DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

SURFICIAL GEOLOGIC MAP OF THE CALIENTE 1^{o} x 2^{o} QUADRANGLE, NEVADA AND UTAH

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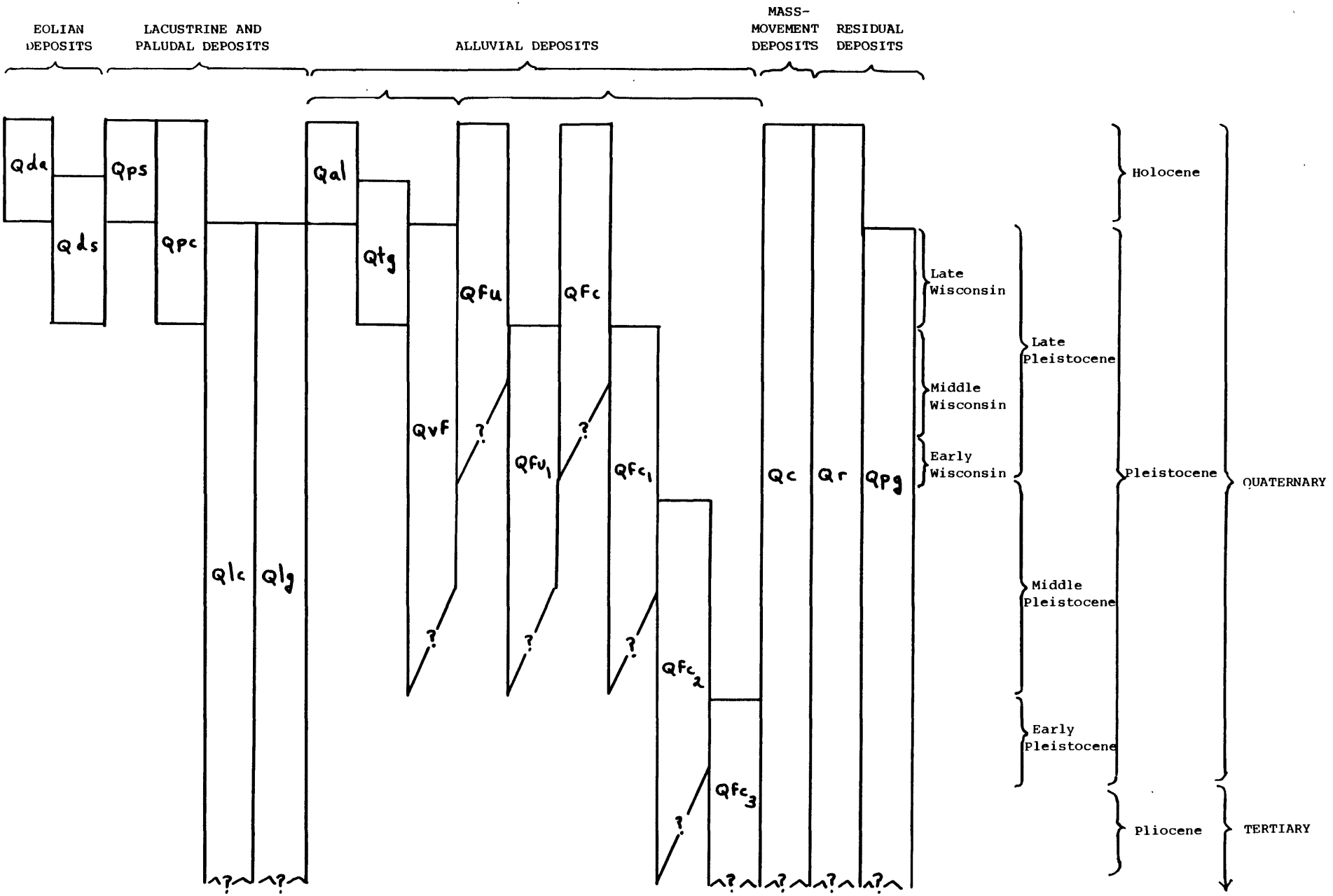
CORRELATION OF SURFICIAL MAP UNITS



