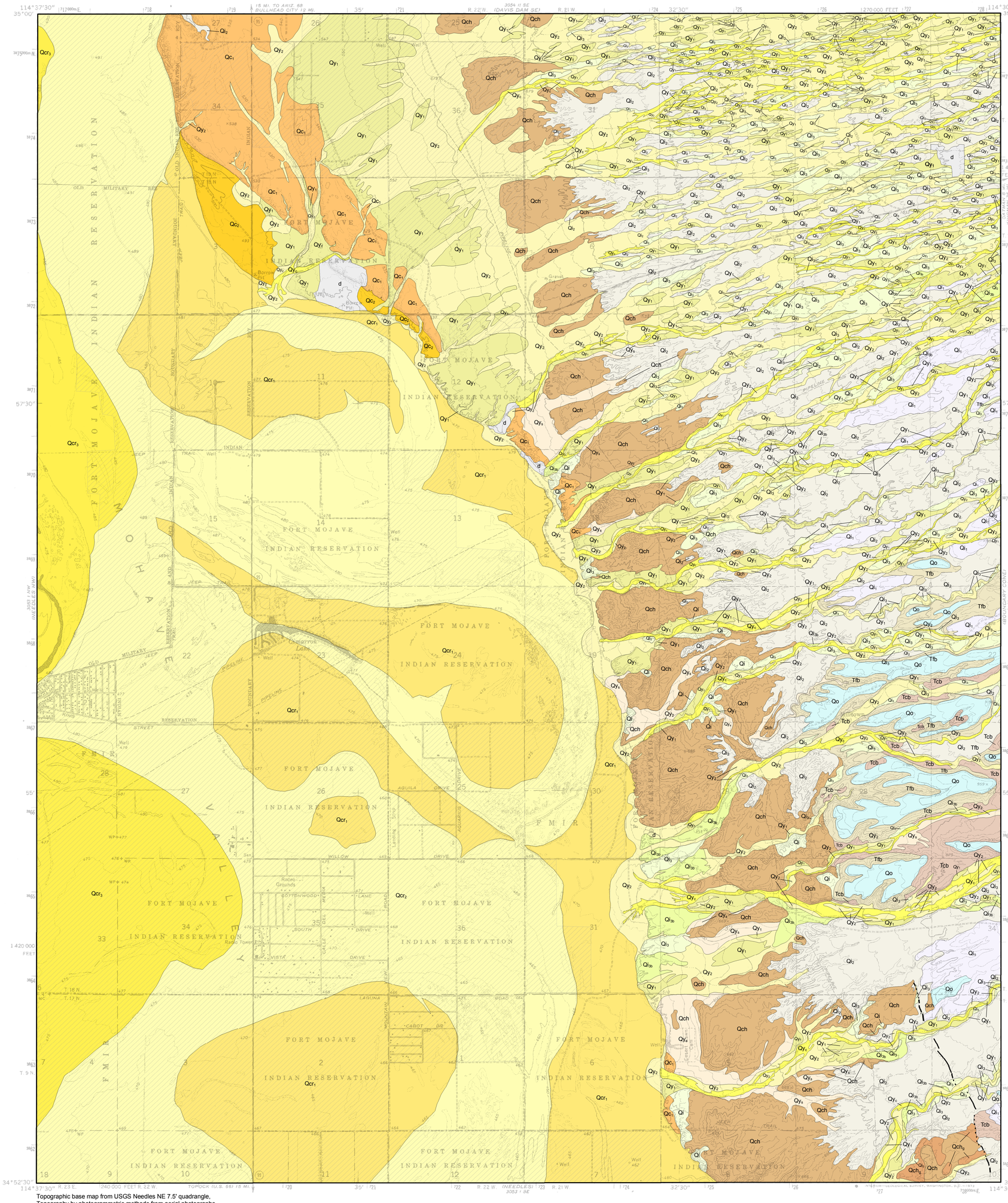
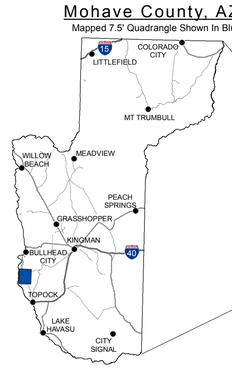


Topographic base map from USGS Needles NE 7.5' quadrangle,
Topography by photogrammetric methods from aerial photographs taken 1969. Field checked 1970
Projection: reprojected by AZGS, NAD 83, UTM zone 12.
Magnetic declination 12º east of true north.

