Map of Surficial Geologic Materials of New Mexico
1st Order Classification: Major Genetic/Age Material Classes

1) Alluvial Deposits

A **Alluvium-undivided.** Stream deposits; fine to coarse grained, with local cementation by secondary carbonates, gypsum, or silica accumulation commonly present in older subunits. Derived from diverse lithologic terranes and landforms including: mountains, high plateaus and table lands, intermontane basins (bolsons), and regional plains. Deposited in diverse settings including: valley of streams ranging from small ephemeral to large perennial systems; shallowly- or non-incised drainageways on alluvial fans, piedmont alluvial plains, and bolson floors; and restricted closed depressions of solution subsidence, deflation, volcanic or structural origin.

Remarks: 1. Symbol when used only with lithologic and textural composition modifiers (without age modifier--y, o, t, etc.) indicates unit of Late Quaternary age (younger than 200-300 ka.). 2. Special subclasses include: 1) river alluvium (AR); 2) valley-fill alluvium (AV); 3) bolson-floor alluvium (AB); 4) fan alluvium (AF); and 5) thin deposits on piedmont and footslope erosion surfaces (AP).

AR **River Alluvium.** Fluvial (floodplain and channel) deposits of major perennial streams (Rio Grande, Pecos, San Juan, Animas, Gila, and Canadian). Includes valley-floor and terrace deposits, and contiguous narrow belts of colluvium and rock outcrop on steep valley-side slopes.

Remark: Major components of bedrock and colluvium are noted by secondary symbol combinations.

AV **Valley-fill Alluvium.** Deposits along narrow valleys and canyons of major streams within extensive upland areas such as mountain ranges and high plateaus. Includes valley-floor and terrace deposits, and contiguous narrow belts of colluvium and rock outcrop on steep valley-sideslopes.

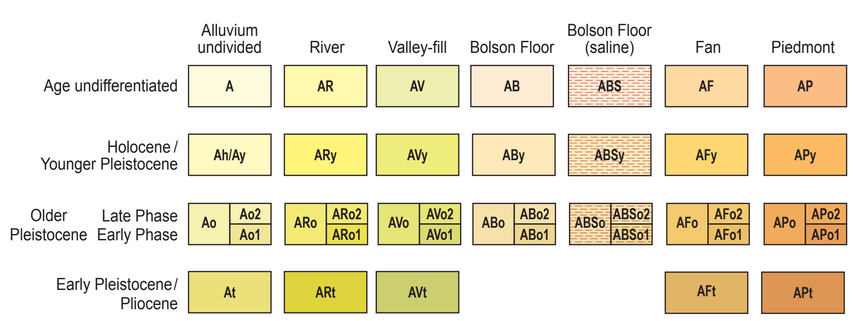
Remarks: 1. Used for significant fluvial deposits in valleys too narrow (< 2 km width) to show at map scale. 2. Major components of bedrock and colluvium are noted by secondary symbol combinations.

AB **Bolson-floor alluvium-undivided.** Streamflood and sheetflood deposits of distributary channels and interchannel areas at the distal part of bolson drainage systems; includes fine- to medium-grained deposits partly impregnated with calcium and sodium sulphate salts (ABS); also includes small playas in widely scattered closed depressions and discontinuous eolian veneers.

AF **Fan alluvium-undivided.** Stream deposits, and lesser amounts of sheetflood and debris-flow deposits of fan-distributaries. Includes deposits of individual fans and interfan valleys in proximal piedmont areas (adjacent to mountain fronts and high escarpments), and coalescent-fan (bajada) deposits on medial to distal parts of piedmont slopes. Proximal piedmont facies are transitional to piedmont erosion-surface covers (AP) and distal facies grade to bolson (basin) floor units (AB). Unit also includes fan and coalescent-fan alluvium in terrains with lower local relief, such as the borders of major stream valleys and footslopes of low escarpments of structural or erosional origin.