DESCRIPTION OF SURFICIAL MAP UNITS

EOLIAN DEPOSITS

Windblown sand deposits in this area are reworked from alluvium in stream channels and (or) older eolian deposits. Commonly sand deposits occur as thin sheets and do not form dunes, suggesting the lack of a prevailing, unidirectional wind. Both active and stabilized sand deposits support some vegetation, but active deposits are marked by very sparse patches of immature soil and numerous wind-deflated hollows.

DUNE DEPOSITS

Qda — Active (Holocene)--Fine to medium quartz sand in thin sheets and very low dunes without significant vegetation covering. Locally may exceed 6 m in thickness

Qds — Stabilized (Holocene to late Pleistocene)--Fine to medium quartz sand in deposits stabilized by vegetation. Locally may include deposits formed of sand-size clay aggregates. Commonly exhibits inceptisols. As much as 6 m in thickness

LACUSTRINE AND PALUDAL DEPOSITS

Lacustrine deposits are subdivided into two major groups, clay and saline playa deposits that occur in closed basins occupied by ephemeral lakes, and lacustrine clay deposits that represent eroded remnants of older lake beds now exposed in areas not periodically inundated. Playa sediments overlie older deposits of interstratified clay and saline minerals that may exceed 400 m in thickness. Although no cores are available from this area, data from similar deposits in a similar setting at Searles Lake, Calif. suggest intermittent lacustrine deposition for at least 120,000 years (Smith, 1979, p. 113).

Qps — SALINE PLAYA DEPOSITS (HOLOCENE)--Silty sand capped by crusts of mud mixed with halite and gypsum. Salt-rich units as much as 8 m in thickness

Qpc — CLAY PLAYA DEPOSITS (HOLOCENE TO LATE PLEISTOCENE)--Thin-bedded silt and clay deposited by ephemeral flooding on playas. Commonly forms flat surfaces containing desiccation polygons and patches of easily deflated mud curls. Thickness 5 to 25 cm

Qlc — LAKE CLAY (LATE PLEISTOCENE TO PRE-PLEISTOCENE)--Thin-bedded silt and clay having well-developed stratification. Commonly restricted to areas inundated by Pleistocene lakes. Easily eroded to badland topography having as much as 15 m of relief. Contains numerous buried paleosols and volcanic-ash layers. Commonly marked by buried desiccation features and sand-filled paleochannels. As much as 40 m in thickness

Qlg LAKE GRAVELS (LATE PLEISTOCENE TO PRE-PLEISTOCENE)--Well-rounded pebble to cobble gravel commonly without sand matrix but containing lenses of coarse angular to subangular sand. Lithology highly variable reflecting bedrock in nearest tributary canyons. Commonly found in arcuate deposits reflecting the gravel bars and spits developed along shorelines of Pleistocene lakes. Mapped only in basins in northern part of quadrangle. Locally, internal structures, including cross stratification and foreset and topset bedding, suggest deposition in small deltas. Age indeterminate but probably correlative with Pleistocene lake clays (unit Qlc). As much as 5 m in thickness

ALLUVIAL DEPOSITS IN CHANNELS

In the Caliente quadrangle, major alluvial deposits are restricted to streams that carried large volumes of water during the late Pleistocene, such as the White River or Meadow Valley Wash. In the eastern part of the quadrangle, channel and terrace gravels reflect earlier periods of increased stream capacity. Along drainages of the White River and Meadow Valley Wash, for instance, lithology of the gravels does not reflect adjacent bedrock but is composed of material derived upstream.

