Demsey* (1990) but, where this unit was expanded to cover areas not designated as Quaternary by Demsey, the age is estimated to cover the full range of the middle to early Pleistocene (250-1,800 ka; equivalent to map units Qm and Qo).

Qo Older alluvium ***(early Pleistocene, 790-1800 ka)***--Generally gravelly to bouldery axial-valley terraces and alluvial fan deposits. Unit is restricted to oldest alluvial deposits that have at least partially preserved depositional surfaces. Remnants of depositional surfaces, generally confined to broad, erosionally rounded ridges, are highly degraded and covered by abundant pedogenic carbonate fragments (≤ about 7 cm thick). Gullies and deeply incised channels are typically 2-15 m deep and are locally up to 25 m deep.

Quaternary to upper Tertiary sedimentary and volcanic units

QTp Pedogenic carbonate ***(early Pleistocene to Pliocene)***--White to gray, highly resistant carbonate, up to 2 m thick, on gently sloping to horizontal, topographically elevated areas in the Little Horn Mountains (*Grubensky and Demsey*, 1991).

QTx Unconsolidated breccia and rubble ***(early Pleistocene to late Miocene)***--Slopes and hills mantled with unconsolidated boulders and cobbles of resistant basalt in the western Eagletail Mountains (*Spencer et al.*, 1993). Possibly represents deeply eroded remnants of post-volcanic alluvial fans.

Tertiary sedimentary and volcanic units

Most of the bedrock exposures in the Little Horn 30' x 60' Quadrangle consist of volcanic rocks that were deposited between 19 and 25 Ma. Volcanic rocks erupted at this time roughly define a regional stratigraphy characterized by basal mafic lava flows overlain by intermediate to felsic lava flows and pyroclastic rocks, in turn overlain by intermediate to mafic lava flows that commonly form mesas. This 5 m.y. period of intense volcanism also produced three granitoid plutons and numerous dikes in the map area, and was accompanied by normal faulting and northeast-southwest directed extension (*Spencer et al.*, in press). Basaltic volcanism produced the Pliocene to, possibly, earliest Quaternary Sentinel volcanic field in the southeastern corner of the map area.

Tby Younger basalt ***(Pliocene)***--Dark, vesicular, olivine basalt at the northern margin of the Sentinel volcanic field. Three samples of basalt from this volcanic field, from south of the map area, yielded dates of 1.7 to 3.4 Ma (*Shoustra et al.*, 1976; *Eberly and Stanley,* 1978; *Shafiqullah et al.*, 1980).

Trg River gravels ***(Pliocene)***--Deposits of well rounded, well sorted Gila River gravels that are typically darkly varnished or stained by weathering, and at least locally indurated by carbonate cement. This unit was considered to be early Pleistocene to late Tertiary by *Demsey* (1990) but was mapped by *Skotnicki* (1993a) as overlain by basalt flows of the Sentinel volcanic field that are dated as latest Tertiary (*Reynolds et al.*, 1986).

Tsy Younger sediments ***(Pliocene to upper Miocene)***--Coarse, untilted, gravelly to bouldery alluvial fan deposits characterized by a high degree of dissection and erosional degradation, with no remnants of the original depositional surface.

Tsyl **Younger sediments, lower unit** ***(Pliocene to middle Miocene)***--Tan, weakly to strongly consolidated pebbly sandstone and clast-supported conglomerate in the northern Palomas Mountains and southern Tank Mountains (*Ferguson et al.*, 1994; *Skotnicki and Ferguson*, 1994).

Tb **Basalt** ***(middle to early Miocene)***--Widespread basaltic flows, locally including andesitic rocks, that commonly form mesas of flat lying to gently dipping flows. Scoria, flow breccias, and phenocrysts of olivine, pyroxene, and plagioclase are visible in some areas.

Tbx **Basaltic volcanogenic breccia, Eagletail Mountains** ***(middle to early Miocene)***--Basalt fragments in indurated basaltic rock matrix.

