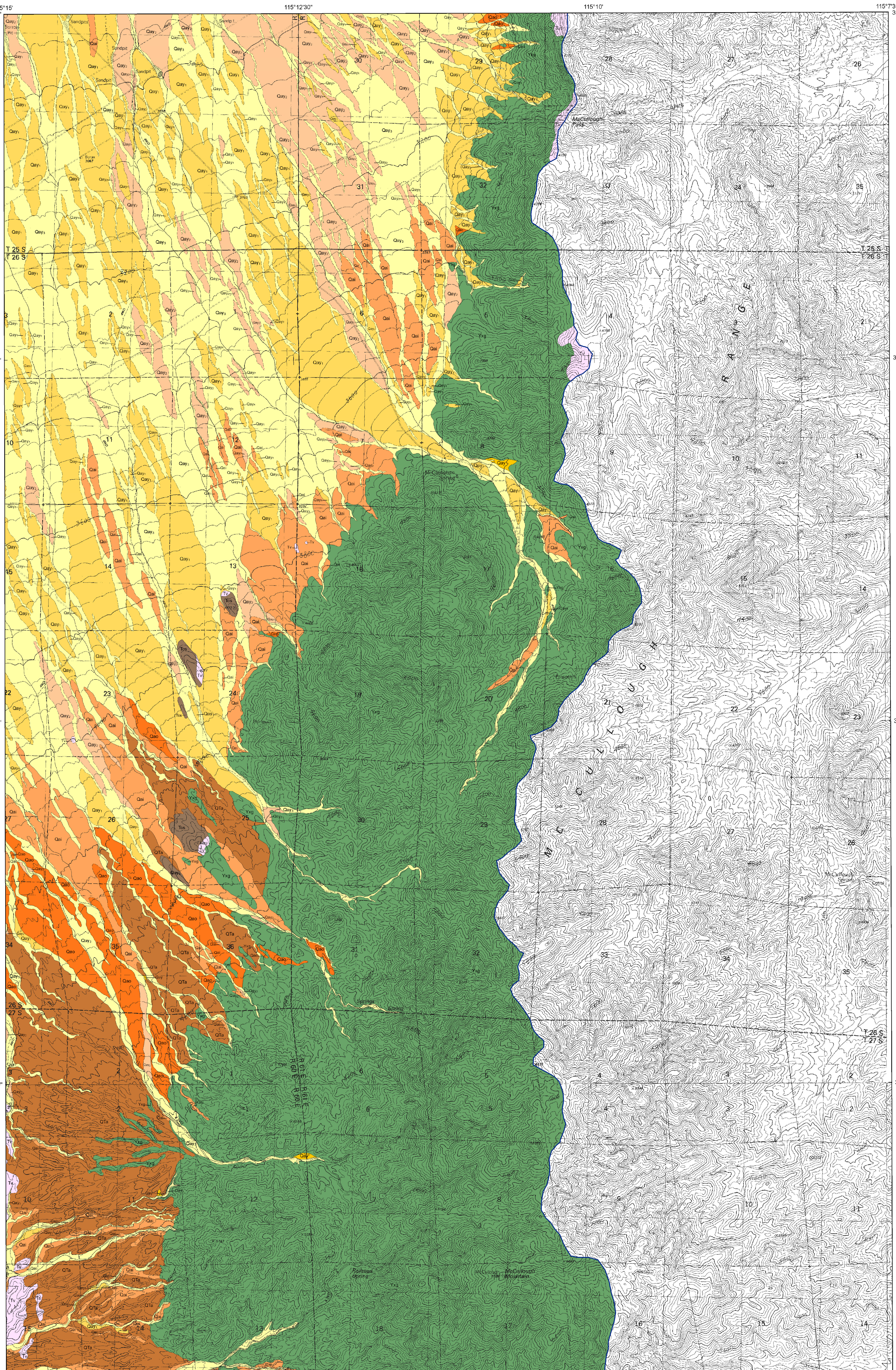


SURFICIAL DEPOSITS, HOLOCENE TO MIOCENE

Descriptions modified slightly from House and others (2006)

Alluvial deposits

Deposits of ephemeral washes and alluvial fans. Washes include alluvial fan feeder channels, well-defined axial streams, and channels in stable distributary flow networks; alluvial fans include extensive areas of downstream branching, unstable distributary flow networks, broad areas that convey relatively shallow swaths of unconfined flows, and areas of intricately braided washes. In most cases, active washes and fans are closely interrelated or mutually gradational, so no effort has been made to divide them at this scale.

