

Preliminary Geologic Map of the North Half of the Spirit Mtn. NW Quadrangle, Clark County, Nevada and Mohave County, Arizona

by

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SURFICIAL GEOLOGIC DEPOSITS

Piedmont Alluvium and Hillslope Deposits

Qay **Piedmont alluvium, undivided (Holocene)** Poorly to moderately sorted gravel deposits on the piedmonts of the Eldorado and Black Mountains. This undivided unit is dominated by active alluvial fan and wash deposits that range in age from late to middle Holocene. In some areas of both piedmonts, small remnants of older piedmont deposits (Qay₁) are extensively interspersed.

Qay₂ **Piedmont alluvium (late to middle Holocene)** Alluvial deposits of inactive or intermittently active alluvial fans and washes. Mapped only where spatially continuous and widespread. Minimal to no soil development, weak to no desert pavement. Variable dissection up to 2 meters.

Qay₁ **Piedmont alluvium (middle to early(?) Holocene)** Alluvial deposits of youngest inactive alluvial fans and alluvial terraces. Deposits characterized by planar surfaces with moderate to strong desert pavements and moderate desert varnish. Only mapped on the lower piedmont of the Black Mountains.

Qai₃ **Piedmont alluvium (early Holocene to late Pleistocene)** Youngest series of relict, inactive alluvial fan and alluvial terrace deposits and terraces. Unit is graded to past Colorado River level that was higher than the surface of Lake Mohave. Surface characterized by muted bar-and-swale topography with common cobble-rich bar crests and sparse weathered (split or disaggregated) clasts. Moderately to strongly developed pavements common in swales. Moderate to dark varnish. Weak soil development with distinctive Av and Bw horizons, but low carbonate accumulation (stage 1).

Qai₂ **Piedmont alluvium (Late Pleistocene)** Alluvial fans that truncate the highest Pleistocene Colorado River deposits (Qch) and grade to the highest, well-preserved Colorado River terrace in the Qcts sequence. Unit also

includes relatively high standing alluvial terrace remnants in deeply incised washes in the northwest part of the map. Characterized by planar to broadly undulate surfaces with moderate to darkly varnished clasts in a moderately tight desert pavement. Protruding boulder bars common on terrace remnants. Underlying soils characterized by moderate soil carbonate development (strong stage 2 to stage 3).

Qai₁ **Piedmont alluvium (late to middle Pleistocene)** Includes a suite of alluvial fan deposits and related surfaces that interbed with and underlie Qch and are also interbedded with Qcw. Extant surfaces exhibit tight desert pavements with darkly varnished clasts. Underlying deposit hosts strong stage 3 carbonate soil development. Unit locally contains a buried soil with stage 3 carbonate development that caps the Qcw sediments and is overlain by Qch. Subsequent refinement of the mapping and pending geochronologic analyses may divide this part of the unit as an older variant.

Qay+i **Piedmont alluvium, undivided. Mixed Qay and Qai (Holocene to Pleistocene)** Intricately interspersed Qay and Qai where Qay predominates. Division of units impractical at this scale.

Qai+y **Piedmont alluvium, undivided. Mixed Qai and Qay (Holocene to Pleistocene)** Intricately interspersed Qai and Qay where Qai predominates. Division of units impractical at this scale.

Qao **Piedmont alluvium (middle Pleistocene)** Relict alluvial fans with strong soil carbonate development (Bk stage 4 to 4+). Surface remnants are moderately to deeply dissected (3-4 meters), and characterized by shallow ridge-and-ravine topography. Only a few examples are present in the map area. Remnants closest to Lake Mohave are most deeply dissected and beveled slightly along their toes which are capped with a thin veneer of river gravel (Qcg).

QTa **Piedmont alluvium (early Pleistocene to Pliocene(?))** Sparse, erosional remnants of ancient alluvial fan deposits. Degraded, rounded ridges with surface litter

contain moderately to deeply weathered gravel clasts and abundant disaggregated fragments of petrocalcic soil.

QTac Piedmont alluvium with reworked Colorado River sediments (early Pleistocene to late Pliocene(?)) Piedmont alluvium containing abundant clasts of reworked Pliocene Colorado River sediments. Unit is generally poorly exposed and is likely more extensive than mapped. This unit is unconformably overlain by Qai fan gravels in most exposures.

Tfe Fanglomerate of the Eldorado Mountains (Pliocene to late Miocene) Poorly to moderately sorted, angular to subangular gravel. Only present in deeply incised ravines in this map area and is more extensive than mapped. A key section of Tfe in 'Wishy Wash' near the northern edge of the map contains an extensive exposure of the 4.1 Ma lower Nomlaki tephra layer (House et al., 2008).

