

Geologic Map of the Rattlesnake Hill 7.5' Quadrangle, Mohave County, Arizona

by

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INTRODUCTION

The Rattlesnake Hill 7½' quadrangle is located in Mohave County, northwestern Arizona, about 10 km east of Kingman. The southern portion of the quadrangle consists of the northern Hualapai Mountains, while the northern portion is mainly low-relief alluvial plains. Rattlesnake Hill is the only feature of significant topographic relief north of Interstate 40, which trends roughly east-west through the quadrangle.

An important watershed divide trends northwest from near the southeastern corner to the west-central portion of the quadrangle. Southwest of this divide is the Thirteenmile Wash-Sacramento Wash watershed, which in the quadrangle is drained by Sawmill Canyon. This stream system is integrated with the Colorado River. Northeast of the watershed divide is the Frees Wash subdivision of the Red Lake Playa watershed. Red Lake Playa is the low point of Hualapai Valley, and is primarily an internally drained watershed not integrated with the Colorado River. The main drainages in this watershed within the quadrangle are Frees Wash and Hualapai Canyon. Average annual rainfall in the quadrangle ranges from 8 to 16 inches, with the higher precipitation values concentrated over the Hualapai Mountains in the southern portion of the quadrangle.

The bedrock geology of this quadrangle includes Paleoproterozoic metamorphic rocks that experienced migmatization during the emplacement of a Mesoproterozoic megacrystic granite. Additionally, the Neogene Peach Spring Tuff, and other Neogene lava flows are exposed in the southwestern part of the map and dip gently WNW.

Several geologic maps at a variety of scales have included all or portions of the Rattlesnake Hill 7½' quadrangle. These include 1:250,000 scale geologic maps of the region (Santa Fe Pacific Railroad Company, 1981; Beard et al., 2011) and a 1:48,000 scale reconnaissance geologic strip map (Goff et al., 1983). The current geologic map also compliments several previous or ongoing 1:24,000 scale Arizona Geological Survey maps including quadrangles to the west, northwest, southeast, and east (Ferguson and Cook, 2015; Garcia et al., 2024; Johnson et al., 2022; Ma and Kwiatkowski, 2025).

GEOLOGIC SUMMARY

Surficial geology

Quaternary surficial deposits form vast alluvial plains in the northern portion of the quadrangle and also consist of alluvial fan, terrace, and channel deposits within and below the mouths of Sawmill Canyon, Frees Wash, Hualapai Canyon, and other unnamed washes that drain the Hualapai Mountains.

The oldest Quaternary surficial deposits observed in the quadrangle are middle Pleistocene alluvial fan and deposits (Q1), which form a mostly continuous fan surface in Hualapai Canyon, east of the modern channel, from near the eastern edge of the quadrangle to 3 km north of Interstate 40.

North of Interstate 40, Qi1 surfaces also form discontinuous caps atop hills of Neogene basin-fill conglomerate. The Qi1 fan surface in Hualapai Canyon, which is within the Red Lake Playa watershed, is about 5–13 meters above the modern channel. In the Sacramento Wash watershed, Qi1 deposits are sparse, only mapped in one location on the south side of Sawmill Canyon near the canyon mouth, about 20 meters above the modern channel.

Middle to late Pleistocene deposits (Qi2) are much more extensive, forming major alluvial fan deposits at the mouth of Sawmill Canyon and Frees Wash, and several significant fans along smaller, unnamed drainages between the two major canyons. Qi2 surfaces are generally 1–3 meters above adjacent modern channels in the Red Lake Playa watershed, and 5–10 meters above the modern channel along Sawmill Canyon and tributaries in the Sacramento Wash watershed.