The broad range of soil development observed on alluvial deposits in the map area and the diverse assemblage of related alluvial landforms indicates a complex history of alluvial fan formation, occupation, and abandonment spanning approximately the last 5–6 million years. [illegible]

Alluvial deposits are composed predominantly of massive to moderately sorted, moderately to well stratified sands and gravels ranging from pebbles to boulders. [illegible]

Alluvial fans of different ages in the mapped area are divided on the basis of a suite of surficial and morphologic characteristics, including: topographic position; degree of dissection and nature of extant drainage pattern (e.g., tributary or distributary); alteration of original depositional morphology evident as progressive smoothing of surface morphology over time; development of gravel pavement; degree of chemical and physical weathering of surface clasts; and soil horizon development and carbonate morphology (e.g., Christenson and Purcell, 1985; Machette, 1985; Bull, 1991; Birkeland, 1999). [illegible]

Qay — Young alluvium, undivided (Holocene to late Pleistocene) Coarse-grained alluvial fan and wash deposits from principal drainages in the Spring, Bird Spring, McCullough, and Lucy Gray Mountains and various local sources. [illegible]

Surface and soil characteristics of Qay deposits depend strongly on relative age and frequency of fluvial activity. [illegible]

Qay₃ — Young active alluvium (late Holocene) Active wash and alluvial fan deposits of poorly to moderately sorted gravel, sand, and minor silt. [illegible]

Qay₂ — Young active alluvium and recently abandoned active alluvial surfaces (Holocene) [illegible]

Qay₁ — Young inactive alluvium (early Holocene to late Pleistocene) [illegible] Radiometric and mineral luminescence ages of the deposits reported in those studies range from the early Holocene to the late Pleistocene (approximately 9 to 22 ka).

Qai — Intermediate alluvium, undivided (late to middle Pleistocene) Deposits and surfaces of inactive alluvial fans. Undivided unit includes up to three subunits that are locally divisible on the basis of slight differences in soil carbonate horizon development and topographic position (when adjacent to one another), but overall surface characteristics are very similar and consistent division is difficult at 1:50,000 scale. Surface is distinctly planar with strongly developed, tightly packed gravel pavement and dark to very dark varnish on surface clasts of siliceous composition. Many surface clasts are strongly weathered. Deeply etched and pitted carbonate clasts; and split, shattered, and disaggregated clasts of crystalline rocks, where present, are common. Surface drainage has tributary pattern and depth of channel incision generally ranges from 2 to 4 m. Exposed thickness of unit rarely exceeds 5 m. Qai deposits are moderately to strongly consolidated. Typical soil development is characterized by stage III to incipient stage IV petrocalcic carbonate morphology. A/Av/Avk horizons (1–7 cm thick) overlie Bw (8–10 cm thick); Btk (occurs in granitic alluvium only, 77 cm thick); Bk (20–89 cm thick), and/or Bkm (20–197 cm thick) horizons. Carbonate morphology increases with depth. Bk horizons display strong stage I to stage II carbonate morphology and overlie stage III Bkm petrocalcic horizons.

Youngest subunit within Qai is possibly as young as late Pleistocene (25 to 50 ka; Page and others, 2005), the older and more widespread subunit(s) possibly date to late-middle Pleistocene (>50 to 350 ka; Sowers and others, 1988; Page and others, 2005).