Remark: Symbol also used in lower-relief terrains to denote fan deposits on constructional toeslopes to valley sides and escarpments.

AP **Alluvium on erosion surfaces.** Piedmont and escarpment footslopes. Stream deposits, with lesser amounts of sheetflood and debris-flow deposits that form relatively thin covers (< 10 m) on piedmont and footslope erosion surfaces. Unit includes alluvial veneers on rock pediments, and valley-flanking and mountain-front erosion surfaces cut on both bedrock and older valley basin fill.



2) Eolian Deposits

E **Eolian deposits - undivided.** Wind-deposited sand, silt and clay, with active and stabilized dune forms and sheet-like morphology; includes quartz to feldspathic-quartz sand, and calcareous silt-clay-fine sand (loamy) aggregates. Zones of pedogenic clay and carbonate accumulation occur locally as buried and relict-surface soil horizons. Generally less that 15 m thick.

Remark: Larger deposits are in areas downwind of river floodplains, and basin-floor alluvial and lacustrine plains. Symbol used in combination with other categories where eolian deposits form thin veneers on genetic material classes including alluvium, colluvium and lacustrine sediments.

E- (prefix) **Eolian cover-discontinuous.** Thin sandy deposits, including vegetation stabilized ridges and coppice dunes over designated substrate (for example, EAo1, EKM). Up to 3 m thick. Primarily equivalent to Ey.

ES **Eolian deposits-gypsiferous.** Eolian sand and silt, primarily calcium sulfate; with dune and sheet morphology; with alkali-flat deposits in scattered interdune depressions. Generally less that 15 m thick. Coeval with E.

Remark: Occurs in complexes with, and downwind of, relict gypsiferous and alkalic lake plains and playas central bolson areas (e.g. Tularosa and Estancia Valleys).

ED **Dune sand of quartz to feldspathic quartz composition.** In addition to active parabolic and barchanoid forms, dune complexes include vegetation-stabilized coppice mounds and longitudinal ridges. Up to 10 m thick.

Remarks: Most dune complexes include small interdune flats and sheetlike eolian deposits, lake beds, and basin-floor alluvium. Unit for the most part postdates maximum expansion of Wisconsin pluvial lakes, and includes presently active forms.

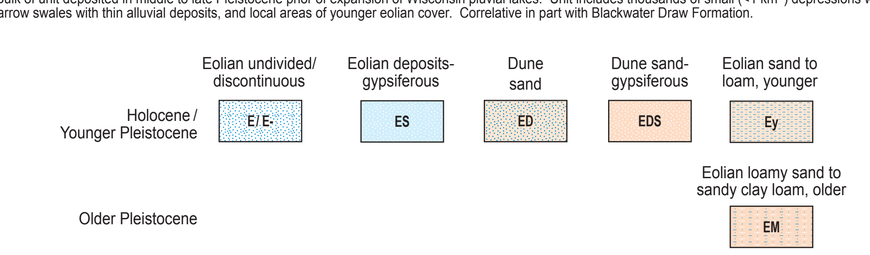
EDS **Dune sands-gypsiferous.** Dune complexes include large areas of active transverse forms (parabolic and barchanoid) with restricted areas of vegetation stabilized coppice mounds and longitudinal ridges. Unit includes alkali-flat deposition scattered interdune depressions. Up to 15 m thick (See LE).

Remark: Unit for the most part postdates maximum expansion of Wisconsin pluvial lakes, and include presently active forms.

Ey **Eolian sand to loam (younger).** Deposits with active and stabilized dune forms or sheet-like morphology; includes quartz to feldspathic-quartz sand, and calcareous clay-silt-fine sand aggregates. Up to 15 m thick. Undifferentiated dune deposits (ED and LE), and other eolian sediments postdating last major expansion of pluvial lakes.