Txv **Breccia and volcanic rocks in the Tank Mountains** ***(middle to early Miocene)***--Brecciated rhyolitic and dacitic flows in the central Tank Mountains (volcanic breccia unit of *Grubensky et al.*, in press).

Txu **Rock avalanche breccia, upper unit** ***(middle to early Miocene)***--Indurated, thickly bedded breccia containing angular clasts of Tertiary volcanic rocks and Mesozoic metamorphic rocks. Map unit is restricted to the central Tank Mountains where it has been named Rocks of Kofa Butte (*Grubensky et al.*, in press).

Tfu **Felsic to intermediate volcanic rocks, upper unit** ***(middle to early Miocene)***--Primarily encompasses the gently dipping Rhyolite of Nottbusch Valley (*Grubensky and Demsey,* 1991). Includes local exposures felsic volcanic rocks that are generally near the top of volcanic sequences, gently dipping, and may be associated with map unit Tb (northeastern Tank Mountains and Cemetery Ridge).

Ta **Andesitic volcanic rocks** ***(middle to early Miocene)***--Includes olivine-clinopyroxene-plagioclase andesite in the northern Tank Mountains (*Grubensky et al.*, in press), hornblende-plagioclase andesite in the eastern Tank Mountains (*Ferguson et al.*, 1994), pyroxene-plagioclase andesite in the Palomas Mountains (*Skotnicki and Ferguson*, 1993), and pyroxene-hornblende and hornblende-biotite andesite flows and breccias at Saddle Mountain (*Ort and Skotnicki*, 1993).

Ts **Clastic sedimentary rocks** ***(early Miocene)***--Sandstone, conglomerate, and sedimentary breccia interbedded with volcanic rocks in the Little Horn Mountains (*Grubensky and Demsey*, 1991) and the northern part of the western end of the Gila Bend Mountains (*Gilbert et al.*, 1992).

Tx **Rock avalanche breccia, middle unit** ***(early Miocene)***--Rock avalanche breccias interbedded with volcanic rocks. Includes breccia of gneiss and granitoids, with clasts up to 7 m, in the eastern Tank Mountains (breccia component of Unit of Dummy Gulch of *Ferguson et al.*, 1994), generally massive breccias of metasedimentary and granitic rocks in the central and northwestern Tank Mountains (*Grubensky et al.*, in press), locally bedded granitic clast breccia in the Little Horn Mountains (*Grubensky and Demsey*, 1991), massive breccia of granitoid and gneiss clasts in the Clanton Hills and bedded breccia at Cemetery Ridge (*Gilbert and Spencer*, 1992). All of these breccias are interpreted as largely or entirely rock avalanche deposits shed from active fault scarps during the period of most active extension and magmatism. All are interbedded with the volcanic rocks, and many contain some volcanic clasts or have gradational contacts with underlying volcanic units, but the sparseness or absence of volcanic clasts in general is difficult to explain. Possibly uplifted areas that were the source of clasts received little volcanic rock precisely because they had been uplifted. However, no remnant of these uplifted areas in known directly adjacent to the breccias.

Tm **Mafic to intermediate volcanic rocks** ***(early Miocene)***--Mafic to intermediate lava flows and flow breccias. Rocks of this unit are interbedded with felsic volcanic rocks in the northwestern

Eagletail Mountains and northern Tank Mountains. In the southeastern Tank Mountains rocks of this unit are overlain by andesite that is in turn overlain by basalt of map unit Tb.

Tf **Felsic to intermediate volcanic rocks** ***(early Miocene)***--Widely exposed, felsic to intermediate lava flows, flow breccias, massive and bedded pyroclastic rocks, breccias of uncertain origin, and probable flow domes, dome complexes, and shallow intrusions. K-Ar dates from rocks of this unit range from about 20 to 24 Ma. Granitic intrusions (map unit Tg) in the western Gila Bend, Palomas, and Painted Rock Mountains represent the magma chambers from which some of the volcanic rocks of this unit were probably derived.

Tt **Tuff and bedded pyroclastic deposits** ***(early Miocene)***--Widespread deposits that reflect explosive volcanism during the main phase (20-24 Ma) of mid-Tertiary felsic volcanic activity in southwestern Arizona. Induration may be the result of welding.