Qao — Old alluvium, (middle to early Pleistocene) Deposits and surfaces of old alluvial fans. Typically characterized by concordant, weakly to moderately crowned surface remnants separated by deeply (3–6 m) dissected tributary drainage networks. Surface clasts include moderately to deeply weathered fluvial pebble and cobble and sparse boulder gravels; abundant angular clasts of indurated soil carbonate; exposed mantle of eolian silt locally common. Abundant surface carbonate litter results in somewhat lighter to much lighter surface tone than typical of Qai and Qay1 surfaces. Exposed thickness of Qao ranges from 5 to ~15 m.

Soils characterized by strongly developed, thick, stage IV petrocalcic horizons. A/Av/Avk (1–8 cm thick) overlies either Btk (9–39 cm thick) or Bk (16–38 cm thick) horizons that display stage I-II carbonate morphology. Btk horizons occur in granitic parent materials in the southeast part of the study area and contain well developed clay coats and clay bridges between sand grains. The underlying, strongly indurated Bkm horizon (50+ cm thick) is characterized by a laminar cap <1 cm thick.

Qao soil and surface characteristics generally correspond to deposits in parts of Las Vegas Valley that are older than 730 ka (Sowers and others, 1988).

QTa — Old alluvium, undivided (early Pleistocene to late Miocene) Old alluvial fan deposits derived from granitic bedrock sources (unit YXg). The only extensive outcrop area is in the valley between the McCullough and Lucy Gray Mountains. Likely correlative in part to Qao and Tay (see below) in other parts of the mapped area. Deposits consist predominantly of subangular to subrounded gravel (pebbles to boulders) and coarse grussy sand and pebbles. Surface morphology ranges from deeply dissected ridge-and-ravine topography with concordant, flattish surfaces to isolated, rounded ridges with discordant ridge crests. Surface clasts include deeply weathered fluvial pebble to boulder gravel and, less commonly, broken fragments from underlying petrocalcic soil horizons. Extensive gravel pavements are rare on QTa surfaces because of moderate vegetation density. Pavements may be present locally as patches on surface crests and side slopes where they are interpreted as retrograde features. QTa deposits overlie bedrock erosion surfaces in some upper piedmont areas. Deposit thickness ranges from typically less than 5 m in upper piedmont areas to more than 15 m in lower piedmont areas.

QTa soils are characterized by moderately to strongly developed stage III to IV petrocalcic horizons. Buried soils with stage III Bk horizons are present in some QTa deposits. One or more of the following horizons are also observed: A (2–8 cm thick), Bw (15–17 cm thick), Bt (25 cm thick), and Btk (20–29 cm thick) containing stage I and II carbonate morphology.

BEDROCK UNITS, MIOCENE TO PALEOZOIC

Descriptions modified slightly from House and others (2006)

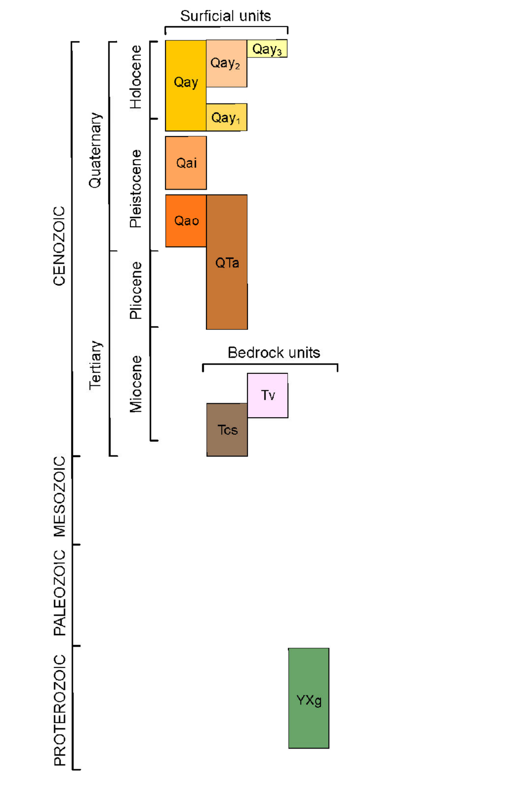
This map shows five principal bedrock units divided on the basis of major lithologic characteristics, including middle Miocene to Oligocene siliciclastic sedimentary rocks (conglomerate, sandstone, and minor mudstone); Mesozoic and Paleozoic sedimentary rocks (carbonate and siliciclastic, undivided); Miocene volcanic rocks (undivided rhyolite, andesite, and basalt); Miocene to Cretaceous silicic intrusive rocks; and Proterozoic crystalline basement rocks (granite, quartz monzonite, and granitic gneiss, undivided). No structure or individual formations are indicated on the map.

