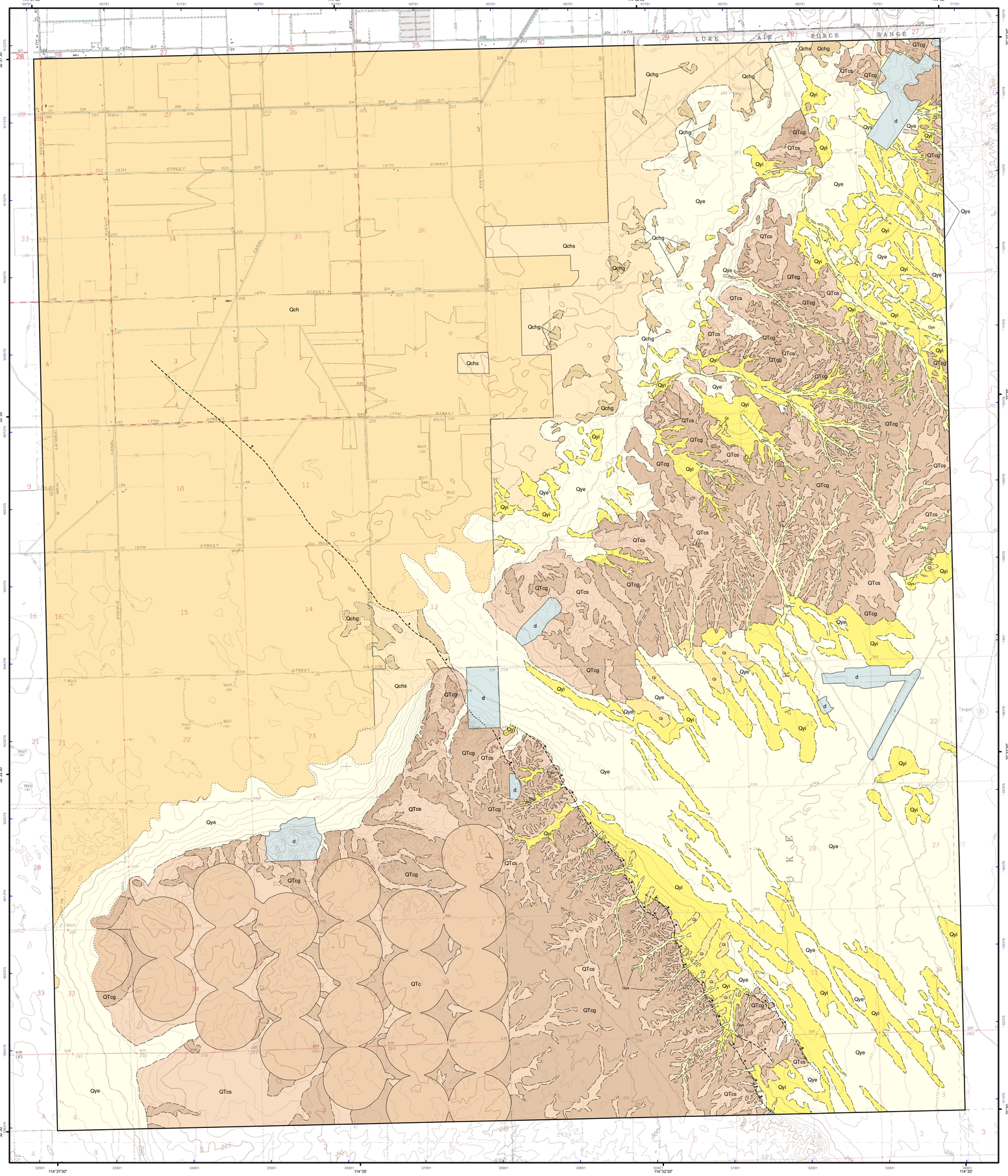


Topographic base from USGS 1:24,000 Quadrangle Series. Seamless basemap generated using iGage Alt Topo Pro software.

APPROXIMATE MEAN DECLINATION, 2011

SCALE 1:24,000

CONTOUR INTERVAL 5 FEET

Projection Information:
North American Datum of 1983.
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue.