Qal CHANNEL ALLUVIUM (HOLOCENE)--Silt, fine to coarse sand, and gravel in beds and along flood plains of ephemeral or permanent streams. Intermittently deposited as bars or other channel deposits, then eroded and redeposited. Unit occupies almost all drainage channels, but only the larger deposits are shown. Along major streams, alluvium is inset in older flood-plain and lacustrine deposits. Alluvial units contain numerous cut-and-fill lenses of silt, sand, or gravel. Locally may exceed 20 m in thickness

Qtg TERRACE GRAVEL (HOLOCENE TO LATE PLEISTOCENE)--Gray well-rounded gravel composed of volcanic rock, overlain by patches of white very fine sand and silt, and red angular calcareous gravel. Matrix is medium to coarse, angular to subangular sand composed of equal amounts of volcanic and calcareous detritus that commonly is cemented by 2 m of white powdery calcium carbonate. Unit caps terraces 18-25 m above present drainages. Thickness 8-21 m

Qvf VALLEY FILL (LATE TO MIDDLE PLEISTOCENE)--Mixture of interbedded lake silt, fluvial sand and gravel, buried eolian deposits, and sand- to silt-size material deposited at the distal edges of alluvial fans. Commonly does not exhibit well-defined stratification but locally may contain buried paleosols and lenses of volcanic ash. Surface characterized by well-developed soils as thick as 1.5 m. Ranges from 10 to 60 m in thickness

ALLUVIAL-FAN DEPOSITS

In this quadrangle, alluvial-fan deposits are subdivided into two broad categories, unconsolidated and cemented. Cemented fan deposits are further grouped by degree and amount of calcium-carbonate (caliche) cementation. The degree of cementation is a highly subjective criterion because it results from many interacting causes including lithology of the contributing bedrock, ground-water and pedogenetic factors, climatic history, and time. Nevertheless, the practice adopted when separating fan units in the field suggests a relative age classification based on the number of cemented horizons within any given fan deposit. For instance, a fan deposit containing three cemented horizons, of probable pedogenetic origin, separated by layers of unconsolidated fan debris, is assumed to have had a longer depositional history than a fan having caliche cementation only on its surface. On this map, where sequential and superimposed (or inset) fan deposits that contain caliche can be recognized, they are numbered from youngest to oldest, Qfc, Qfc_1, Qfc_2, and Qfc_3. No data leading to an absolute fan chronology is presently available in this area. Where approximate ages are suggested, they are inferred from information collected at the Nevada Test Site (Hoover and others, 1981).

Qfu UNCONSOLIDATED FAN DEPOSITS (HOLOCENE TO LATE PLEISTOCENE)--Mixture of uncemented well-rounded poorly sorted sand- to boulder-size material. Surface characterized by large areas of gravel pavement interspersed with pockets of weakly developed sandy soil. Particle size of surface gravels decreases downslope where fan deposits merge into valley-fill units (Qvf). Although surficial pavements and soils range in thickness from 0.5 to 3.0 m, unconsolidated fan deposits commonly exceed 250 m in total thickness

Qfu_1 Deposit with thick pavement (late to early Pleistocene)--Mixture of sand- to boulder-size material without carbonate cement but with thick (1-3 m) pavement of angular pebbles in calcareous silt matrix. Commonly overlain by younger unconsolidated fan deposits (unit Qfu). Thickness 10-30 m

Qfc CEMENTED FAN DEPOSITS (HOLOCENE TO LATE PLEISTOCENE)--Mixture of sand- to boulder-size material having as much as 1 m of surficial calcium-carbonate cementation. Surfaces usually are cemented with stage II to III carbonate (caliche partially coats pebbles or fills interstices between pebbles). Surfaces are highly resistant to erosion but support widely spaced, headward-cutting arroyos as deep as 10 m. Age of these deposits is poorly known, but deposition may have begun at least by middle Pleistocene. Deposit beneath calcium-carbonate cement may exceed 100 m in thickness