Tcs — Young sedimentary rocks, undivided (Miocene to Oligocene?) [illegible]

Tv — Young volcanic rocks, undivided (late? to middle Miocene) [illegible]

YXg — Ancient intrusive and metamorphic rocks, undivided (Proterozoic) Includes granite, granite gneiss, granitic augen gneiss, and quartz monzonite. These rocks form the bulk of the Lucy Gray Mountains, and the south range of the McCullough Mountains (Bingler and Bonham, 1972; DeWitt and others, 1989).

A shapefile of the geology polygons is available at: www.nbmg.unr.edu/dox/Map156_ivanpah_geo_polygons.zip



REFERENCES

[illegible]

Bohannon, R.G., 1984, Nonmarine sedimentary rocks of Tertiary age in the Lake Mead region, southeastern Nevada and northwestern Arizona: U.S. Geological Survey Professional Paper 1259, 72 p.

Bull, W.B., 1991, Geomorphic Response to Climate Change: Oxford University Press, New York, 326 p.

Burchfiel, B.C., Fleck, R.J., Secor, D.T., Vincelette, R.R., and Davis, G.A., 1974, Geology of the Spring Mountains, Nevada: Geological Society of America Bulletin, v. 85, p. 1013–1022.

Carr, M.D., and Pinkston, J.C., 1987, Geologic map of the Goodsprings District, southern Spring Mountains, Clark County, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-1514, 1:24,000.

Christenson, G.E., and Purcell, C., 1985, Correlation and age of Quaternary alluvial-fan sequences, Basin and Range province, southwestern United States, *in* Weide, D.L., ed., Soils and Quaternary geology of the southwestern United States: Geological Society of America Special Paper 203, p. 115–122.

DeWitt, E., Anderson, J.L., Barton, H.N., Jachens, R.C., Podwysocki, M.H., Brickey, D.W., and Close, T.J., 1989, Mineral resources of the South McCullough Mountains Wilderness Study Area, Clark County, Nevada: U.S. Geological Survey Bulletin 1730-C, 24 p.

Gardner, L. R., 1972, Origin of the Mormon Mesa caliche, Clark County, Nevada: Geological Society of America Bulletin, v. 83, p. 143–156.

Hewett, D.F., 1931, Geology and ore deposits of the Goodsprings Quadrangle, Nevada: U.S. Geological Survey Professional Paper 162, 172 p.

Hewett, D.F., 1956, Geology and mineral resources of the Ivanpah Quadrangle, California and Nevada: U.S. Geological Survey Professional Paper 275, 172 p.

House, P.K., Ramelli, A.R., and Buck, B.J., 2006, Surficial geologic map of the Ivanpah Valley area, Clark County, Nevada: Nevada Bureau of Mines and Geology Map 156, 1:50,000.

House, P.K., Pearthree, P.A., Howard, K.A., Bell, J.W., Perkins, M.E., and Brock, A.L., 2005, Birth of the lower Colorado River—Stratigraphic and geomorphic evidence for its inception near the conjunction of Nevada, Arizona, and California, *in* Pederson, J., and Dehler, C.M., eds., Interior Western United States: Geological Society of America Field Guide 6, p. 357–387.