Map Unit Descriptions

Other Deposits

disturbed ground - Land that has been substantially modified or obscured by human activity. Includes aggregate pits and airfield runways, but does not include areas disturbed by agricultural activity.

Holocene sandy eolian deposits - Windblown sand and silt deposits in broad valleys and mantling the lower portions of hillslopes in upland areas. Deposits are reworked Colorado River quartz-rich medium to fine sand, and eolian silt. Local topography is undulating, with ubiquitous small-scale coppice dunes and mounds around vegetation. Soil development is minimal.

Piedmont Deposits

Holocene sandy fluvial deposits - Quartz-rich medium to fine sand deposits with minor gravel associated with wash systems draining upland areas. Qys deposits are reworked from older Colorado River deposits and are compositionally very similar to them, but generally contain only minor, pebble and cobble gravel. Channels are small, discontinuous, and multi-threaded, with low sand bars and small terraces between channels. Soil development is minimal.

Older Holocene to late Pleistocene fluvial(?) deposits - Sand, silt, and fine gravel deposits with minor eolian overprint. Deposits are mostly reworked older Colorado River sand and gravel, so sand is quartz-rich and medium to fine-grained, and gravel is commonly rounded to well-rounded. Surfaces typically are relatively planar with small mounds around bushes and burrows. Surfaces typically have lightly varnished pebble lags, although open gravel pavements with more darkly varnished clasts are found in some areas. Qyi surfaces are darker and typically are topographically higher than adjacent Qys surfaces, but lower than adjacent Qye surfaces.

Late Pleistocene gravel and sand deposits - Intermediate age gravel and sand deposits reworked from older Colorado River deposits. Pebbles and cobbles are well-rounded to subangular, mixed lithologies. Medium to fine sand is quartz-rich. Surfaces typically are planar to broadly rounded; surface margins are rounded by local erosion. Surface character varies from weak to moderate grave; pavements with weak to moderate varnish, making these surfaces substantially darker than those on younger and finer deposits

River Deposits

Late Pleistocene Chemehuevi Formation, sandy member - Sand, silt, clay and very minor gravel Colorado River, and locally Gila River, deposits associated with a major late Pleistocene aggradation period. Deposits consist primarily of beds of sand, clay and silt, generally in thin to medium, nearly horizontal beds. OSL dating of similar deposits farther upstream along the Colorado River suggests that they are ~70 ka. Deposits are at least 20m thick, and the base of the unit is rarely exposed. Surface deposits are commonly reworked into small-scale eolian features.

Late Pleistocene Chemehuevi Formation, gravelly member - Late Pleistocene Colorado River pebble, cobble, sand, silt, and clay deposits. Underlying deposits likely are very similar to Qchs, but these areas are covered with open to tight pebble to fine cobble lag. Surface clasts vary from well-rounded to subangular clasts. In some areas lithologies are very diverse, in other areas gravel is mostly locally derived.

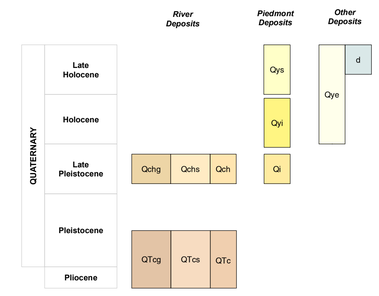
Chemehuevi Formation, undivided - Late Pleistocene Colorado River deposits, undifferentiated. Silt, clay, sand and minor gravel. Surface is modified by agricultural activity or urban development.

Pliocene to Quaternary Colorado River gravel deposits - Older Colorado River gravel and sand deposits underlying dissected upland areas. Surfaces are partially or completely covered by well-rounded to subangular pebbles and cobbles of diverse lithology. Exposures are limited, but gravel bedding varies from subhorizontal to large-scale crossbedding. Because gravel clasts are difficult to transport by local fluvial processes, gravel likely mantles ridge crests and side slopes as underlying sandier deposits are translocated by erosion.

Pliocene to Quaternary sand deposits - Older Colorado River medium to fine-grained sand deposits with minor gravel. Sand is quartz-rich and mature. Gravel consists of rounded to well-rounded pebbles of diverse lithology. Surface sand deposits have been reworked by eolian activity to varying degrees, and locally QTcs deposits are mantled by small-scale dunes and mounds.