Tl **Tuffaceous limestone in the Clanton Hills** ***(early Miocene)***--Limestone, tuffaceous limestone, and calcareous tuff with sparse tuff beds in the Clanton Hills (*Gilbert and Spencer*, 1992).

Tml **Mafic to intermediate volcanic rocks, lower unit** ***(early Miocene or Oligocene)***--Dark brown to dark gray, vesicular, mafic to intermediate lava flows and flow breccias. Rocks of this unit commonly rest on bedrock or on clastic sedimentary rocks that in turn rest on bedrock. Unit is widely exposed in the Gila Bend Mountains where it rests on both bedrock and basal Tertiary sedimentary rocks. It is locally exposed in the Eagletail, Painted Rock, Palomas, and northern and southeastern Tank Mountains, Clanton Hills, and at Face Mountain and Saddle Mountain. It rests on bedrock in the southern Eagletail, Tank, and Palomas Mountains and on Tertiary sedimentary rocks in the northern Eagletail Mountains.

Tsl **Clastic sedimentary rocks, lower unit** ***(early Miocene or Oligocene)***--Generally well bedded to massive, red to medium to dark brown conglomerate, conglomeratic sandstone, and sandstone consisting of subangular to well rounded clasts typically of pre-Tertiary rock types in a poorly sorted arkosic matrix. Tertiary volcanic-rock clasts are locally common. Unit is exposed primarily in the Gila Bend Mountains where it commonly rests on pre-Tertiary bedrock. Unit is interbedded with mafic lava flows of map unit Tml in the western Gila Bend Mountains. Limestone and shale are present at the base in the central Gila Bend Mountains (*Gilbert and Skotnicki*, 1993), and the unit locally contains breccias that represent debris flows or rock avalanches. An interbedded tuff was dated at 23.7 Ma (*Scarborough and Wilt*, 1979).

Txl **Rock avalanche breccia, lower unit** ***(early Miocene or Oligocene)***--Massive to weakly stratified breccia consisting of angular clasts of pre-Tertiary rocks in an unsorted matrix. Interpreted as rock avalanche breccias, talus breccias, or the product of deep weathering and disaggregation of pre-Tertiary bedrock before Tertiary volcanism. Small exposures are shown in the Little Horn and central Gila Bend Mountains where the depositional base of the unit is not exposed. Rocks of this unit, exposed in areas too limited to show on this map, rest on bedrock in the Central Gila Bend (*Skotnicki*, 1994), Palomas (*Skotnicki and Ferguson*, 1994), and southeastern Tank Mountains (*Ferguson et al.*, 1994).

Tertiary intrusive rocks

Tg **Granitic rocks** ***(early Miocene)***--Medium to fine grained, equigranular, biotite-hornblende granite or granodiorite. Rocks of this unit include pegmatitic granite in the Palomas Mountains, garnet-bearing granite in the Painted Rock Mountains (*Skotnicki*, 1993b), and the sanidine-bearing Columbus Wash granodiorite in the western Gila Bend Mountains. At Cemetery Ridge rocks of this unit are fine-grained, grade into hypabyssal rhyolite, and form a northwest-trending set of irregular dikes.

Th **Hypabyssal intrusive rocks *(middle to early Miocene)***--Intermediate to felsic, light to medium gray and tan dikes with plagioclase, biotite, ± hornblende, and little or no quartz in the Eagletail Mountains, with some quartz-bearing dikes in the eastern Eagletail Mountains (*Spencer et al.*, 1992, 1993). At Cemetery Ridge rocks of this unit consist of flow-banded, porphyritic rhyolite that grades into fine-grained granite (*Gilbert and Spencer*, 1992). Also includes hypabyssal rhyolite in the central Gila Bend Mountains (*Skotnicki*, 1994).