EM **Eolian loamy sand to sandy clay loam (older).** Deposits with stabilized dune forms or sheet-like morphology; includes quartz to feldspathic-quartz sand and calcareous clay-silt-fine sand aggregates; with prominent buried and relict soil horizons of clay and carbonate accumulation. Generally less than 10 m thick. Coeval with Ao.

Remarks: Bulk of unit deposited in middle to late Pleistocene prior of expansion of Wisconsin pluvial lakes. Unit includes thousands of small (<1 km^2) depressions with thin playa deposits, widely scattered narrow swales with thin alluvial deposits, and local areas of younger eolian cover. Correlative in part with Blackwater Draw Formation.



3) Lacustrine and Playa Deposits

L **Lacustrine deposits-undivided.** Sediments deposited in permanent bodies of standing water, including medium- to coarse-grained shore facies, fine- to medium-grained floor facies, and local fine- to coarse-grained deltaic facies.

Remark: Primarily to deposits of Pleistocene to early Holocene pluvial lakes; includes numerous deposits of playa lakes in small deflation depressions, and associated eolian deposits.

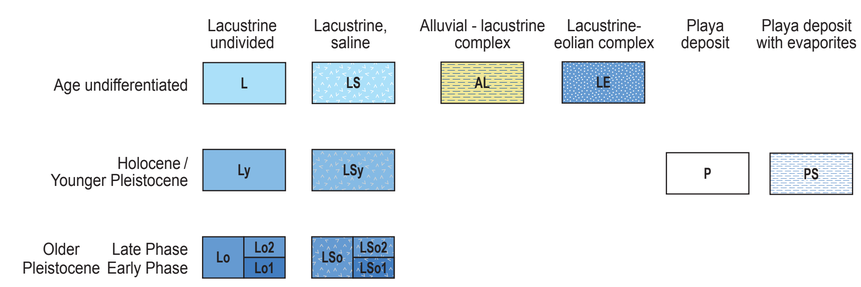
LS **Lacustrine deposits with evaporites.** Sediments deposited during desiccation phases of pluvial lakes and after ephemeral flooding of playa areas. Dominant evaporites are sodium and calcium sulfates; zeolites and dolomitic marks are locally present, with high magnesium and calcium clays including sepiolite and montmorillonite.

LE **Lacustrine-eolian complex.** Complex of Ly and EL.

P **Playa deposit.** Clay to loam of ephemeral lakes in a variety of geomorphic settings, including deposits of bolson floors, solution-subsidence basins, deflation basins, lava field depressions, structural depressions, and former valleys blocked by subsequent eolian and alluvial deposition or lava flows. Up to 5 m thick.

Remark: Thousands of playas less than 2 km in width not shown. Also included in "depression fill" units (D).

PS **Playa deposit with evaporites**. Clay or loam deposited in ephemeral lakes subject to ground-water discharge or in deflation basins in older saline lake deposits (LS) or wind reworked evaporites (ES). Dominant salts are calcium and sodium sulfates. Up to 5 m thick.



4) Depression Fills

D **Depression Fill-undivided.** Complexes of alluvial, colluvial lacustrine, and eolian deposits of large closed depressions or interconnected systems of depressions that range in area from about 10 to as much as 200 km^2 and closure relief ranging from several meters to 50 m. Major mechanisms of depression formation, (usually operating in combination) include: solution-subsidence in carbonate and evaporite tenures; deflation; large-scale piping; basalt extrusions; local structural subsidence; and blocking of former valleys by alluvial or eolian processes, mass wasting or lava flows.

Remark: Tens of thousands of small depressions and associated fill complexes not shown due to map scale limitations.

DS **Filled Solution-subsidence Depressions in salme-gypsum evaporite terrane.** Depressions significantly modified by stream erosion and deposition, deflation and eolian deposition, pluvial-lake and playa deposition, and mass wasting. Complex alluvial, colluvial, eolian and lacustrine fills locally as thick as 100 m, generally less than 30 m thick.