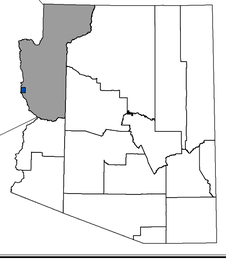
Mohave County, AZ

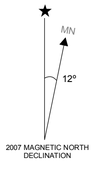
Mapped 7.5' Quadrangle Shown In Blue



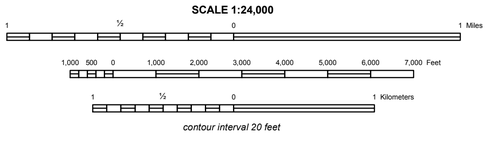
Location Map

Arizona Counties Shown





SCALE 1:24,000



contour interval 20 feet

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Map Symbols

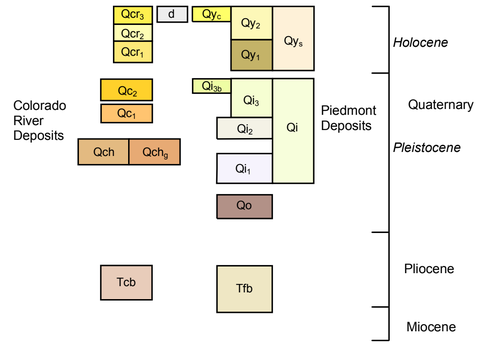
line features

- contact, accurately located
- contact, approximately located
- fault, accurately located
- fault, concealed

polygon feature

- areas obscured by agricultural activity or urban development

UNIT CORRELATION DIAGRAM



Stevan Gyetvai was the cartographer responsible for map layout.

GEOLOGIC MAP OF THE NEEDLES NE 7½' QUADRANGLE, MOHAVE COUNTY, ARIZONA

by: Philip A. Pearthree

Arizona Geological Survey Digital Geologic Map 53 (DGM-53), version 1.0

March 2007

Citation for this map sheet:
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(also available as Adobe Acrobat pdf file on CD-ROM)

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Acknowledgments

The Bureau of Land Management and the Bureau of Reclamation supplied some of the aerial photographs used in these mapping efforts. Remote sensing data provided by Simon Hooke and Sarah Robinson of the U.S. Geological Survey were vital in id entifying and mapping old Colorado River deposits on the piedmont. Kyle House of the Nevada Bureau of Mines and Geology and Keith Howard of the USGS provided valuable insights into the geology of this area. Stevan Gyetvai and Joseph P. Cook were responsib le for the map layout for version 1.0 of DGM -53.

Geologic Map Units

d — **Disturbed areas -** Areas where the landscape has been profoundly altered such that the pre-development surficial geologic units no longer exist.

Piedmont Alluvium

Qy_c — **Modern sand and gravel deposits associated with active channels of tributary washes –** Very young cobbles, pebbles, boulders, sand, and minor silt deposits in active tributary channels. Gravel is derived from the Black Mountains and consists of various volcanic lithologies, including basalt, andesite and rhyolite. Clasts are typically subangular or angular and range from pebbles to small boulders. Vegetation is sparse, consisting of small bushes with trees along the channel margins or on channel bars. Channels vary substantial in width along washes and commonly are not continuous upstream and downstream. Active channels are mapped where they are sufficiently large to depict at 1:24,000-scale.

Qy_2 — **Late Holocene deposits on low terraces, active alluvial fans, and small wash channels** – Young deposits associated with active fluvial systems. Channel deposits typically are very poorly to poorly sorted, consisting of sand, pebbles and cobbles, with some small boulders. Terrace and fan deposits consist of gravel, sand and silt. Clasts typically are subangular and deposits are poorly to very poorly sorted. Fan and terrace surfaces typically are gently undulating where deposits, with gravel bars and finer-grained swales. Desert pavement development is minimal and rock varnish is very light or nonexistent. Soil development is weak. Surface dissection is minimal and is associated with channels that are incised up to 1.5 m below adjacent fans or terraces. Channel patterns are variable, including anastamosing or distributary linked channels and separate small tributary channels feeding into larger channels.

Qy_1 — **Late to early Holocene deposits on low terraces and young alluvial fans** – Relatively young deposits associated with active washes and alluvial fans. Deposits typically are poorly to very poorly sorted, consisting of cobbles, pebbles, sand, small boulders, and silt. Bar and swale topography is common. Soil development is weak, with minimal soil structure and minor visible carbonate accumulation, but surfaces have a brownish cast due to moderate rock varnish accumulation on surface gravel clasts. Active washes are incised up to 2 m below Qy_1 fans or terraces. Relict channel patterns are variable, including anastamosing channels and separate small tributary channels feeding into larger channels.