Mesozoic intrusive rocks

Jg **Granitic rocks *(Jurassic)***--In the southeastern Tank Mountains consists of medium to locally coarse grained equigranular to locally porphyritic felsic granitoids and local dioritic granitoids. In the northwestern Tank Mountains consists of (1) coarse to medium grained, equigranular, leucocratic granite with accessory biotite and, locally, muscovite, (2) coarse to medium grained biotite-hornblende granodiorite, (3) leucocratic granitic pegmatite containing muscovite, biotite, garnet, and local tourmaline, (4) and foliated granite and granodiorite and equigranular and augen gneiss derived from felsic granitoids (*Grubensky et al.*, in press).

In the eastern Eagletail Mountains consists of hornblende biotite granodiorite. Strontium isotopic analyses of a sample of this unit from the northeastern Eagletail Mountains (sample ET-1, located on Plate 1) indicate a Phanerozoic age (an Early to Middle Proterozoic age would require unreasonably low initial $^{87}Sr/^{86}Sr$ [Table 1]). Jurassic age assignment is based on this and on interpretation as part of a cogenetic intrusive suite that includes map unit Jp in the Eagletail Mountains (see below).

Jp **Porphyritic granitic rocks *(Jurassic)***--In the Eagletail Mountains consists of medium to fine grained biotite and hornblende-biotite granite to granodiorite. Gray K-feldspar phenocrysts, up to 4 cm long, are rounded in some areas and are aligned with long axes oriented subparallel to local tectonic lineation, which is not obviously mylonitic (*Spencer et al.*, 1993). Jurassic age assignment is based on lithologic similarity to the Sore Fingers Granite in the southern Little Harquahala Mountains which has yielded a K-Ar biotite date of 140.4±3.2 Ma (*Rehrig and Reynolds*, 1980). The Sore Fingers Granite is considered to be related to monzodiorite in the northern Little Harquahala Mountains that has yielded a nearly concordant, 165 Ma U/Pb date on a single fraction of zircons (Nancy Riggs, 1994, personal communication to Steve Richard).

Jd **Dioritic rocks *(Jurassic)***--In the northwestern Tank Mountains this unit consists of fine to medium grained, hornblende-bearing dioritic granitoids. In the eastern Eagletail Mountains this unit consists of fine-grained, gneissic, hornblende diorite and local medium to coarse grained hornblendite, and is considered to be Jurassic because rocks of this unit are interpreted as part of a cogenetic intrusive suite that includes map units Jg and Jp (see above; *Spencer et al.*, 1992).

Mesozoic and Paleozoic sedimentary and volcanic units

Js **Metasedimentary rocks *(Jurassic)***--In the southeastern Tank Mountains consists primarily of purple argillite and argillaceous siltstone with less abundant quartzite, quartz-pebble conglomerate and brown limestone. In the northwestern Tank Mountains consists of argillite, siltstone, phyllite, schist, sandstone, and local orthoquartzite (*Grubensky et al.*, in press).

Jv **Metavolcanic rocks *(Jurassic)***--Quartz porphyry felsic metatuffs and aphyric tuff and possibly lava flows.

Jsv **Metasedimentary and metavolcanic rocks, undivided** ***(Jurassic)***--In the southeastern Eagletail consists of light green, light gray, and purple sericite-feldspar schist and phyllite with porphyroclasts of quartz and feldspar. Interpreted as volcaniclastic rocks with minor interbedded non-volcanic sedimentary rocks. In the western Gila Bend Mountains consists of dark green, medium to fine grained, foliated actinolitic metadiorite to metabasalt with minor interlayered phyllite and banded quartzite. In the Little Horn Mountains consists of arkose, quartzite, quartz-pebble conglomerate, purple phyllite, andesitic lava, and local intrusive porphyry, all correlated with the Rocks of Slumgullion of *Haxel et al.* (1985) by *Grubensky and Demsey* (1991).

Mzo **Orocopia Schist** ***(Jurassic)***--Rocks of this unit are exposed at Neversweat Ridge south of the Tank Mountains, and represent the easternmost exposure of the Orocopia Schist. Unit consists of homogeneous quartzofeldspathic schist with scattered layers of quartzite, siliceous marble, and rare pods and layers of hornblende schist. Black, graphitic albite porphyroblasts, a distinctive feature of the Orocopia Schist, are commonly visible (*Haxel et al.*, 1987; *Dillon et al.*, 1990; *Grubensky et al.*, in press).

