

Geologic Map of the Northern Plomosa Mountains

Metamorphic Core Complex, Arizona

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Coordinate reference system:
NAD 1983 State Plane Arizona West FIPS 0203
Datum: North American 1983
Projection: Transverse Mercator

Elevation contours: derived from the digital elevation model
USGS NED r34w114 1/3 arc-second 2013 1 x 1 degree ArcGrid, from
the National Elevation Dataset.

0 0.5 1 km
scale 1:10,000
contour interval = 10 m

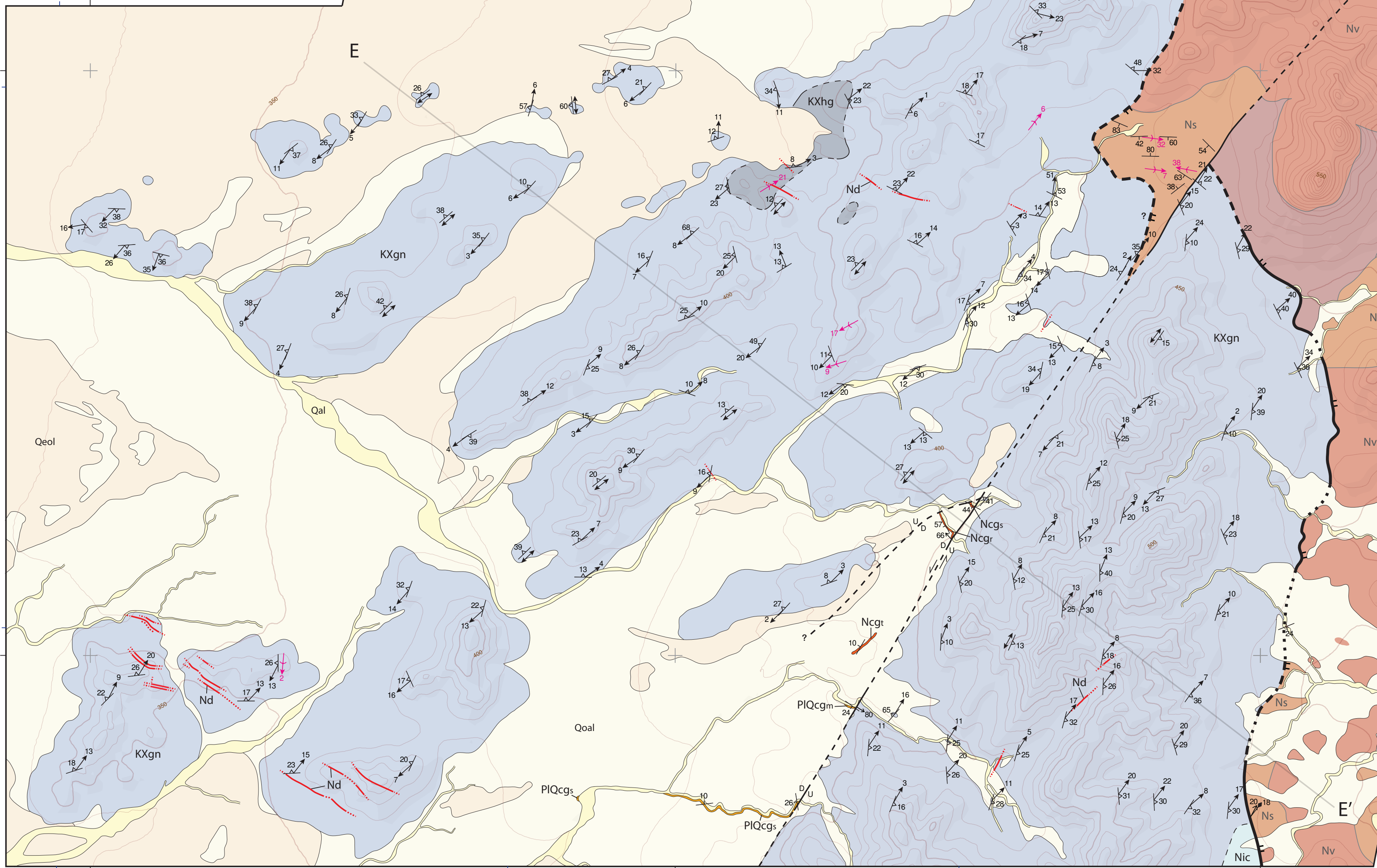


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Strikes of barite veins
Strikes of carbonate veins
Copper mineralization
(mostly chrysocolla and malachite)

Mylonitic foliations

Mylonitic Lineations
• Top-NE shear recorded in outcrop or thin section
• +/- 20° to 40° from mean NE-SW direction
• +/- 40° to 90° from mean NE-SW direction