Late Pleistocene alluvial surfaces are also extensive, especially in the upper, middle, and lower piedmont between Sawmill Canyon and Rattlesnake Hill, and the lower piedmont adjacent to Frees Wash. Qi3 deposits are also relatively abundant along the Frees Wash and Hualapai Canyon drainages within the Hualapai Mountains. The Qi3 surfaces are generally 1–2 meters above modern channels in the Red Lake Playa watershed and 5–7 meters above the channel in the few exposures in the Sacramento Wash watershed. Below the mouth of Sawmill Canyon, both middle to late Pleistocene (Qi2) and late Pleistocene (Qi3) alluvial fans are primarily within the Red Lake Playa watershed, which may suggest that incorporation of Sawmill Canyon into the Colorado River system may have occurred after late Pleistocene time.

Holocene alluvial deposits from channels, bars, terraces, and fans that are relatively narrow within the Hualapai Mountains and more extensive in the middle and lower piedmont areas that make up the northern third of the quadrangle. In many drainages, Holocene alluvial deposits are too narrow to subdivide at the map scale and are grouped into one map unit (Qy). Along larger washes such as Sawmill Canyon, Frees Wash, Hualapai Canyon, and several other tributaries, Holocene alluvial deposits are subdivided into active wash channel and lowest terraces (Qy3), low terraces adjacent to active drainages (Qy2), and slightly higher terraces and alluvial fans (Qy1). Qy1 surfaces are the most widespread Holocene alluvial deposits, forming wide, smooth surfaces that cover a significant portion of the northern third of the quadrangle. Flood hazards are relevant to all Holocene alluvial surfaces. Qy3 channels are prone to flooding during even relatively minor storm events. Qy2 surfaces may be inundated during moderate to large flood events. The edges of both Qy2 and Qy1 surfaces may be subject to lateral erosion during flood events, and portions of Qy1 surfaces may be inundated by crevasse splay channels formed during large floods.

Debris-flow deposits consisting of boulder levees and lobes occur along Frees Wash and Hualapai Canyon within the Hualapai Mountains. The debris-flow deposits are found from the upper canyon reaches of these drainages to ~800 meters downstream of the confluence of Hualapai Canyon and Frees Wash. The largest deposit is along Frees Wash immediately upstream of this confluence, covering over 18,000 m². The debris-flow deposits are emplaced on various Quaternary alluvial surfaces ranging in age from middle to late Pleistocene (Qi2) to the active modern channel (Qy3).

Thus, these deposits probably represent many different debris-flow events spanning middle Pleistocene to late Holocene time. The lack of fresh scour marks on the slopes in the upper reaches of Frees Wash and Hualapai Canyon suggests that these debris flows are at least older than the last several decades. However, debris flows could still occur along Frees Wash, Hualapai Canyon, or other steep drainages in the quadrangle in the event of extreme precipitation or in the wake of a severe wildfire.

Bedrock geology

The bedrock geologic units of the Rattlesnake Hill quadrangle include Proterozoic plutonic and metamorphic rocks (Ymg, Xgn, Xmt) and Neogene volcanic rocks (Np4, Np3, Npl, Nbx, Nbb, Nb). The contact between the Proterozoic and Neogene rocks is mostly along a system of west-side down normal faults, but locally the contact is an unconformity that represents deposition of xenolith-bearing mafic lava (Nbx) atop paleotopography in the Proterozoic basement. The quadrangle is within the Kingman uplift/arch (Beard, 2010; Goetz et al., 1975; Herrington, 2000), a broad uplifted area where several kilometers of Paleozoic and Mesozoic strata were removed by erosion associated with development of northeast flowing streams during the Laramide orogeny (Young, 2024).