Qfc_1 Well-cemented deposits (late to early Pleistocene)--Gray to red, well-rounded pebble to cobble gravel composed of calcareous, volcanic, and quartzite clasts in a matrix of coarse to medium angular to subrounded sand composed of calcareous and volcanic detritus. Commonly contains a single, well-developed caliche-cemented horizon within 1 m of the surface. Caliche commonly ranges from 1 to 2 m in thickness and attains stage III or IV in development (interstices between pebbles filled with carbonate, upper layers of carbonate massive, relatively pebble free, and having the texture, structure, and degree of induration of fine-grained limestone). Fans are undated but may have begun to form during the early or middle Pleistocene. Thickness of surficial cemented horizon ranges from 1 to 3 m. Deposit may exceed 150 m in thickness

Qfc_2 Multiple cementation layers (middle Pleistocene to pre-Pleistocene)--Gray to red, well-rounded pebble to cobble gravel composed of calcareous, volcanic, and quartzite clasts in a matrix of coarse to medium sand comprised of calcareous and volcanic sand. Mapped on the basis of multiple carbonate-cement (caliche) horizons, two to three in number, 1-3 m thick. Upper caliche horizon commonly stage II to III development. Lower caliche horizons commonly stage III or IV development. Age unknown, but formation of fan deposits may have begun during the late Tertiary. Surfaces commonly support vesicular, silty soils and desert-pavement deposits as much as 0.5 m thick. The caliche-cemented part ranges from 5 to 10 m in thickness; deposit may exceed 150 m in total thickness

Qfc_3 Multiple cementation layers, very well cemented (early Pleistocene to pre-Pleistocene)--Gray to red, well-rounded pebble to cobble gravel composed of calcareous, volcanic, and quartzite clasts in a matrix of coarse to medium sand composed of calcareous and volcanic detritus. Mapped on the basis of multiple superimposed caliche horizons that are 2-5 m thick and commonly attain stage III or IV development. These fan deposits appear to be the oldest in this quadrangle and may have formed between late Tertiary and early Pleistocene time. Surfaces commonly stripped of soil and (or) desert-pavement deposits exposing large areas of caliche. Caliche-cemented part ranges in thickness from 10 to 40 m. Deposit may exceed 150 m in total thickness

MASS-MOVEMENT DEPOSITS

Qc COLLUVIUM (HOLOCENE TO PRE-PLEISTOCENE)--Cobble- to boulder-size angular fragments of underlying bedrock on slopes greater than 5°. Matrix is generally silty; may exhibit weakly developed soil as thick as 1 m. Subject to sheet erosion and rill wash. Marked in many places by small bedrock outcrops upslope from thick lobes and patches of cobble- to boulder-size concentrations without sand or silt matrix. Commonly cemented by carbonate throughout the quadrangle regardless of the lithology of the underlying bedrock. Unit includes sheetwash alluvium, discontinuous patches of talus and scree on steep slopes, and solifluction deposits at elevations above 8,500 ft (2600 m). Rarely exceeds 5 m in thickness

RESIDUAL DEPOSITS

Qr RESIDUUM DEPOSITS (HOLOCENE TO PRE-PLEISTOCENE)--Sparse angular cobbles of underlying bedrock in a silty matrix. May contain pockets of clay-rich, well-developed soil as thick as 1 m. Commonly forms on slopes of less than 5^{o} and reflects chemical and mineralogical properties of the underlying bedrock. In the map area, residuum deposits include both solution residuum derived from calcareous bedrock, and decomposition residuum derived from silicious bedrock. Where developed on basic volcanic rocks, residuum is rich in smectitic swelling clays. Where developed on calcareous rock, residuum may be cemented with caliche. Rarely exceeds 3 m in thickness

Qpg PEDIMENT GRAVEL (LATE PLEISTOCENE TO PRE-PLEISTOCENE)--Subrounded to angular pebbles to cobbles in a matrix of medium to coarse quartz sand. Along the southern boundary of the quadrangle, unit is developed on beveled surfaces adjacent to mountain ranges formed of intrusive igneous rock. Commonly has a well-developed desert pavement and desert varnish. Age is unknown, but unit may be at least as old as the older consolidated alluvial fans (units Qfc_2 and Qfc_3). As much as 4 m in thickness

BEDROCK UNITS

Rock units pose a particularly vexing problem to the constructor of a map of surficial deposits, especially in arid areas marked by steep slopes, numerous outcrops, and a lack of weathered debris. For the purposes of this map, an area was designated as a rock unit if structural information, such as an attitude on a bedding plane, joint, fracture, or fault, could be obtained within a circle of 100-ft (30-m) radius from any given point.