Pliocene to Quaternary Colorado River deposits, undivided - Older Colorado River sand and gravel deposits. Medium to fine, quartz-rich sand, and well-rounded pebbles and cobbles of diverse lithology. Unit used in areas where the character of surface deposits has been disturbed by agricultural activity.

Unit Correlation Diagram



Line Symbol Descriptions

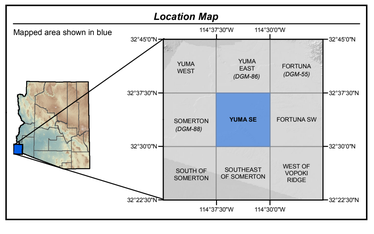
All geologic contacts are solid where accurately located, dashed where approximately located and dotted where concealed beneath surficial units.

contact

normal fault, ball and bar on downthrown block

Location Map

Mapped area shown in blue



GEOLOGIC MAP OF THE YUMA SE 7 ½' QUADRANGLE, YUMA COUNTY, ARIZONA

Arizona Geological Survey Digital Geologic Map

DGM-87, version 1.0

Scale 1:24,000

By
Philip A. Pearthree
October 2011

Citation for this map:

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Introduction

This geologic map covers part of Yuma Mesa and the Yuma Desert in Yuma County, southeast of Yuma and east of the Colorado River. This geologic map is the product of research under the National Cooperative Geologic Mapping Program, with funding provided by the U.S. Geological Survey and the Arizona Geological Survey. Mapping was compiled digitally using ESRI ArcGIS software, over digital orthophoto bases (National Agricultural Imagery Program, 2007, 2010) and a 7 ½' U.S. Geological Surveytopographic base.

The Yuma SE quadrangle is entirely covered by late Cenozoic surficial deposits, and these are depicted in detail on this map. The map area is near the northeastern margin of the Salton Trough– northern Gulf of California plate boundary in southwestern Arizona. The quadrangle is entirely underlain by variably thick, late Cenozoic clastic sedimentary deposits. At least at the surface and in the near subsurface, nearly all of these deposits were emplaced by the Colorado River. Bedrock is ikely deep throughout the quadrangle, but the basin deepens dramatically from about 800 ft at the northern edge of the quadrangle to more than 8000 ft along the eastern boundary of the quadrangle (Richard et al., 2007). This deep basin is filled primarilywith sand, silt and clay deposited in a marine environment during the late Miocene and Pliocene. These marine deposits transition upward into thick Colorado River sand and gravel deposits (Olmsted et al, 1973).

Surficial geologic units are typically mapped using field observations in conjunction with aerial photographs and topographic information derived from topographic maps and digital elevation models (DEMs). Relative ages of alluvial deposits can be estimated using characteristics of clast weathering,soil development, carbonate accumulation, and position in the landscape (Gile and others, 1981; Machette, 1985; Bull, 1991; Birkland, 1999). In portions of the map area that have been heavily modified by human activity, however, it was difficult to find original, undisturbed alluvial surfaces with which to assess relative ages. In areas that have been substantially modified, mapping was based on information gleaned from historical topographic maps, soil surveys, and 1956 Army Map Service aerial photographs,but map units are nonetheless quite generalized. Surface topography is generally subdued, and altitude ranges from about 200 to 300 ft above sea level. There are 2 principal geologic/geomorphology domains: (1) the virtually flat Yuma Mesa in the westernhalf of the quadrangle, which is a late Pleistocene Colorado River terrace; and (2) the higher, more dissected, more variable "Upper Mesa" (Olmsted et al, 1973) in the eastern half, which consists of eroded, much older Colorado River deposits. On Yuma Mesa, the terrace surface has been heavily modified by human activity, thus very few original, undisturbed alluvial surfaces can be observed. Yuma Mesa is composed mainly of Colorado River sediment deposited during a late Pleistocene aggradation period. Malmonet al (2011) formally proposed the name Chemehuevi Formation for this lithostratigraphic unit. Three Chemehuevi units are mapped in the Yuma SE quadrangle. The upper sand facies is split into a unit with more gravel (unit Qchg) and a unit that is predominantly sand (Qchs). Qchg surfaces are covered with open to tight pebble to fine cobble lag reflecting coarser deposits within the sand facies. Where surfaces are disturbed these deposits are mapped as undivided Chemehuevi Formation (Qch). Units Qch, Qchs and Qchg are equivalent to the sand facies of Malmon et al (2011) and unit E of Metzger et al (1973). Some unaltered areas along the southeastern margin of Yuma Mesa are covered with eolian deposits, which consist of smallscale dunes and mounds of sand and silt reworked from the terrace surface. The lower mud facies of the Chemehuevi Formation almost certainly underlies much of Yuma Mesa, but is not exposed in the quadrangle. Luminescence dating of these sediments at Yuma and farther upstream indicate these sediments were deposited from approximately 70 – 40 ka, depending on the dating technique used (Lundstrom et al, 2008). Tephrochronology of four tephra deposits found in the Chemehuevi Formation in the Cottonwood Valley area suggest an age of 74- 59 ka (Sarna-Wojcicki et al, 2011).