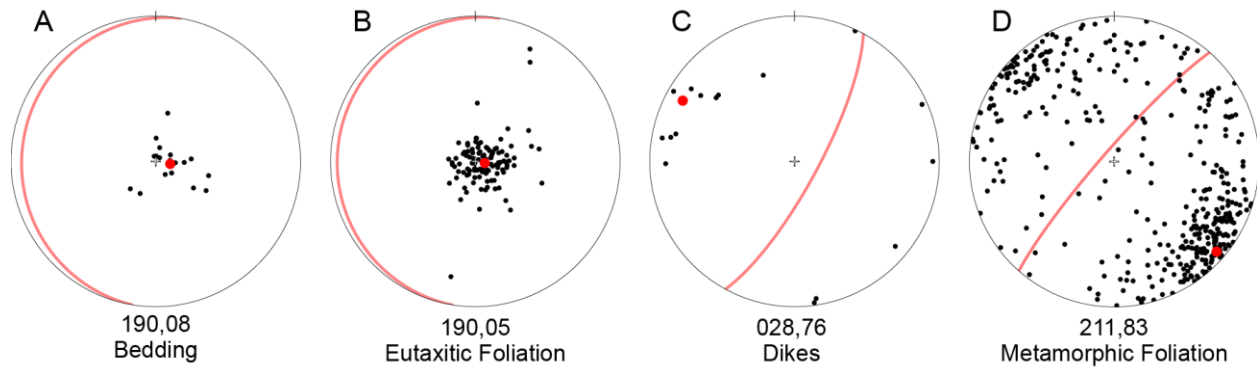
The Proterozoic rocks primarily include gneissic (Xgn) and migmatitic (Xmt) supracrustal rocks and a Mesoproterozoic megacrystic granite. New zircon geochronology on two samples from the adjacent Hualapai Spring quadrangle (Ma and Kwiatkowski, 2025) yield ages for megacrystic granite of 1425.8 ± 8.8 Ma and 1424.3 ± 9.5 Ma. Zircon geochronology on migmatitic rocks from the Hualapai Spring quad yielded ages of 1430-1410 Ma, suggesting migmatization was synchronous with pluton emplacement (Ma and Kwiatkowski, 2025). The protolith ages of the gneisses and migmatites are likely Paleoproterozoic. Generally, northeast-trending syenitic dikes are also exposed throughout the exposed bedrock, which may be as young as Cretaceous, but are likely Mesoproterozoic. The Neogene volcanic rocks include exposures of the Peach Spring Tuff (Np4, Np3, Npl), as well as mafic lava flows (Nbx, Nbb, Nb). Each of these units is more extensively exposed on the adjacent Kingman quadrangle (Ferguson and Cook, 2015).

Structural geology

The Hualapai Mountains are bounded on the east side by the Hualapai low-angle normal fault (Frost and Heidrick, 1998; Morgan et al., 2009; Garcia et al., 2024; Gootee et al., 2025). The nature of the northern boundary of the Hualapai Mountains is less certain; the Hualapai fault may curve northwest parallel to mountain front or may die out along a northern trend in the subsurface within the Hualapai Springs quadrangle. The main portion of the Hualapai Mountains in the Rattlesnake Hill quadrangle is bounded on the west by west-side down normal faults that juxtapose Proterozoic rocks to the east against mostly Neogene rocks to the west. Additionally, the buried but structurally

important Kingman fault trends southwest through the northern portion of the quadrangle, underlying the Quaternary surficial deposits. The Kingman fault bounds the eastern edge of the Kingman sub-basin within the Hualapai Valley, which consists of up to 1200 meters of Neogene basin-fill deposits (Truini et al., 2013) and hosts an important aquifer for the Kingman community.

The figure below shows stereographic plots of orientation data collected throughout the bedrock exposures. Bedding and eutaxitic foliation in the Peach Spring Tuff (A,B) indicate these units dip very gently to the WNW. The metamorphic rocks are dominated by a steeply dipping, NE-striking foliation (D). The syenitic dikes (KXs) also generally have a steep, northeast striking orientation (C), potentially suggesting their emplacement orientation was guided by a pre-existing structural grain or ambient stress field. Given that migmatization appears to be broadly related to the emplacement of the megacrystic granite (Ymg), and many of the measured foliations represent migmatitic leucosomes, it is likely that ductile deformation features in this area dominantly Mesoproterozoic in age.