JTrs **Metasedimentary rocks** ***(Jurassic to Triassic)***--Green quartz-poor schist, quartz sericite schist, phyllite, and chloritic, platy schist in the western Gila Bend Mountains.

Pzs **Quartzite and carbonate rocks** ***(Paleozoic)***--In the southeastern Eagletail Mountains consists of pink to black weathering, white quartzite correlated with the Permian Coconino Sandstone and impure, possibly calcareous quartzite with thin limestone beds correlated with the Permian to Pennsylvanian Supai Group, and pale tan to pale gray dolomitic marble with local siliceous laminations correlated with the Mississippian Redwall Limestone and Devonian Martin Formation (*Gilbert et al.*, 1992).

Tertiary to Proterozoic crystalline rocks

TXg **Felsic granitic rocks** ***(Tertiary to Early Proterozoic)***--In the southeasternmost Tank Mountains consists of a complex of medium to fine grained equigranular biotite-hornblende felsic granitoids that grade into magmatically layered dioritic and gabbroic(?) intrusions (*Ferguson et al.*, 1994). In the western Gila Bend Mountains consists of medium to fine grained, leucocratic, equigranular granitoids that are nonfoliated to moderately foliated.

KXg **Felsic granitic rocks** ***(Cretaceous to Early Proterozoic)***--Unfoliated granodiorite in the central Gila Bend Mountains and leucocratic pegmatitic granite in hills east of the main ridge of the southeastern Eagletail Mountains.

JXg **Felsic granitic rocks** ***(Jurassic to Early Proterozoic)***--In the Little Horn Mountains consists of equigranular and prophyritic granite and granodiorite. In the southeasternmost Eagletail Mountains consists of medium to fine grained, equigranular, leucocratic granitoids that are unfoliated to moderately foliated, reddish brown weathering, and contain sparse quartz veins. To the northwest, also in the southeastern Eagletail Mountains, this unit consists of medium to fine grained, leucocratic, equigranular, foliated to unfoliated granitoids. Although considered as possibly Tertiary by *Gilbert et al.* (1992) and *Spencer et al.* (1992), rocks of this unit are here considered to be pre-Tertiary because they are depositionally overlain by pre-volcanic Tertiary conglomerate or by basal Tertiary mafic volcanic units, and are considered to be pre-Cretaceous because of the high degree of fracturing, iron oxide alteration of mafic minerals, sericitization of plagioclase, local foliation, and sutured grain boundaries.

JXp **Porphyritic felsic granitic rocks** ***(Jurassic to Early Proterozoic)***--In the Clanton Hills and at Cemetery Ridge this unit consists of weakly foliated biotite granite with abundant (15-40%)

rounded K-feldspar phenocrysts up to 6 cm long.

JXd **Dioritic rocks** ***(Jurassic to Early Proterozoic)***--At Cemetery Ridge this unit consists of medium grained, equigranular, hornblende-biotite mafic granitoids with sparse quartz.

JXgn **Gneiss** ***(Jurassic to Early Proterozoic)***--In the Eagletail Mountains, this unit consists of fine-grained feldspar + quartz + biotite ± hornblende gneiss with subconcordant to cross cutting small intrusions of leucogranite, granodiorite, and granite, and of metasedimentary gneiss, muscovite granite, and pegmatite. In the southeastern part of Cemetery Ridge biotite gneiss contains K-feldspar augen up to 3 cm long.

Proterozoic igneous and metamorphic rocks

Xv **Metavolcanic rocks** ***(Early Proterozoic)***--At Saddle Mountain consists of green, slaty, fine-grained metavolcanic rocks probably derived from andesite and containing sparse layers of iron-silica rock interpreted as banded iron formation (*Ort and Skotnicki*, 1993).