Symbols

- Map trace or projected trend of dikes
- Mylonitic foliation strike and dip
- Vertical mylonitic foliation strike
- Horizontal mylonitic foliation
- Mylonitic lineation trend and plunge
- Mylonitic lineation trend
- Mylonitic marble foliation strike and dip
- Bedding strike and dip
- Fault plane dip direction and dip
- Detachment plane calculated from 3-point solution
- Slickenside trend and plunge
- Open fold axis trend and plunge
- Isoclinal/tight fold axis trend and plunge
- Fold axial trace trend
- Location of magnesio-actinolite pods
- Location of metachert
- Location of L-tectonites
- Location or contact of uncertainty
- Zircon U-Pb geochronology sample
- Fault
- Approximate fault
- Concealed fault
- Detachment fault
- Approximate detachment fault
- Concealed detachment fault
- Alluvium contact
- Bedrock contact
- Approximate bedrock contact

Unit descriptions

- Qal** Recent alluvial deposits: Poorly-sorted, unconsolidated, angular to subrounded sediment deposited within unvegetated to lightly vegetated active channels. Sediment is derived from the surrounding bedrock and consists primarily of sand, gravel, and cobbles with minor silt and sparse boulders. Channels are incised 0.5–6 m into bedrock and Qoal.
- Qeol** Aeolian deposits: Unconsolidated, moderately-vegetated, tan-colored, fine- to very-fine sand deposits consisting of ~97% quartz. Most sand is subangular to subrounded and well sorted. This unit is deposited on Qoal, contains scattered colluvium clasts, and has locally accumulated into dunes (typically on the flanks of colluvium mounds or bedrock slopes). Locally a weakly-consolidated, 1–3 mm thick crust is developed a few centimeters beneath the surface.
- Qoal** Older colluvium and alluvium: Mostly paleo-terraces composed of weakly-consolidated, clast-supported colluvium and alluvium with a silt matrix. Clasts are mostly angular to subangular, pebble to cobble in size with sparse boulders, and are commonly imbricated. Terraces are locally >6 m thick where incised by active channels. This unit is moderately vegetated in most areas, but lightly to sparsely vegetated where desert pavement is developed. On the northwest side of the range colluvium and alluvium terraces are locally moderately to well consolidated.
- PIOCg** Pliocene to Quaternary(?) sandstone and conglomerate: Concealed mostly beneath Qoal, this unit is exposed within two main drainages in the southernmost map area, and is bounded on its SE side by the mapped NE-striking fault. There are two subunits: **PIOCgs** The southernmost subunit, interpreted as the youngest, is a tan-colored, moderately-consolidated silty sandstone, with 5–20% pebble to boulder-sized (up to 30 cm) angular clasts of mylonite. **PIOCgt** To the north is a well-consolidated, angular, clast-supported sedimentary breccia. Clasts are mostly pebble to cobble in size, and are sourced from the surrounding mylonitic gneisses (unit KXgn). Compared to Qoal this unit has much more sand and gravel in the matrix (up to 30–40%), is more well consolidated, and clasts have a higher degree of angularity.
- Ncg** Miocene(?) siltstone and conglomerate: Concealed mostly beneath Qoal, this unit is exposed within three drainages just NNE of the unit PIOCg. There are three subunits: **Ncg1** The southernmost and youngest subunit is a moderately-consolidated, clast-supported, pale salmon to tan conglomerate, with a silty to sandy matrix. Clasts are mostly subangular, with 50–60% gravel to cobble in size (5–10% of the total volume are cobble clasts >10 cm in diameter), and sparse boulders 0.4–1 m in diameter. Clast lithologies include volcanic (including rhyolitic tuff and vesicular basalt), plutonic (medium-grained granite and diorite), and quartz-pebble conglomerate. This subunit lacks mylonitic clasts, but is overlain by a sedimentary breccia consisting entirely of mylonite clasts, likely the same breccia as PIOCgt. **Ncg2** The middle subunit is a moderately- to well-consolidated, matrix-supported, reddish-tan conglomerate, with a sand and pebble matrix (~60%), and mostly rounded to subrounded cobble-sized clasts (~30%). Clasts include volcanic and plutonic lithologies (with those in this subunit Ncg2, but also sparse, well-rounded pegmatitic granite boulders (up to 50 cm), and rare mylonite. **Ncg3** The oldest and northernmost subunit is a well-consolidated (though fractured and friable) brownish-red and tan siltstone, with bedding ranging from 0.5 mm to ~5 cm thick. Resistant, cobble-sized oblate nodules are common, and sparse 1–2 cm thick manganiferous(?) to ferruginous sandstone layers are present.