Remarks: Active formation and filling of depressions since late-middle Pleistocene time (past 300-500 ka). Includes extensive modern subsidence at San Simon Sink (near Hobbs).

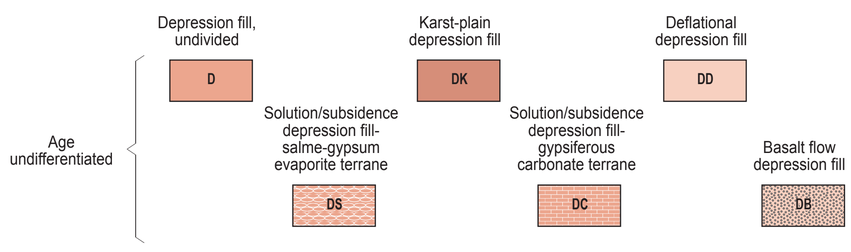
DC **Fills of Solution-subsidence Depressions in gypsiferous carbonate terrane.** Depressions significantly modified by stream erosion and deposition, and mass wasting and are aligned along zones of faulting and structural warping. Alluvial and colluvial fills with minor playa and eolian deposits usually less than 10 m thick.

Remark: Includes depressions near Vaughn along north-south-trending structural subsidence.

DK **Karst-plain deposits.** Pitted upland plains on carbonate rocks.

DD **Fills of deflational depressions in eolian sheet and dune deposits, and in sandstone and calcrete caprock terranes; modification by carbonate and sulfate dissolution and stream erosion is of secondary importance.** Eolian and playa deposits form the major fill components; usually <10 m thick.

DB **Fill of depressions on and adjacent to basalt flows.** Genetically related to flow emplacement, including intraflow collapse basins and extraflow valley blockage depressions. Eolian, playa, and colluvial deposits form the major fill components, usually <10 m thick.

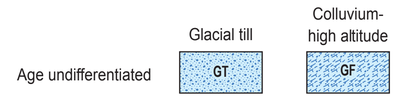


5) Glacial and Periglacial Deposits

GT **Glacial till, and associated ice contact stratified drift in alpine valley areas of southern Rocky Mountains and on Sierra Blanca.** Glacial outwash mapped with AV and AR units.

Remark: Only larger areas shown.

GF **Colluvium-high altitude.** Includes C and CB in alpine or subalpine areas of northern and central NM (elevations >3900 m).



6) Colluvium

C **Colluvium-undivided.** Deposits on mountain and hill slopes emplaced by mass-wasting processes, including creep, small landslides, debris flows, rock falls and slides, and unconcentrated slopewash; with wide range of textures and composition. Area of bedrock outcrop generally less than 25%. Includes thin residuum, and narrow belts to thin sheets of alluvium deposited by low order streams (up to 25% A and AV equivalents). Surface and buried horizons of pedogenic-clay and/or carbonate accumulation are commonly present in older subunits.

CA **Colluvium in combination with valley-fill alluvium.** Complex of C, CR, CW, or CB with A, AV, or AP. Sometimes in combination with small landslides in areas of high local relief with steep slopes underlain by weak bedrock types capped by resistant units. Larger colluvium-landslide complexes depicted as CJ.

CR **Colluvium with large areas of bedrock outcrop (usually >50%).** Used in combination with Second-order symbols denoting bedrock terranes.

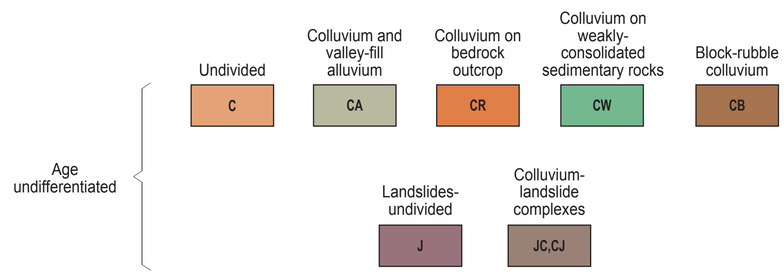
Remark: Used primarily in arid parts of the state: includes extensive mudstone-siltstone-shale badlands; and very high relief terrains with erosion-resistant rocks.