The "upper mesa" or Yuma Desert in the eastern half of the map is consists of older Colorado River sand and gravel deposits and reworked versions of these deposits. The primary Colorado River deposits consist primarily of sand, with significant proportion of cobbles and pebbles. Exposures are generally poor, as this area consists mostly of broadly rounded hillslopes covered with sand and gravel, but medium to largescale cross-bedding was observed in a few artificial excavations. Sand is quartz-rich and mature, and most gravel clasts are well-rounded. The age of these deposits is not closely constrained in this area, but they are younger than the late Miocene to Pliocene marine deposits that fill the deep basin and are at the top of a thick sequence of primarily Colorado River sand and gravel (Olmsted et al, 1973). These older Colorado River deposits may correlate generally with old river deposits of Yuma Proving Ground farther upstream. The age of these deposits has been estimated at middle Pliocene based on species of fossilized wood found in the deposits (Nations et al, 2009). Because the upper mesa is relatively high and the deposits are quite old, the landscape of this area is highly eroded.

The Algodones fault zone trends northwest across most or all of the map area. On the upper mesa, the location of the fault zone is expressed as a northeastfacing, 15-20 m high fault scarp. A broad topographic trough exists immediately northeast of the fault scarp. Near the northwesternmargin of the upper mesa this trough is about 1 km wide; farther to the southeast the trough is much broader. The southwestern extent of the trough is obviously controlled by the Algodones fault zone. The eastern and northern extents of the trough may alsobe controlled by faulting, but these margins are much less clearly defined. The surface expression of the Algodones fault zone is shown in detail on this map. The overall trend of the fault zone is northwest, but there are several minor left-steps; near the southern margin of the quadrangle there are multiple parallel faults. Given that the orientation of the fault is approximately parallel with the San Andreas Fault there may be a component of right-lateral strike-slip displacement, and the Algodones fault zone was even considered as a possible continuation of the San Andreas Fault (Mattick and others, 1973). However, the subsurface configuration of the top of late Miocene to early Pliocene marine deposits that cross the fault precludes substantial lateral displacement (Olmsted et al, 1973). The Algodones fault zone bounds a deep sedimentary basin to the northeast, implying that the dip-slip component of displacement is predominant. The fault zone clearly displaces the upper mesa surface by at least 20 m. The Colorado River deposits that form the upper mesa are likely early Pleistocene to Pliocene in age, but the age of the surface could be substantially younger if it is a strath terrace formed by the Colorado River. Vertical displacement of the late Pleistocene Yuma Mesa terrace is very subtle and must be minor. Interpretation of early topographic maps and 1955 aerial photographs suggests that a very small version of the Algodones fault scarp may have continued northwest across much, but not all of, the terrace. The recent history of movement on Algodones fault was investigated in the early 1970's as part seismotectonic study for a proposed nuclear power facility (WoodwardMcNeil & Associates, 1974). Trenches excavated across a series of steeply NE-dipping faults revealed evidence for multiple faulting events in the late Pleistocene, with the most recent event estimated at 11-15 ka. They estimated the amount of vertical displacement per event at 0.5-1.5 m. If multiple faulting events occurred in the late Pleistocene, then displacement must decrease rapidly to the northwest because cumulative displacement of the 4070 ka Yuma Mesa terrace is minor.

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