Qy_s — **Holocene sandy channel and fan deposits –** Young, quartz-rich sand deposits derived from older Colorado River deposits. These deposits typically consist of thin sheets of reworked sand in valleys cut into Pleistocene or Pliocene Colorado River deposits or along the flanks of eroded river deposits.

Qi_3 — **Late Pleistocene alluvial fan and terrace deposits** – Younger intermediate deposits associated with inactive alluvial fans and terraces along washes. These surfaces grade to terraces along the Colorado River about 520 to 540 feet asl, about 40 to 60 feet above the modern river channel. Deposits typically are poorly sorted mixtures of pebbles, cobbles, silt, and sand, with some small boulders. Surfaces are fairly smooth to undulating, but local topographic relief varies from about 1 to 3 m along active drainages. Soil development is weak, with no clay accumulation and stage I calcic horizon development with fine filaments and discontinuous clast coatings. Desert pavement development typically is strong, and rock varnish is dark brown.

Qi_{3b} — **Late Pleistocene terrace and fan deposits, younger member** – A younger subdivision of the Qi_3 unit is differentiated where there are 2 mappable levels of late Pleistocene deposits. These Qi_{3b} deposits typically form terraces inset one to several m below adjacent Qi_3 surfaces, although locally they form more extensive inset alluvial fans. Rock varnish is moderate to dark, and soil development is similar to Qi_3 units. Typically these deposits are limited in areal extent and grouped with older Qi_3 deposits.

Qi_2 — **Older late Pleistocene alluvial fan deposits** – Older intermediate deposits associated with extensive relict alluvial fans. These surfaces are approximately graded to 650 to 700 foot asl terraces of the Colorado River. Deposits are poorly sorted, including sand, pebbles and cobbles, with silt and minor clay. Qi_2 surfaces are drained by extensive incised tributary drainage networks. Surfaces are smooth to gently undulating, but are dissected from about 2 to 10 m along active washes. Surface color is typically dark brown due to darkly varnished, well developed desert pavements. Soils have weak clay accumulation and slight reddening in the upper 30 cm beneath the surface, and calcic horizons typically are stage II with continuous coatings on gravel clasts and some whitening of the soil matrix.

Qi_1 — **Middle Pleistocene alluvial fan deposits** – Oldest intermediate deposits associated with relict alluvial fans. These surfaces extend down slope to approximately to the 800 foot asl terrace of the Colorado River. Locally Qi_1 deposits have fluvial (river) scarps cut into them at that level, so Qi_1 deposits are older than late Pleistocene river deposits (unit Qc_c). Deposits are poorly sorted, including sand, subangular pebbles and cobbles, and minor silt. Surfaces are moderately to deeply dissected, with local topographic relief varying from about 2 to 10 m. Original depositional topography is modified by erosion, and surfaces typically are rounded toward active washes and only locally are planar. Well-preserved planar surface remnants are typically fairly dark because surface gravel is darkly varnished, but desert pavements include some light-colored debris from underlying calcic horizons. More eroded Qi_1 surfaces are relatively light-colored with common calcic horizon litter. Soils typically have stage III to IV calcic horizon development and minor or no evidence of clay accumulation. Surfaces commonly are a 1-5 meters higher and much more eroded than adjacent Qi_2 surfaces, and are inset well below adjacent Qo surfaces.

Qi — **Middle and late Pleistocene alluvial fan and terrace deposits, undifferentiated.**

Qo — **Early Pleistocene alluvial fan deposits** – High, old relict alluvial fan deposits. Alluvial surfaces associated with these deposits are truncated at high erosional scarps associated with the ~800 foot asl terrace of the Colorado River. Deposits typically are very poorly sorted, including angular to subangular cobbles and pebbles with sand and minor silt and clay. Surfaces are moderately to deeply dissected, with 5 to 20 m of relief between channels and ridgecrests. Original fan surfaces have been removed or strongly modified by erosion in most areas; the characteristic topographic expression of these deposits is alternating ridges and valleys. Planar surfaces are preserved locally, however, and these are quite smooth with concentrations of boulders and abundant litter from underlying calcic soil horizons. Soil development is moderate to strong, depending on local preservation, but stage IV and occasionally stage V petrocalcic horizons are associated with planar surface remnants. Qo surfaces have a fairly light appearance on aerial photographs.