CW **Colluvium with large areas of weakly-consolidated sedimentary-rock outcrops (w).**

CB **Block-rubble Colluvium.** Mantle of angular to subangular very-coarse rock fragments, or steep slopes capped by resistant bedrock types. Clasts primarily of boulder size, but including blocks. Fabric ranges from clast supported to matrix supported with matrix including sandy (s), loamy (m), and clayey (c) textures. Includes lesser amounts of non-blocky colluvium and small landslides.

J **Landslides-undivided.** Large, broken to coherent masses of bedrock units on steep, high-relief slopes underlain by weak rock types and capped with resistant units. Includes up to 50% blocky colluvium. Only larger areas shown (>2 km wide).

JC, CJ **Colluvium-landslide complexes.** Symbol order denotes relative abundance.



7) Calcretes

K **Calcretes-undivided.** Primarily soil petrocalcic horizons formed in surficial alluvial and eolian deposits (upper 2-4 m), with local occurrences on bedrock surfaces and in rock fractures. Sediments and fracture fillings are impregnated with alluvial calcium carbonate and lesser amounts of alluvial clay. Upper indurated laminar to platy horizons usually grade downward to non-indurated, massive to nodular horizons of carbonate impregnation. Locally includes minor amounts of carbonate-cemented conglomerate, sandstone, and mudstone with nonpedogenic, secondary carbonate introduced by ground water or deeply percolating vadose water.

Remarks: K2m (Bkm) horizons-morphogenetic Stage IV (gravelly and non-gravelly) of Gile and others, 1965-1966), and States V and VI of Bachman and Machette (1977). Unit mapped only where it is generally within 1 m of the land surface and is a really extensive (>4 km^2). May include genetically-related overlying horizons of clay accumulation (Bt), or thin overlays of eolian and/or alluvial deposits (usually <1 m thick).

KI **Incipient calcrete.** Plugged, weakly indurated stage III-IV.

KG **Gravelly calcrete.** Primarily soil petrocalcic horizons formed in very gravelly alluvium (>35% granule to cobble size). Sediments are impregnated with alluvial calcium carbonate and many clasts are supported by a carbonate-cemented sand to loam matrix. Upper, moderately-well-indurated horizons 0.3 to 2 m thick, form thin caprock units with platy structure and laminar internal fabric; calcrete bulk densities range up to 2.2 g/cm^3. Lower weakly-indurated, massive to nodular horizons grade downward into uncemented gravel or gravelly sand to loam with carbonate-coated clasts.

Remarks: K2m (Bkm) horizons-State IV (gravelly) of gile et al. (1965-1966) to Stage V of Bachman and Machette (1977). Primarily associated with relict constructional geomorphic surface of Pleistocene age.

KM **Calcrete.** Thick soil petrocalcic horizons formed in sandy to loamy alluvial and eolian deposits with <15% granule and pebble gravel; including lesser amounts of gravelly alluvium (15 to 35% >2 mm); most primary grains are dispersed in a matrix of alluvial calcium carbonate. Upper moderately-well-indurated horizons, 0.3 to 2 m thick, form thin caprock units with platy structure and laminar internal fabric; calcrete bulk densities range up to 2.2 g/cm^3. Lower weakly-indurated, massive to nodular, horizons grade downward in to uncemented sand and gravelly sand to loam.

Remarks: K2m (Bkm) horizons-Stage IV (nongravelly) of Gile et al. (1965, 1966) to Stage V of Machette (1985). Primarily associated with relict constructional geomorphic surfaces of early to middle Pleistocene age, with older (early Pleistocene to Pliocene) surfaces in the Great Plains region.