Kohl, M.S., 1978, Tertiary volcanic rocks of the Jean-Sloan area, Clark County, Nevada, and their possible relationship to carnotite occurrences in caliches [M.S. thesis]: University of California, Los Angeles, 116 p.

Longwell, C.R., Pampeyan, E.H., Bower, B., and Roberts, R.J., 1965, Geology and mineral deposits of Clark County, Nevada: Nevada Bureau of Mines and Geology Bulletin 62, 230 p.

Ludwig, K.R. and Paces, J.B., 2002, Uranium-series dating of pedogenic silica and carbonate, Crater Flat, Nevada: Geochemica et Cosmochemica Acta, v. 66, p. 487–506.

Machette, M.N., 1985, Calcic soils of the southwestern United States, *in* Weide, D.L., ed., Soils and Quaternary geology of the southwestern United States, Geological Society of America Special Paper 203, p. 1–21.

McDonald, E.V., McFadden, L.D., and Wells, S.G., 2003, Regional response of alluvial fans to the Pleistocene-Holocene climatic transition, Mohave Desert, California: *in* Enzel, Y., Wells, S.G., and Lancaster, N., eds., Paleoenvironments and Paleohydrology of the Mohave and Southern Great Basin Deserts: Geological Society of America Special Paper 368, p. 189–205.

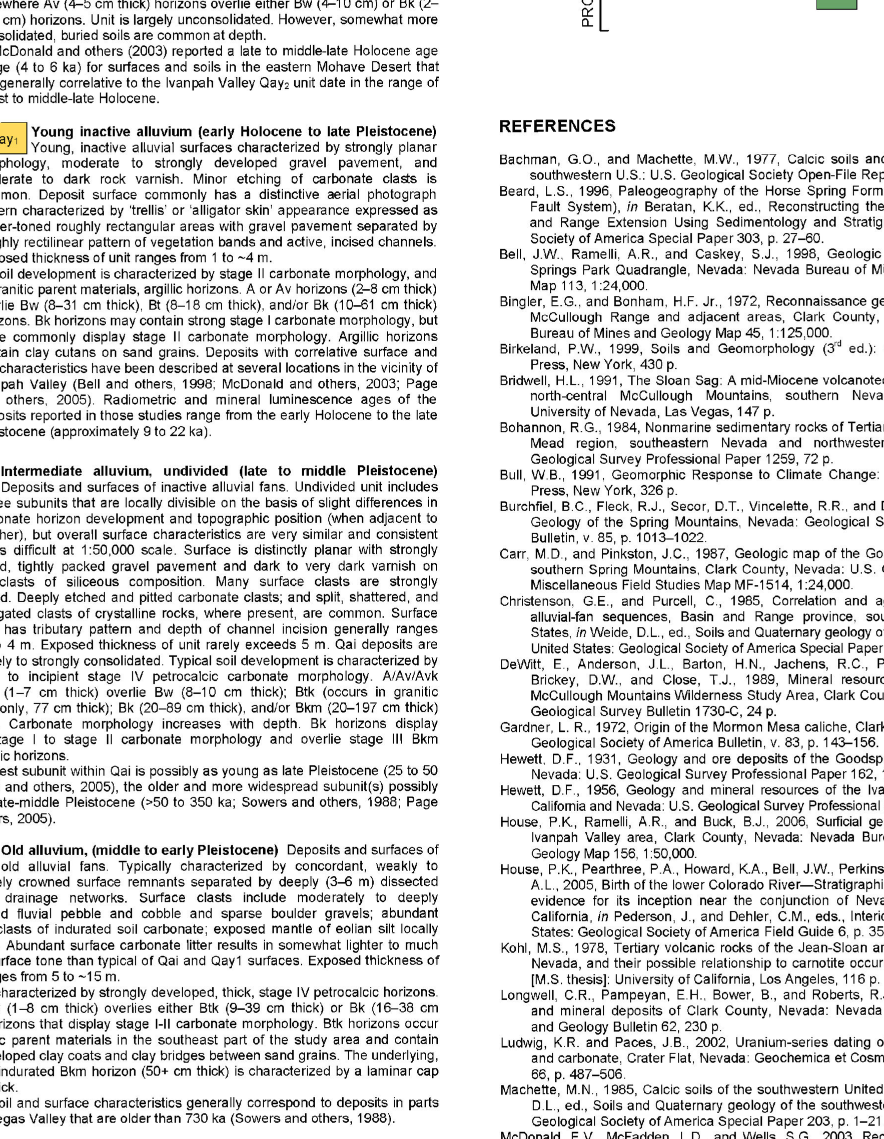
Page, W.R., Lundstrom, S.C., Harris, A.G., Langenheim, V.E., Workman, J.B., Mahan, S.A., Paces, J.B., Dixon, G.L., Rowley, P.D., Burchfiel, B.C., Bell, J.W., and Smith, E.I., 2005, Geologic and geophysical maps of the Las Vegas 30' x 60' Quadrangle, Clark and Nye Counties, Nevada, and Inyo County, California: U. S. Geological Survey Scientific Investigations Map 2814, 1:100,000.