Tfb — **Late Miocene to Pliocene alluvial fan deposits –** Very old piedmont alluvium exposed in the middle and lower portions of dissected ridges near the eastern edge of the quadrangle. This alluvium was deposited before the arrival of the Colorado River and during the early Pliocene aggradation of the river. Deposits typically are poorly sorted to very poorly sorted, including angular to subangular cobbles, pebbles and sand with minor silt and clay. Deposits typically are moderately indurated and form steep faces where they have been undercut by recent erosion.

Colorado River Alluvium

Qcr_3 — **Historical channel deposits –** Sand and gravel deposits in areas that were active river channels prior to damming of the river. Deposits consist of well-sorted to poorly sorted quartz sand, pebbles and cobbles. Surfaces have commonly been altered by agricultural activity and are likely subject to inundation in modest floods.

Qcr_2 — **Historical floodplain deposits** – Sand, silt, and gravel deposits associated with the historical flood channels and the floodplain of the Colorado River. Preserved floodplain surfaces typically are undulating, but most have been smoothed by agricultural activity and more recently by urban development. Prior to human alteration, historical floodplain areas included flood channels and abandoned channels and recently cut-off channel meanders, all of which may have been subject to inundation in large Colorado River floods. Floodplain surfaces typically are covered with fine-grained floodplain deposits, but relict gravel bars and lenses are common. Vegetation consisting of small to medium trees, shrubs and grasses is lush where not altered by agricultural activity. Qc_{r2} terraces are less than 10 feet above the active channel.

Qcr_1 — **Holocene river deposits** – Sand, silt, and gravel deposits associated with low terraces along the margins of the historical floodplain and point bars on the insides of abandoned channel meanders. Terrace surfaces typically are quite smooth (most have been altered by agricultural activity) and are less than 20 feet above the active channel. Terrace surfaces typically are fairly smooth and covered with fine-grained floodplain deposits, but relict gravel bars and lenses are common in the lateral accretion deposits on old point bars. Vegetation consisting of small trees and shrubs is fairly lush. These surfaces may have been inundated by large floods on the Colorado River prior to dam construction.

Qc_2 — **Older Holocene river terrace deposits** – Sand and gravel deposits associated with an inset terrace found along the flank of the historical Colorado River floodplain, in the northwestern part of the quadrangle. The terrace surface is about 20 feet above the active river channel, and is mantled with lightly varnished river pebbles and cobbles and quartz-rich sand; some relict channel features are preserved locally. Soil development is weak. Vegetation cover is very sparse.

Qc_1 — **Younger late Pleistocene river terrace deposits** – Sand and gravel deposits associated with an intermediate terrace found along flank of historical Colorado River floodplain. Terrace surfaces and eroded slopes are commonly mantled with river gravel and sand, but deposits consist of gravel, cross-bedded sands, silt and clay. Soil development is weak with discontinuous to continuous carbonate coatings on gravel clasts where terraces are well preserved. Vegetation cover is very sparse. Terrace surfaces are 50 to 70 feet above the modern river channel.

Qch — **Older late Pleistocene river deposits** – Clay, silt, sand and gravel deposits associated with a major phase of late Quaternary aggradation along the Colorado River (Lundstrom et al, 1998). Terrace surfaces at or near the top of this unit are extensive in this quadrangle and are bounded on the east by erosional scarps cut into older river and piedmont deposits. Terraces are fairly flat or slope gently toward the river, but terrace surfaces are deeply dissected by tributary drainages. Deposits typically are sandy to gravelly at the surface but deeper exposures indicate that the deposits are dominated by silt and clay. Qc_c terrace surfaces range from about 200 to 350 feet above the active river channel. Lower terraces in this range are probably primarily erosional features cut into these river deposits.

Qch_g — **Older late Pleistocene river deposits, gravelly member** – Gravel-rich member of the late Pleistocene river deposits. Some terrace surfaces are capped by gravel, and in other areas gravel-rich layers are interbedded with sandier units. Gravel consists of well-rounded, far-travelled clasts and sub-rounded to sub-angular volcanic clasts from the Black Mountains.

Tcb — **Early Pliocene river deposits, alluvium of Bullhead City** – A moderately thick sequence of old Colorado River deposits that underlies younger tributary terrace and fan deposits. The alluvium of Bullhead City consists of quartz sand, rounded pebbles and cobbles, and silt, with a substantial component of subangular tributary gravel. Deposits are weakly to moderately indurated and locally oxidized. River sands typically are fairly coarse and cross bedding is common. Exposures reveal abundant minor unconformities, but no strong buried soils or other evidence of major depositional hiatuses was observed.

See accompanying text for references, mapping methods and map description.