DESCRIPTIONS OF MAP UNITS

QUATERNARY SURFICIAL DEPOSITS

Quaternary alluvial deposits

Qy3 – Deposits in wash channels, gravel bars, and adjacent low terraces (late Holocene) – Poorly to moderately sorted alluvial deposits composed of subangular pebbles, sand, and cobbles, as well as boulders close to the mountain fronts. These deposits are associated with active channels of modern washes as well as gravel bars and adjacent low terraces less than 0.5m above the active channel. In areas of ponding, such as the upstream side of earthen fill stock pond dams, this unit also contains fine-grained sediment. Locally, Qy3 channels have overtopped their banks and formed crevasse splay deposits onto adjacent Qy1 or Qi3 surfaces.

Qy2 – Deposits in low terraces along active drainages (late Holocene) – Alluvial deposits that form low terraces 0.5 – 1m above active stream channels. Deposits consist of poorly sorted subangular to subrounded cobbles, pebbles, granules, and coarse sand in a matrix of fine sand and silt. Surfaces are undulatory, with bars and swales that preserve original depositional topography. Soil development is minimal, apart from localized areas of cryptobiotic soil crust. Willow trees and rabbitbrush are the dominant vegetation on Qy2 surfaces.

Qy1 – Young deposits in low terraces and alluvial fans (Holocene) – Low terraces and alluvial fans higher than adjacent Qy3 or Qy2 surfaces, typically 1–2m above modern channels. Deposits consist of granules, pebbles, and cobbles in a matrix of silt to fine sand. Soil development is minimal. Surfaces are typically planar, with some relict channels, as well as recent or active headward-propagating gullies. Vegetation consists of acacia, juniper, willow, yucca, prickly pear, creosote, and shrubs.

Qy – Undivided young alluvial deposits (Holocene) – Alluvial deposits of channels, gravel bars, and low terraces equivalent to map units Qy3, Qy2, and Qy1. Qy deposits represent Holocene alluvial systems in areas where the extent of Holocene alluvium is too narrow to subdivide.

Qi3 – Young intermediate age deposits in relict alluvial fans and terraces (late Pleistocene) – Alluvial deposits consisting of poorly sorted sand, pebbles, and cobbles. Clast lithologies vary depending on the source area. The uppermost meter is reddish orange, while the lower meter contains stage II calcrete, cementing together the sandy matrix and coating fracture surfaces. Vegetation mostly consists of yucca, acacia, juniper, and snakeweed. In the Red Lake Playa watershed, which occupies most of the quadrangle, Qi3 surfaces are typically 1–2 m above adjacent active channels, with their boundary with Qy1 marked by a subtle ~0.5m escarpment. In the Thirteenmile Wash-Sacramento Wash

watershed in the southwestern corner of the quadrangle, Qi3 deposits are elevated 3–7m above modern drainages.

Qi2 – Intermediate age deposits in relict alluvial fans and terraces (middle to late Pleistocene) – Alluvial fan deposits that consist of poorly sorted pebbles, cobbles, sand, and small boulders in a silt to fine sand matrix. Clasts are dominantly granite, gabbro, diabase, porphyritic volcanic rock, and basalt. Moderate to strong soil development, with reddened, clay-rich argillic horizons and obvious surface reddening. Carbonate accumulations on gravel clasts and carbonate accumulation between clasts. In the Red Lake Playa watershed, Qi2 surfaces are 1–3 meters above adjacent modern stream channels, and surface topography is rather smooth except where substantially eroded at rounded surface margins. In the Thirteenmile Wash-Sacramento Wash watershed in the southwestern portion of the quadrangle, Qi2 deposits form alluvial fan surfaces and terraces approximately 5–10 m above adjacent modern channels. Vegetation on Qi2 surfaces consists of rabbitbrush, yucca, juniper, and acacia.

Qi1 – Older intermediate age deposits in dissected alluvial fans (middle Pleistocene) – Alluvial deposits of remnant alluvial fans that mostly consist of poorly sorted sand, pebbles, cobbles, and boulders with minor silt and clay. Significant carbonate accumulation at base of deposit includes laminar calcrete layers. In the Red Lake Playa watershed, Qi1 surfaces range from 5–13 meters above modern channels. In the Thirteenmile Wash-Sacramento Wash watershed, the only Qi1 deposits are mapped on the south side of Sawmill Canyon, elevated approximately 20 meters above the adjacent active stream channel.

