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TEXAS BUREAU OF ECONOMIC GEOLOGY

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES
AUSTIN 4° x 6° QUADRANGLE
MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1420 (NH–14)

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES AUSTIN 4° x 6° QUADRANGLE, UNITED STATES

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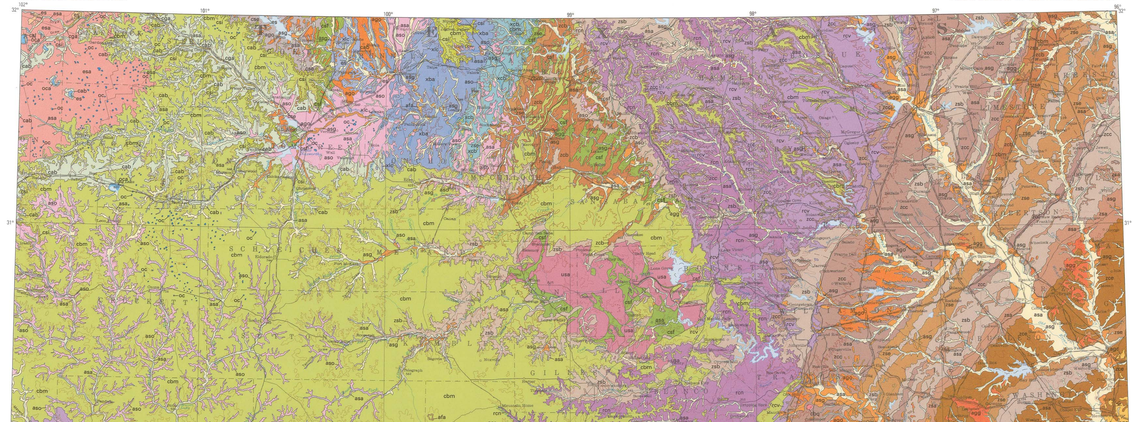
QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES



INDEX TO INTERNATIONAL MAP OF THE WORLD 1:1,000,000 TOPOGRAPHIC SERIES
Showing location of the Quaternary Geologic Map of the Austin 4° x 6° quadrangle in red (U.S. Geological Survey Miscellaneous Investigations Series Map I–1420 (NH–14)) and other published maps in the Quaternary Geologic Atlas of the United States in yellow.

PHYSIOGRAPHIC MAP
Showing features mentioned in Description of Map Units

RESPONSIBILITY FOR STATE COMPILATION
(1) U.S. Geological Survey
(2) Texas Bureau of Economic Geology

NOTE: This map is the product of collaboration of the Texas Bureau of Economic Geology and the U.S. Geological Survey, and is designed for both scientific and practical purposes. It was prepared in two stages. First, the map and map explanation were prepared by the State compiler. Second, information on the map was integrated with that of adjacent maps, locally supplemented, and related to a uniform map symbol classification by the editors. Map unit descriptions were edited, supplemented, and coordinated with those of other maps of this series so that individuals unit descriptions are applicable throughout both this map and all other maps of the series. Problems of mapping or interpretation in different areas were resolved by correspondence to the extent possible; most strictly reflect differences in available information or differences in philosophies of mapping and serve to encourage further investigation.

Less than forty percent of the surficial deposits of the United States have been mapped and described. Traditionally, mapping of surficial deposits has focused on glacial, alluvial, eolian, lacustrine, marine, and landslide deposits. Slope and upland deposits have been mapped only in restricted areas. However, an enormous amount of engineering construction and many geological studies have taken place on these deposits since publication of the previous map of this series. Moreover, extensive slope and upland deposits (colluvium and residuum, for example). These materials have many different physical characteristics. Therefore, an effort has been made to classify, map, and describe these deposits, based in large part on published and unpublished surficial data, distribution, and structure of bedrock parent materials, slope, and unpublished interpretations of individuals. The classification is crude, but represents a first step toward a more refined and useful product.

For scientific purposes, the map differentiates Quaternary surficial deposits on the basis of a combination of criteria, such as lithology, texture, genesis, stratigraphic relationships, and age, as shown on the correlation diagram and indicated in the map unit descriptions. Some geomorphic features, such as dunes, beach ridges, and playas are delineated as map units. Erosional features, such as stream terraces, are not distinguished, and differentiation of alluvial deposits of different ages is possible at a scale of 1:1,000,000 only where they are extensive.