Xg **Felsic granitic rocks, undivided** ***(Early Proterozoic)***--In the southeastern Tank Mountains consists of variably foliated to non-foliated, fine to medium grained, equigranular to magacrystic, felsic, biotite-hornblende granite or granodiorite(?) that is gradational with nearby leucogranite and dioritic granitoids. Faint concordant layering at margins with Early Proterozoic gneiss suggests Early Proterozoic age. In the Palomas Mountains granitoids of this unit are largely equigranular, medium grained, and biotite rich.

Xgl **Leucocratic felsic granitic rocks** ***(Early Proterozoic)***--In the southeastern Tank Mountains consists of light, medium to fine grained, generally non-porphyritic felsic granite with K-feldspar phenocrysts up to 15 mm long and up to 5% very fine grained biotite. Faint lithologic layering at margins and within screens or inclusions.

Xgm **Mafic granitic rocks** ***(Early Proterozoic)***--In the southeastern Tank Mountains consists of dark, medium to fine grained, mafic granitoids and amphibolite. Mafic content is generally 20 to 50%. Locally contains K-feldspar up to 15 mm long and aggregates of very fine grained biotite. Generally unfoliated but local foliation near contacts with Proterozoic gneiss suggests an Early Proterozoic age.

Xa **Amphibolite** ***(Early Proterozoic)***--Dark green, coarse to fine grained, foliated hornblende-plagioclase amphibolite in the western and central Gila Bend Mountains.

Xs **Schist** ***(Early Proterozoic)***--Biotite-garnet-staurolite-quartz-feldspar schist east of Columbus Peak in the western Gila Bend Mountains (*Gilbert et al.*, 1992). In the northwestern part of Cemetery Ridge this unit consists of medium grained quartzofeldspathic biotite schist (*Grubensky and Demsey*, 1991) that grades laterally into foliated dioritic granitoids mapped by W. Gilbert (reported by *Gilbert and Spencer,* 1992) and shown here as map unit JXd. The significance of this gradational contact and implications for the ages of the two units are not well understood.

Xgn **Gneiss** ***(Early Proterozoic)***--In the southeastern Tank Mountains consists of fine to medium grained, amphibolite facies, quartzo-feldspathic layered gneiss with small granitic intrusions, migmatitic felsic segregations, bull quartz veins, and local amphibolite bodies. Steeply dipping, north to northeast striking attitude of lithologic layering is consistent with Early Proterozoic age assignment. In the Gila Bend Mountains consists of weakly to moderately foliated sphene+epidote+muscovite+biotite±hornblende quartzofeldspathic gneiss with local lenses of amphibolite and pegmatite dikes containing magnetite. In the Palomas Mountains consists of quartzofeldspathic gneiss dominated by leucosome with less abundant melanosome.

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TABLE 1

Sr and Nd isotope data from Eagletail Mountains sample ET-1, map unit Jg. Data provided by Felix Lerch (written communication, 1994).
Sample collected by S.J. Reynolds, 33° 27.68′ N., 113° 17.00′ W.
Sample analyzed by Felix Lerch at the University of Arizona using a multicollector mass spectrometer. Given errors reflect mass spectrometer measurement and not other factors such as spike calibration.

Concentrations (ppm)

Rb	77.16843
Sr	618.6554
Sm	6.447671
Nd	36.57407

Isotope ratios

$^{87}Rb/^{86}Sr$	0.360844
$^{85}Rb/^{87}Rb$	1.265497
$^{86}Sr/^{88}Sr$	0.119400
$^{84}Sr/^{86}Sr$	0.073600
$^{87}Sr/^{86}Sr$	0.707352 ±0.000009
$^{147}Sm/^{144}Nd$	0.1065676
$^{142}Nd/^{144}Nd$	1.14211
$^{143}Nd/^{144}Nd$	0.5121625 ±0.000008
$^{145}Nd/^{144}Nd$	0.3483099

Assumed initial $^{87}Sr/^{86}Sr$	Apparent age (Ma)
0.7000	1451
0.7020	1059
0.7040	665
0.7060	269
0.7070	70