In general, areas designated as "rock" range from 85 to 100 percent outcrop. Any such outcrop area contains numerous patches of colluvium, residuum, talus, or scree, and small areas of coarse entisols and other immature azonal soils developed under discontinuous, highly variable plant communities.

The lithology of parent bedrock influences surficial deposits in terms of their soil development, ground-water characteristics, and engineering properties. On this map a simple classification is used to show the dominant lithology of a bedrock outcrop.

ROCK--Lithologic nomenclature follows that of Stewart and Carlson (1978)

Rv1 Basaltic volcanic

Rv2 Andesitic volcanic

Rv3 Rhyolitic volcanic

Rs Siliceous sedimentary rock--Sandstone, shale, and quartzite

Rc Calcareous rocks-Including limestone, dolomite, and marble

Rpm Plutonic, metamorphic, and ultramafic rocks

CONTACT

FAULT CUTTING QUATERNARY DEPOSITS--Bar and ball on downthrown side where sense of movement is known

TRACE OF PLEISTOCENE LAKE-GRAVEL SHORELINES

METHOD OF COMPILATION

This map constitutes a portion of the Quaternary Geologic Map of the Mount Whitney 4° x 6° Quadrangle, in preparation for the National Quaternary Atlas of the United States at a scale of 1:1,000,000. The map units shown on the Caliente 1° x 2° Quadrangle map are scaled for reduction from 1:250,000 to 1:1,000,000 and are, of necessity, generalized. Surficial deposits that form a linear pattern, for instance, are limited by cartographic constraints to a minimum width of 0.5 mile (800 m); those that occur as patchy deposits are restricted to a minimum area of 1 mi^2 (2.6 km^2). Because of these size limitations, many specific deposits and groups of deposits are not shown or are generalized to reflect the dominant component. Use of this 1:250,000-scale map for specific information about a particular locality must be supplemented by field investigation.

The map was derived from three primary sources: (1) published geologic maps, (2) recent Landsat images corrected for a scale of 1:250,000, and (3) fieldwork. The first step was to compare specific surficial deposits that appeared on published maps with Landsat imagery. Such deposits were then visited and described. In areas where little or no published information was available, the Landsat signature (color hue, tone, and intensity, albedo or reflectivity, and degree of surface roughness) was compared with a known locality and a tentative unit description assigned to the deposit. The area was then field checked and the Landsat description verified or revised. Large areas, such as coalesced alluvial fans covering as much as 75 mi^2, were spot checked. If the signature was constant over the entire surface, the deposit was assumed to be uniform throughout and equivalent to adjacent areas that displayed the same signature.

Relative age determinations for deposits, such as alluvial fans or terrace gravels, were first made from tonal differences on Landsat images. These were then verified or revised in the field using such criteria as degree of calcium carbonate (caliche) development, soil profiles, and extent of weathering.

On this map, as is the case for the Quaternary Atlas of the United States in general, certain surficial deposits imply specific processes and materials. For the purposes of this map, "solifluction deposit" is a general term for material transported and deposited by viscous flow of unconsolidated debris saturated with water. Colluvium is material transported and deposited by mass-wasting processes, chiefly by creep. Sheetwash alluvium is material transported and deposited by running water, chiefly by sheetflow or rill wash. Decomposition residuum is material derived in place by decomposition of bedrock, and has not been moved laterally. Solution residuum is residuum derived primarily by solution of calcareous rock.

SOURCES OF INFORMATION

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