QTtc Talus and colluvium (Pleistocene to Pliocene) Poorly sorted, angular, and coarse gravel deposits on steep hillslopes. Locally includes small, steep alluvial fan deposits of coarse gravel. Only significant accumulation in map area is on the flanks of Black Mountain. There the deposits exhibit moderate to strong soil carbonate development (stage 4 to 5), dark varnish and well-developed, tightly packed desert pavement. Pavement clasts include fragments of petrocalcic soil.

Colorado River Deposits

Qcts Colorado River terrace sediments, undivided (late Pleistocene) Stair-stepping series of 4 Colorado River terraces in the NE corner of the map. Composed primarily of well-sorted rounded gravel and minor sand and mud. Each terrace surface characterized by patchy, moderately tight pavement of rounded pebbles. Soil development in the first, second, and third terraces is similar and includes stage 3 soil carbonate development and reddish-brown Bw horizon.

Qcts₁ First (oldest and highest) Colorado River terrace (late Pleistocene) Gravel forms veneer that overlies 6-9 meter thick sequence of Colorado river sand and minor mud along an erosional unconformity. Underlying river sediments (mapped as Qch) locally contain 2-4 meter thick interbeds of piedmont gravels. In some locales, more than 4m of cross-stratified fluvial sand of the Colorado River underlie the Qcts₁ gravels.

Qcts₂ Second Colorado River terrace (late Pleistocene) Underlain primarily by rounded cobble gravel. Approximate thickness of 8-10 meters.

Qcts₃ Third Colorado River terrace (late Pleistocene) Underlain primarily by rounded cobble gravel. Approximate thickness of 4-5 meters.

Qcts₄ Fourth (lowest lying) Colorado River terrace (late Pleistocene) Composed of sand and gravel. Notable for dense vegetation probably owing to phreatic effect of Lake Mohave.

Qcs Colorado River sediments, undivided (late to middle(?) Pleistocene) Pleistocene Colorado River sands that underlie the terrace gravels (undivided, may all be Qch, but remains unresolved).

Qcg Colorado River gravels, undivided (late to middle Pleistocene) River gravels that overlie a complex bedrock surface in the Nevada part of the map area and gravels that underlie Qch and Qcw sediments. Most of the former probably relate to one or more Qcts units in the Arizona part of the map, but others are lags. Most of the latter are likely channel gravel facies of Qch and Qcw. Further division of these deposits is warranted and anticipated.

Qch Colorado River sediments; Chemehuevi beds of House et al. (2005) (late Pleistocene) Late Pleistocene Colorado River gravel, sand, and mud comprising the 'Chemehuevi beds' of House et al. (2005). Most extensive exposures associated with 4 conspicuous sand-capped hills of sand and mud that overlie unit Qai₁ south of Cottonwood Cove. The Chemehuevi beds form a conspicuous stratigraphic couplet of a sand-dominated facies over a mud-dominated facies that, in this map area, caps a complex aggradation sequence of river gravel, fan gravel, river mud, and river sand (including Qai₁ and Qcw deposits). Lundstrom et al. (2008) report luminescence ages for the mud-dominated facies of Qch that range from 40 to 80 ka.

Qchs Sand dominated facies of the Chemehuevi beds (late Pleistocene) Relatively loose mixture of gravelly fluvial sand and piedmont alluvium. Exposures generally poor, but surface expression is conspicuous. Locally, outcrops of well-sorted and flat-bedded to cross-stratified fluvial sand are present. In some areas, the base of the unit is characterized by a well-sorted sequence of bedded fluvial gravel that unconformably overlies subunit Qchm.

Qchm Mud-dominated facies of the Chemehuevi beds (late Pleistocene) Sequence of bedded fluvial mud and sand. Forms conspicuous bluffs below loose capping sediments of Qchs.

Qcw Colorado River sediments; the "sediments of Cottonwood Cove" (late(?) Pleistocene) Unit includes intervals of well-sorted and rounded pebble-cobble gravel and sand, and local beds and lenses of mud. Some beds of sand in Qcw contain clear evidence of bioturbation. Locally interfingering with and universally truncated by piedmont alluvium unit Qai₁. At several locations in this

map area, Qcw is separated from the roughly similar sediments of Qch by a bed of Qai₁ that hosts a stage 3 carbonate soil. More work is required to better resolve the stratigraphic distinction between Qcw and Qch. Best exposures of Qcw are in sandy bluffs along the south side of the Cottonwood Cove trailer park.