For practical purposes, the map is a surficial materials map, on which materials are distinguished on the basis of texture, composition, and local genesis, except where features such as swelling clay. It is not a map of pedologic or agronomic soils. Rather it is a generalized map of soils as recognized in engineering, geology, or of substrates for agronomic materials from which pedologic and agronomic soils are formed. As a materials map it serves as a base from which engineering, land-use-planning, or land-management maps can be derived.

LIST OF MAP UNITS

HOLOCENE

asa	ALLUVIAL SAND, SILT, CLAY, AND GRAVEL
fl	NATURAL LEVEE SILT AND CLAY
hmu	FRESHWATER, BRACKISH, AND SALINE-MARSH SILT AND CLAY
msf	LAGOON AND WIND-TIDAL-FLAT SAND AND CLAY
mxl	LAGOON AND TIDAL-FLAT SILT AND CLAY
msc	BACK-ISLAND SLOPE SAND AND SILT
bb	BEACH SAND AND SHELL SAND

HOLOCENE AND LATE PLEISTOCENE

afa	ALLUVIAL FAN DEPOSIT
afb	ALLUVIAL-FAN GRAVELLY LOAM
es	EOLIAN SAND

HOLOCENE TO MIDDLE PLEISTOCENE

cga	CHERTY CALCAREOUS CLAY COLLUVIUM
cbm	LIMESTONE-CLAST LOAMY COLLUVIUM
cbs	BASALT-CLAST CLAYEY COLLUVIUM
ccb	SLABBY LIMESTONE-CLAST CLAYEY COLLUVIUM
cse	RED SELENITIC SANDY COLLUVIUM AND LOCAL GYPSUM SOLUTION RESIDUUM
cef	PEBBLY SANDY CLAY LOAM COLLUVIUM
csa	QUARTZ SANDSTONE-CLAST SANDY COLLUVIUM
xba	SHALE- AND LIMESTONE-CLAST DISINTEGRATION RESIDUUM
xga	CEMENTED PEBBLY LOAM DISINTEGRATION RESIDUUM
xsb	QUARTZ SAND DISINTEGRATION RESIDUUM
xlc	FINE SANDY LOAM DISINTEGRATION RESIDUUM
xcl	RED SILTY CLAY DISINTEGRATION RESIDUUM
xcb	CALCAREOUS CLAY DISINTEGRATION RESIDUUM
rgd	CEMENTED PEBBLY LOAM DECOMPOSITION RESIDUUM

LATE PLEISTOCENE

bmw	BEAUMONT FORMATION
bma	Beach and near-shore marine sand
dia	Delta sand and silt
dla	Delta silt and clay
oca	LACUSTRINE CLAY AND SILT

LATE PLEISTOCENE TO MIDDLE PLEISTOCENE

aso	CEMENTED ALLUVIAL GRAVELLY SAND
alm	ALLUVIAL SAND
ash	ALLUVIAL SAND, SILT, AND CLAY
alf	ALLUVIAL SILT AND CLAY

LATE PLEISTOCENE TO EARLY PLEISTOCENE

asl	ALLUVIAL CLAY, SILT, SAND, AND GRAVEL
esg	EOLIAN SHEET SAND
cab	CEMENTED COLLUVIUM AND SHEETWASH ALLUVIUM

MIDDLE PLEISTOCENE AND EARLY PLEISTOCENE

sgo	ALLUVIAL GRAVEL AND SAND
afc	ALLUVIAL SILT AND CLAY

MIDDLE PLEISTOCENE

lsc	LISSIE FORMATION
alm	Alluvium
ash	Alluvial sand, silt, and clay
alf	Alluvial silt and clay

LATE PLEISTOCENE TO EARLY PLEISTOCENE

asl	ALLUVIAL CLAY, SILT, SAND, AND GRAVEL
esa	EOLIAN SHEET SAND
cab	CEMENTED COLLUVIUM AND SHEETWASH ALLUVIUM
sgo	CEMENTED SANDY CLAY DECOMPOSITION RESIDUUM
cpe	SMECTITIC CLAY DECOMPOSITION RESIDUUM
ccc	SILTY CLAY DECOMPOSITION RESIDUUM
ccb	MASSIVE CLAY DECOMPOSITION RESIDUUM
rcn	CEMENTED SANDY CLAY DECOMPOSITION RESIDUUM
rcv	CHERTY CALCAREOUS CLAY SOLUTION RESIDUUM
rsv	STONY CALCAREOUS CLAY SOLUTION RESIDUUM
uxa	FELDSPATHIC SANDY FINE GRUS
esa	EOLIAN SHEET SAND
rsb	CHERTY CALCAREOUS CLAY SOLUTION RESIDUUM
rcv	STONY CALCAREOUS CLAY SOLUTION RESIDUUM
uxa	FELDSPATHIC SANDY FINE GRUS
rgd	CEMENTED PEBBLY LOAM DECOMPOSITION RESIDUUM