Reheis, M.C., Sowers, J.M., Taylor, E.M., McFadden, L.D., Harden, J.W., 1992, Morphology and genesis of carbonate soils on the Kyle Canyon fan, Nevada, U.S.A.: Geoderma, v. 52, p. 303–342.

Sowers, J.M., Harden, J.W., Robinson, S.W., McFadden, L.D., Amundson, R.G., Jull, A.J.T., Reheis, M.C., Taylor, E.M., Szabo, B.J., Chadwick, O.A., Ku, T.L., 1988, Geomorphology and pedology on the Kyle Canyon alluvial fan, southern Nevada, *in* Weide, D.L., and Faber, M.L., eds., This Extended Land, Geological Journeys in the Southern Basin and Range, Geological Society of America Cordilleran Section, Field Trip Guidebook, p. 137–157.

Williams, V.S., 1996, Preliminary geologic map of the Mesquite Quadrangle, Clark and Lincoln Counties, Nevada and Mojave County, Arizona: U.S. Geological Survey Open-File Report 96-0678, 1:24,000, 12 p.

Generalized Geology and 7.5' Quadrangle Index



Base map: U.S. Geological Survey, McCullough Pass, NV, 7.5' Quadrangle, 1969. CONTOUR INTERVAL 40 FEET. U.S. Geological Survey, McCullough Mountain, NV, 7.5' Quadrangle, 1969. CONTOUR INTERVAL 40 FEET. Projection: Universal Transverse Mercator, zone 11. 1983 North American Datum

SCALE 1:24,000

0 0.5 1 Kilometer

0 1 Mile

0 1,000 2,000 3,000 4,000 5,000 Feet

Contact: Dashed where approximately located.

Watershed Boundary

NEVADA BUREAU OF MINES AND GEOLOGY
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Funding from Clark County Regional Flood Control District and U.S. Geological Survey STATEMAP Program (Agreement Nos. 04-HQ-AG-0032, 03-HQ-AG-0049, and 02-HQ-AG-0019). Field work performed from 2002-2006.

We thank the following individuals for their assistance and input towards the development of this map: Brian Park, Thomas Prescott, Amy Brock, and Andrew Hanson.

This map is extracted directly from the House and others (2006) 1:50,000 scale geologic map. The data have not been explicitly reviewed at 1:24,000 scale.

Preliminary geologic map.
Has not undergone office or field review.
Has not been edited.
Will be revised before publication.

Cartography: P. Kyle House and Christine M. Arritt
Printed by: Nevada Bureau of Mines and Geology
First Edition, 2006

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PRELIMINARY SURFICIAL GEOLOGIC MAP OF THE IVANPAH VALLEY PART OF THE McCULLOUGH PASS AND McCULLOUGH MOUNTAIN 7.5' QUADRANGLES, CLARK COUNTY, NEVADA

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2006