KT **Caprock Calcrete.** Thick soil petrocalcic horizons formed in alluvial and eolian deposits, late Miocene to early Pleistocene age, generally with <15% granule and pebble gravel; most primary grains are dispersed in a matrix of alluvial calcium carbonate; with very thin zones of silica cementation. Upper, well-indurated horizons 2 to 4 m thick, form caprock units with tabular structure, and laminar and pisolitic internal fabric; calcrete bulk densities range from 2.4 to 2.7 g/cm^3. Lower weakly-indurated, massive to nodular horizons grade downward into partly-cemented sand to loam with or without interbedded pebble gravel.

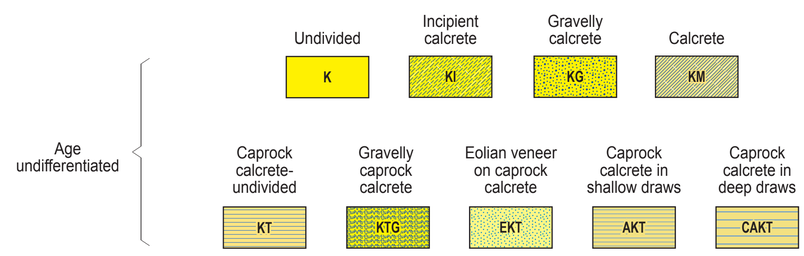
Remarks: Morphogenetic Stages V and VI of Machette (1985). Primarily formed in loamy to gravelly deposits associated with relict construction and erosional geomorphic surfaces of Pliocene and late Miocene age. Major parent sediments are the upper Miocene Ogallala and Pliocene Blanco Fms of the Great Plains province and equivalent units. Unit includes some areas where calcrete has formed in the veneers of eolian, colluvial and residual material and comprises crusts and fracture fillings, on and in bedrock units (primarily limestone, sandstone, and basalt).

KTG **As above with pebble and cobble gravel within 9 m of surface.**

EKT **Eolian veneer up to 1-3 m thick on KT;** with KT exposed along rims of escarpments, High Plains depressions and draws with local High Plains depression fills and alluvial channels.

AKT **Shallow draws of High Plains.**

CAKT **Deep draws of High Plains.**



8) Volcanics

V **Volcanic Rocks-undivided**. Includes flows and vent units of Pliocene age.

VB **Basalt flows.** Primarily alkali olivine basalt and olivine tholeiite, with lesser amounts of feldspathoidal basalt and basaltic andesite. Holocene to Pliocene.

VBy Late Wisconsin--Holocene.
VBo Basaltic volcanics--older; primarily alkalic basalts, with some feldspathoidal
VBo2 Basalts and basaltic andesites; locally extensive flow from a variety of vent types.
VBo1 Middle to late Pleistocene (VBo2), early to middle Pleistocene (VBo1) and undivided (VBo).
VBt Basaltic volcanics--Pliocene to early Pleistocene; primarily alkalic basalts, with some feldspathoidal basalts and basaltic andesites; locally extensive flows from a variety of vent types.
Younger than 5 my, in part correlative with VBo1.

VBS **Tuff rings (basaltic associated with maare).**

VRo **Rhyolitic volcanics.** Ash-flow tuffs, mostly welded, lava, and tephra from Pleistocene caldera-forming eruptions in the Jemez Mountains. Includes Bandelier Tuff and Cerro Toledo Rhyolite (VRo1); and intracaldera domes, flows, pyroclastics, sedimentary fill (VRo2).

VRt **Dacitic to rhyolitic volcanoes.** Includes lavas and vent units to Pliocene and early Pleistocene emplacement of domes and stratovolcanoes in the Mount Taylor, Raton and San Luis Valley areas.

VA **Andesite.** Includes lavas and vent units related to Pliocene and early Pleistocene emplacement of stratovolcanoes and shield volcanoes in the Rio Grande rift, Raton and Mount Taylor areas.