Other surficial deposits

Qtc – Hillslope colluvium and talus (Quaternary) – Mass movement deposits on steep hillslopes, consisting of angular fragments of bedrock units derived from areas directly upslope.

Qyd – Debris-flow deposits (Holocene to late Pleistocene) – Very poorly sorted boulder lobe and levee deposits resulting from debris flows along Frees Wash and Hualapai Canyon. Deposits typically form lateral, curvilinear levees along active drainages as well as lobate snout deposits at their terminus.

d – Disturbed areas (modern) – Anthropogenically disturbed surfaces including artificial fill that underlays major roadways such as I-40, earthen fill dams at stock tanks, large cut-and-fill operations related to house construction on hillsides, and areas of removed material such as quarries.

NEOGENE BASIN-FILL DEPOSITS

Nbc – Big Sandy Formation conglomerate (Neogene) – Light tan to light gray, massive to planar-bedded, matrix-supported, pebble-cobble conglomerate containing a diverse assemblage of angular to subrounded clasts derived from bedrock units of the Hualapai Mountains. Clast types, which vary locally, include granite, granodiorite, diorite, diabase, gneiss, and quartz-potassium feldspar-muscovite/biotite pegmatite, hornblende-biotite porphyry, aphanitic non-vesicular basalt, plagioclase-hornblende phyric andesite, aphyric dacite, and rhyolite. Matrix consists of a grus-dominated coarse sand. Unit description modified from Garcia et al. (2024).

NEOGENE VOLCANIC ROCKS

Peach Spring Tuff (Miocene) – The Peach Spring Tuff is a regional, high-volume rhyolitic ignimbrite erupted from the Silver Creek caldera 30 km to the west of Kingman (Ferguson et al., 2013). Five mappable zones are recognized in the Kingman area (Tp1-5), with three of these zones (Np1 and Np3-4) exposed in the Rattlesnake Hill quadrangle (equivalent to Tp1 and Tp3-4 of Ferguson and Cook, 2015). Compositional variations based on phenocryst and pumice content are the basis for three zones that are overprinted by three cooling unit zones. Sanidine $^{40}\text{Ar}/^{39}\text{Ar}$ dates at Kingman of 18.82 ± 0.05 Ma (Ferguson et al., 2013) are within analytical error of two U-Pb zircon dates (Ferguson and Cook, 2015) of the basal surge and lowermost nonwelded tuff. The ignimbrite contains phenocrysts of sanidine (up to 5mm) > plagioclase (<3mm), sparse biotite (<2mm), minor sphene (titanite), amphibole, and traces of quartz, allanite/chevkinite, and pyroxene. The sanidine - plagioclase ratio ranges between 2:1 and 4:1. The presence of sphene (titanite) is often quoted as diagnostic criteria for identification of the ignimbrite, but it is not always visible in hand specimen. Phenocryst content increases upward from 2-35%. The increase is gradual except for an interval just below the top of the ignimbrite where an abrupt increase in phenocrysts (from 20 to 35%) occurs concomitant with an abrupt increase in welding (from moderately welded and strongly vapor phase altered below to dense black vitrophyre above). The abrupt transition, which is preserved at only one locality in the Sacramento Valley (NW1/4 of section 23, T21N, R18W), has also been recognized at one other locality: Warm Springs in the southern Black Mountains (Ferguson et al., 2013). At Warm Springs the abrupt upward increase in phenocrysts is accompanied by a change in chemical composition from rhyolite below to trachyte above (Pamukcu et al., 2013). Recognition that the Warm Springs zone is part of the Peach Spring Tuff and not a separate flow-unit is crucial since the composition and phenocryst modes of the black vitrophyre at Warm Springs is nearly identical to the trachyte ignimbrite within the Peach Spring Tuff's source volcano, the Silver Creek caldera. The phenocryst-rich vitrophyre is mapped separately as the Warm Springs zone of the Peach Spring Tuff (Tp5) in the Kingman NW map area, but it has not been identified in the Rattlesnake Hill map area. The Peach Springs Tuff can be broken into three subdivisions in the Rattlesnake Hill quadrangle. We use the same

nomenclature as Ferguson and Cook (2015) and have modified their descriptions of the Peach Springs Tuff above and its subdivisions below.