The following upper-plate units are simplified from Spencer et al., September 2014, AZGS, Geologic map of the Bouse and Ibez Peak 1/2° Quadrangles, La Paz County, Arizona - scale 1:24,000. Excludes upper Miocene to Quaternary units, and contacts of some units have been modified.

- Ns** Miocene sedimentary units - including conglomerates, sandstones, and limestones.
- Nv** Miocene volcanic units - including hornblende dacite, pyroclastic tuff, and mafic volcanics.
- MaPzs** Paleozoic and Mesozoic sedimentary units - including conglomerates, breccias, sandstones, limestones, and quartzites.
- Paleoproterozoic to Tertiary granitic and gneissic rocks** - including granite, mafic granite, gneissic leucogranite, very fine grained diorite, porphyritic biotite granite, and metamorphic rocks.

Alteration zone: Pale-green to light-gray colored zone within unit Nic, associated with widespread sericitization, chloritization, and pervasive fractures covered in chlorite. This zone is conspicuous only in the northern half of the mapped footwall adjacent to the Plomosa detachment fault.

Miocene dikes: Mostly non-mylonitic NW-striking dikes ~0.2–3 meters wide, which are commonly exposed as linear piles of boulder- and cobble-sized angular clasts. The most common composition is rhyolite-dacite with ~35–40% fine-grained phenocrysts of plagioclase (~20%), biotite (~7%), quartz (~7%), and accessory hornblende (~0.5%). The remaining 60–65% groundmass consists primarily of plagioclase laths. Weathered surfaces of non-mylonitic dikes are pitted (0.2–1 m wide pits). A few of the mapped dikes are phenanitic, mylonitic quartz diorites, which are likely late-stage intrusions of unit Nic.

Miocene intrusive complex: Dominantly appears as a bimodal composition of leucocratic and intermediate dikes, sills, and intrusive bodies. **Leucocratic intrusions:** fine- to medium-grained, mostly mylonitic biotite tonalite, granodiorite, and uncommon granite, which together make up ~60% of Nic. Commonly has up to 10% 1–2 cm feldspar porphyroclasts. In thin-section, feldspars are typically moderately to strongly sericitized, and plagioclase has very well defined oscillatory zoning and polysynthetic twinning. Biotite is usually partially to completely chloritized. Minor minerals include opaques (up to 5%), local muscovite (1–3%), and accessory apatite, titanite, zircon, and rutile. **Intermediate intrusions:** very fine- to medium-grained (but locally aphanitic or coarse-grained), hornblende-biotite diorite, with lesser quartz diorite, quartz monzonite, and rare quartz monzonite. This unit is typically nonmylonitic to protomylonitic, and hornblende abundance typically ranges from 10–40% (rarely up to 70%). Accessory mineralogy is similar to that in the leucocratic intrusions.

The bulk of this unit appears as layered tabular bodies approximately parallel to mylonitic foliation, though nonmylonitic diorite/quartz diorite dikes locally out across well foliated layers. Alternating layers of leucocratic and intermediate intrusions are commonly ~0.2–2 m thick, though leucocratic intrusions are locally as thin as 0.5–3 cm. In some locations, hornblende quartz diorites appear to have undergone magma mingling, with intermediate and more felsic compositions intermixed as centimeter- to decimeter-scale irregular ribbons. Local high-strain mylonitic hornblende-bearing biotite granodiorite is similar in appearance to the well-foliated gneiss of unit KXgn. This unit is locally highly brecciated and intensely chloritized.

Orocopia Schist: Biotite + muscovite quartz-feldspathic mylonitic schist. Mineralogy is dominantly quartz (26–50%) and plagioclase (24–50%), with biotite (8–34%), variably chloritized, locally muscovite (2–20%, generally ~10%), minor opaques (up to 4%, mostly graphite), accessory apatite (up to 1%), rutile, zircon, and local accessory garnet (up to 0.5%). Commonly has 1–3 mm poikiloblastic graphitic plagioclase porphyroblasts, which are dark gray in hand sample, locally with a bluish tint. In some samples a foliation defined by the graphite is preserved within the porphyroblasts. In plane-polarized light, the biotite is typically reddish brown, and rutile needles are common in areas where biotite has retrograded into chlorite. In outcrop this unit is often gray and faggy, or a more resistant with a reddish-purple tint. The texture is generally homogeneous, and the mylonitic foliation (defined by sheared micas and dynamically recrystallized quartz) commonly has a very well developed S-C' fabric indicative of top-to-NE-directed shear. Mylonitic lineations are defined by quartz ribbons and streaks of mica. Locally the unit contains gray metasedimentary layers 10–30 cm wide that have <10% total mica and >60% feldspar. 2–50 cm thick milky quartz lenses locally with up to ~10% feldspar are common throughout the unit.