QTcl Colorado River sediments; the “lakeside beds” (middle to early(?) Pleistocene) Colorado River sand and mud, 'Lakeside beds'. Flat-lying gravel, sand and mud of the Colorado River. Exposed only along the lakeshore. Possibly part of Tcb. Remains unresolved.

QTc Colorado River sediments, undivided (early Pleistocene to late Pliocene(?)) May include Qch and Tcb.

Tcb Colorado River sediments. Bullhead alluvium of House et al. (2005, 2008) (early Pliocene) Gravel, sand, and mud of the early Colorado River. Correlative to the alluvium of Bullhead City (House et al., 2005, 2008), but notable for greater abundance of moderately thick intervals of bedded fluvial mud. Queried unit (Tcb?) denotes small outcrops of possibly reworked Tcb sand exposed in gullies east of Black Peak. These sands may be relict eolian deposits derived from, and possibly contemporaneous with, Tcb.

Tls Valley fill sediments; Lost Cabin beds of House et al. (2008) (late Miocene) Late Miocene valley fill mud, sand, and gravel (possibly equivalent with Lost Cabin beds of House et al. 2008). Flat-lying sediments that underlie the alluvium of Bullhead City. Contain no obvious Colorado River sediment. Only exposed along the lakeshore in west-central part of map.

Other Units

Qby Beach sediments (recent) Wave-worked and moderately sorted to well-sorted, locally derived gravel including subangular piedmont gravels and rounded river gravels.

Qe Eolian sand (recent to late Pleistocene) Reworked from nearby exposures of sandy Colorado River deposits.

Qx Anthropogenic deposits (recent) Includes artificial fill, constructed features, and extensive areas of pavement.

Miocene Strata

Tc Conglomerate and Sandstone (middle to late Miocene) Reddish to grayish brown, matrix supported, poorly to moderately sorted conglomerate and medium- to coarse-grained litharenite. Clasts are generally subangular and dominated by plutonic and hypabyssal intrusive rocks.

Tdbv Breccia of volcanic rock (middle Miocene) Altered breccia of intermediate to felsic volcanic rock, possibly of rock-avalanche origin; probably correlates with breccia units in Mount Davis Volcanics (Faulds, 1995).

Tdm Basaltic andesite lavas (middle Miocene) Aphanitic, vesicular basaltic andesite lava, with phenocrysts of iddingsitized olivine to 3 mm long; probably correlates with mafic lavas of Mount Davis Volcanics (Faulds, 1995).

Trt Rhyolitic tuffaceous rocks (middle Miocene) Altered rhyolitic tuff (?) and tuffaceous sedimentary rocks cropping out on east flank of Black Mountain.

Tda Dacite-andesite lavas (middle Miocene) Dacite and andesite flows at Black Mountain; contain phenocrysts of hornblende and biotite; possibly correlative with Mount Davis Volcanics.

Miocene Intrusions

Tcv Calcite veins (middle Miocene) Calcite veins up to 1 m thick.

Trdi Rhyodacite dikes (middle Miocene) Finely porphyritic rhyodacite dikes containing phenocrysts of plagioclase (altered), biotite, and sparse quartz and sphene.

Tri Rhyolite dikes (middle Miocene) Rhyolite dikes containing ~2–15% phenocrysts of quartz, feldspar, and lesser biotite. Feldspar is commonly altered to clays and sericite.

Tgdi Porphyritic granodiorite dikes (middle Miocene) Contain 20–30% phenocrysts of plagioclase, potassium feldspar, biotite, hornblende, and clinopyroxene.

Tdi Dacite dikes (middle Miocene) Finely porphyritic, purplish-gray dacite with ~15% phenocrysts of plagioclase and biotite.

Tgi Granitic dike (early to middle Miocene) Fine-grained biotite granitic dike intruding Proterozoic(?) quartzite.

Tsuf Upper Searchlight pluton, porphyritic phase (early to middle Miocene) Porphyritic to phaneritic quartz monzonite to granodiorite consisting of potassium feldspar, plagioclase, and lesser quartz, hornblende, and biotite. Commonly slightly altered.

Tsu Upper Searchlight pluton, quartz monzonite to granodiorite (early to middle Miocene) Medium-grained equigranular quartz monzonite to granodiorite containing plagioclase, potassium feldspar, quartz, biotite,

and lesser hornblende. Commonly slightly altered to greenish-gray color.

PROTEROZOIC(?)

Xq Quartzite (probably Proterozoic) Medium-grained quartzite found only in isolated outcrop along east shore of Lake Mohave.

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