Np4 – Hilltop zone of the Peach Spring Tuff (Miocene) – Poorly welded, moderately phenocryst-rich (15-18% sanidine > plagioclase) ignimbrite with abundant, weakly compacted pumice (15-30%) and fairly abundant (5-10%) lithic lapilli. In some areas, lithic blocks up to 1m are present. The base of the zone is defined by an abrupt (1-3m interval) upward increase in pumice accompanied by a decrease in compaction (as defined by shape of the pumice fragments). The base of the zone corresponds to the upper part of a cliff, and the bulk of the zone forms rounded hill tops. The zone is named for the Hill Top Motel at the crest of old US route 66 in Kingman.

Np3 – Slaughterhouse Canyon zone of the Peach Spring Tuff (Miocene) – The main welded zone of the Peach Spring Tuff is a reddish gray strongly welded ignimbrite containing 12-15% sanidine > plagioclase phenocrysts and 5-15% pumice, typically compacted with length to width ratios of > 5:1. The base of the zone is defined by an abrupt upward increase of pumice from <<5% to 7-15%. The base of the zone is also defined by an upward change from vertical joints to horizontal joints that corresponds to a prominent ledge. Pumice at the base of the zone are replaced by lithophysal cavities.

Np1 – Combined lower zones of the Peach Spring Tuff (Miocene) – Where the two lower cooling unit zones of the Peach Spring Tuff (Tp1 and Tp2) are <5m cumulative thickness. Tp1 and Tp2 are not distinguished in the mapping area. Refer to Ferguson and Cook (2015) for more information. The lower part of the welded, interior zone of the Peach Spring Tuff (Tp2) is characterized by strong vertical jointing and very low <5% pumice content. Phenocryst content ranges between 5-12%, and lithics are sparse (<2%). The zone is a strong cliff-former with well-developed vertical joints. The base of the zone is typically very sharp and corresponds to a ledge developed along the top of the nonwelded Holy Moses zone (Tp1). The basal nonwelded zone of the Peach Spring Tuff, typically a cliff-former, contains 1-5% phenocrysts, 1-5% lithic lapilli, and <5% pumice. The zone includes a basal, 50-150 cm thick, laminated to thin-bedded, medium- to coarse-ash surge deposit. The top of the zone is a fairly sharp, yet gradational, contact with welded tuff of the Sawmill Canyon zone (Tp2). The transition typically occurs over an interval <10 cm thick.

Nbx – Xenolithic mafic lava (Miocene) – Mafic lava with 1-5%, <3mm olivine, iddingsite, and/or pyroxene phenocrysts, with 0-5%, 2-15mm xenoliths of two types: quartz-feldspar granitic aggregates, and medium-grained ultramafics (chiefly dunite). Individual grains <3mm of quartz and feldspar are probably xenocrysts. The type of xenoliths present is somewhat diagnostic of outcrop clusters of xenolithic mafic lava that probably represent individual vent areas. Lavas of this map unit in the Cerbat Mountains (north of Kingman) tend to have greater concentration of ultramafic xenoliths, whereas those Hualapai Mountains tend to have more granitic xenoliths. Unit description from Ferguson and Cook (2015).

Nbb – Biotite-phyric xenolithic mafic lava (Miocene) – Mafic lava with 1-5%, <3mm olivine, iddingsite, and/or pyroxene phenocrysts, up to 5%, <3mm biotite, and ubiquitous 1-8mm quartz-feldspar granitic xenoliths, and lesser ultramafic xenoliths. Nbb is sparse and outcrops only in the southwestern part of the map area. Unit description modified from Ferguson and Cook (2015).