Scattered pods of coarse-grained green magnesio-actinolite, 5 cm to 1.5 m wide, are present in the schist; locally, several smaller pods may be aligned parallel to the trend of mylonitic lineations. ~0.1–2 m-thick layers of actinolite-bearing schist with minor talc and rare talc schist are also present, which commonly include actinolite pods within them. In one location, a 0.5 m-wide tabular body of the actinolite is present.

Orocopia amphibolite (metabasalt?): Medium-grained hornblende amphibolite locally interlayered with Orocopia Schist and leucocratic mylonitic sills (unit Nic). Mineralogy is hornblende (60–80%), plagioclase (10–30%), quartz (~5%), titanite (up to 3%), and accessory opaques, biotite, chlorite, garnet, apatite, and diopside. Within this unit are abundant ~3–30 cm thick layers of quartzite (metachert), which are locally isoclinally folded and commonly weathered to a rusty red color, or exposed as clear alternating white and dark-gray layers. The quartzite includes <1 mm wide Mn-rich gamets (2–15%, locally up to 40% in masses), opaque minerals (3–10%), hornblende (<8%), locally minor actinolite (up to 9%), apatite (<1%), and biotite (<1%). The contact with this unit and unit KXgn is folded and varies from gently SE-dipping to subvertical.

Interlayered mylonitic quartzite and marble: Quartzite layers are typically 1–3 m-thick, and are light tan to pale green in color with minor chlorite. Marble layers are typically 0.5 m thick, but may be up to ~2 m thick. The marble is light gray to tan-brown with orangish-brown siliceous layers, mm- to cm-scale foliation, and is locally isoclinally folded. Mineralogy is dominated by calcite with up to 20% tremolite. Most quartzite is intensely fractured, whereas the marble primarily lacks brittle deformation. This unit is pervasively intruded by sills of the unit Nic, particularly in the southern half of the unit. Isolated, discontinuous layers of mylonitic marble exist south of the unit adjacent to the Plomosa detachment fault.

Mylonitic layered gneisses: Most commonly has alternating layers ~3–30 cm thick, composed of hornblende amphibolite, biotite-poor tonalite/granodiorite, and gray to tan-gray, well-foliated and lined hornblende-bearing biotite tonalite/granodiorite. The well-foliated gneiss commonly appears as several meter-thick packages (locally ~10 m), with 1 mm to 1.5 cm-thick layering defined by alternating felsic (up to 50% quartz, 40% plagioclase), and mafic (up to 50% hornblende, 15% biotite) compositions. Amphibolite and hornblende-rich tonalite/granodiorite may be several meters thick, and the amphibolite commonly is boudined or exhibits pinch-and-swell structures. The unit locally includes 1–10 cm thick leucogranitoid layers with recrystallized ribbons of quartz and feldspar. The SW portion of the gneiss unit commonly has an outcrop-scale 'salt-and-pepper' appearance as viewed from a distance, which is fine-grained hornblende amphibolite adjacent to leucocratic biotite-poor tonalite/granodiorite, commonly interlayered with the well-foliated gneiss. Minor and accessory minerals of this unit include opaques (0.5–4%), chlorite (1–2%), and titanite (up to 2%), accessory apatite, and local accessory zircon. The unit is dominantly mylonitic within the map area, though locally there are 5–30 cm thick protomylonitic layers with feldspar porphyroclasts up to 4 cm long. Mylonitic lineations are typically defined by stretched quartz, aligned hornblende, and streaks of biotite. The fabric becomes predominantly protomylonitic towards the southern end of the map area, which is ~2 km NNE of a mylonitic front that demarcates the top of the zone of mylonitic fabrics. A nonmylonitic gneiss with a spotted appearance is found in the very SE portion of the unit, on the east side of the mapped NE-striking fault. It has white poikiloblastic plagioclase ~3 mm to 1 cm in diameter and a weakly-developed foliation defined by aligned hornblende and biotite, which is overgrown by randomly-oriented hornblende 0.5 cm long. Minor titanite up to 2 mm long and quartz are also present. This nonmylonitic gneiss occurs as several repeated layers that vary from 3–8 meters thick, and are laterally continuous for ~400 m.

Hornblende-rich gneisses: areas within unit KXgn composed mostly of medium-grained hornblende amphibolite (~70–90% hornblende) or hornblende-rich tonalite/granodiorite (~40–50% hornblende). This unit is distinguished from the unit Kham by the presence of gneissic banding, and a lack of quartzite (metachert) layers.

Cross-sections through the footwall of the Plomosa detachment fault