Nb – Basaltic lava (Miocene) – Basaltic lavas containing 1-7% 0.5-3mm phenocrysts of iddingsite (after olivine). Lavas are generally <10m thick and interbedded with sparse red, scoriaceous volcanoclastic sandstone sequences <2m thick. Nb is sparse and outcrops only in the western part of the map area. Unit description modified from Ferguson and Cook (2015).

PROTEROZOIC PLUTONIC AND METAMORPHIC ROCKS

KXs – Hornblende-pyroxene (Cretaceous to Paleoproterozoic) – Phaneritic dikes that typically exhibit poor outcrop and crumbly weathering but can be distinguished by their salt and pepper appearance in outcrop and dark brown-grey weathering. Dikes can be traced up to 200m in many cases, are typically 10-20m thick, and contain a foliation that parallels the trend of the dike. Dikes are nearly vertical and typically trend parallel to regional foliation (NE-SW), although some have been observed with a NW-SE trend. KXs contains variable but significant quantities of pyroxene and hornblende making up as much as ~60-90% of rock composition. The remaining mineralogy is predominantly K-feldspar with <5% quartz and/or plagioclase feldspar.

Age relations of KXs are unclear, but dikes likely postdate intrusion of megacrystic granite (Ymg) and possibly banded granite and gneiss (Xgn). KXs predominantly intrudes migmatite (Xmt) and may be related to partial melting associated with migmatite formation. KXs intrudes Xgn and Ymg only in one location adjacent to a major fault, which may be obscuring intrusive relationships.

Ymg – Megacrystic granite – A reddish brown, coarse-grained, equigranular to porphyritic biotite quartz monzonite found in the southeast portion of the Rattlesnake Hill quadrangle. Its composition consists of subhedral to euhedral orthoclase (~45%), anhedral to subhedral quartz (~35%), and biotite (~10%) grains. This unit contains xenoliths and masses of quartz diorite, but migmatitic (Xmt) and banded gneiss (Xgn) xenoliths were also observed. The megacrystic granite also contains aplite and pegmatite dikes/pods ranging in size from a few centimeters to 30 m thick and traceable up to 0.5 km. Unit description modified from Garcia et al. (2024).

Xgn – Banded granite and gneiss (Early Proterozoic) – Biotite quartzofeldspathic banded granite and gneiss. Banding is defined by biotite-rich melanosomes ranging in thickness from 1cm to 2m. Variably to non-foliated fine- to medium-grained granitic to quartz monzonitic orthogneiss. Granitic rocks contain 5-10% biotite. Locally, nonfoliated zones contain up to 15% K-feldspar megacrysts up to 3 cm.

Gneiss (Xgn) contacts with migmatite (Xmt) and megacrystic granite (Ymg) are well-defined. Foliation in the gneiss (Xgn), when present, generally parallels regional trends. The weakening

and lack of foliation in some areas suggests that deformation/intrusion of Xgn may be syn- or post-kinematic with Xmt and may be related to partial melting associated with migmatite formation. Unit description modified from Ferguson and Cook (2015).

Xmt – Migmatite – Quartz-feldspar-biotite migmatite. Xmt is distinguished by the presence of biotite porphyroblasts with leucocratic halos, though locally biotite appears to be replaced by oxides. Leucocratic halos consist of roughly equal portions of quartz and plagioclase feldspar with grain sizes between 1-2mm. Porphyroblasts occur throughout the unit, are locally as small as ~5mm but are typically observed to be between 1-2cm and are gently flattened parallel to regional foliation.

The migmatite (Xmt) contains a strong foliation that is steeply dipping to vertical and predominantly trends NE-SW, though some local variation occurs. Xmt appears to be intruded by banded granite and gneiss (Xgn), megacrystic granite (Ymg), and hornblende-pyroxene-syenite (KXs), though Xgn and KXs may be associated with partial melting related to migmatite formation. Locally, outcrops of schist, quartzite, and stretched-pebble conglomerate occur within Xmt, which have a tectonic fabric that parallels regional trends and may represent remnants of the migmatite (Xmt) protolith.

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