DESCRIPTION OF MAP UNITS

HOLOCENE

asa ALLUVIAL SAND, SILT, CLAY, AND GRAVEL—Gray, brown, grayish-brown, and yellowish-gray, coarse to fine sand and silt, chiefly quartz, and subangular to well-rounded pebble gravel, pebbly sand, and sandy pebble gravel, interbedded and intermixed. Variable grain size and bedding. Near the coast, principally sand and silt, minor clay, sparse gravel, inland, sand-to-gravel ratios 1:1 to 1:1.5. Contains lenses and thin beds of calcareous silt and clay, some organic rich. Includes deposits of point bars, chute bars, active and abandoned channels, natural levees, low terraces, and flood plains. Some point-bar deposits, as exemplified by those of the Brazos River, grade upward from crossbedded basal sandy gravel (2–3 m thick) to fenton crossbedded silt and fine sand and are capped by reddish-brown alluvial clay. In Falls County, Brazos River deposits 15–25 m thick underlie a flat valley floor, 3–7 km wide. Throughout the quadrangle, clasts include subangular to rounded chert, quartzite, and (or) quartz, with minor amounts of limestone, claystone, and petrified wood, except on Edwards Plateau where limestone is dominant. Alluvium along the Colorado River contains granitoid rocks, schist, and gneiss in the Llano uplift area. Gravel in the Rio Grande valley is rounded, composed of sedimentary rocks, and mafic igneous and volcanic rocks derived from Trans-Pecos area (50–250 km west of the quadrangle). flood plain and low terraces covered by 2–4 m of pale-brown sandy and clayey silt. On coastal plain, fine-grained deposits of levees, flood plains, and abandoned channels partially fill valleys cut into Pleistocene deltaic sediments (**dla**,**dla**). Coastal-plain alluvium consists of clayey silt, clay, and admixed silt; surficial and buried immature soil zones contain fine root tubules, secondary calcium carbonate and ferruginous nodules. Mapped areas include organic-rich swamp deposits on Brazos River, and thin (<1 m) clayey-silt interlaminated clay and silt in sinuous abandoned channels. Thickness generally ≤5 m in valleys of large rivers and about 2–6 m in elsewhere; locally as much as 25 m.

fl NATURAL LEVEE SILT AND CLAY—Brown to grayish-brown, light- to medium-gray silt and silty clay; includes small amounts of fine quartz sand and, locally, abundant plant fragments. Thin bedded to laminated. Secondary structures include parallel, wavy, and climbing ripple cross-laminations and erosional truncations of laminae. Common ferric and calcium carbonate nodules and plant roots. Form broad levees 1–4 m high along present and former courses of Brazos and Colorado Rivers on the coastal plain. Levee deposits thin and slope gently away from channel. Near mouth of Guadalupe River, levee deposits are interbedded with silty sand of abandoned distributary channels of the prograding delta and mapped as unit hmu. Thickness 1–4 m.

hmu FRESHWATER-, BRACKISH-, AND SALINE-MARSH SILT AND CLAY—Gray, brown, black, bluish- or greenish-gray silt and clay and locally organic-rich sand layers, intermixed and interbedded. In places, sandy clay beds alternate with layers of peat consisting of compressed mats of shoal grass. Includes tidal-flat deposits, and prograding bayhead-delta deposits of the Guadalupe and Lavaca Rivers. Bayhead-delta deposits grade up from shelly, sandy clay at the base into ripple cross-laminated silty sand and mud, locally overlain by fine-grained levee and marsh deposits. Thickness under modern marshes 0.25–3 m, locally thicker.

msf LAGOON AND WIND-TIDAL-FLAT SAND AND CLAY—Gray pale brown sand and light-gray clay. Includes lenticular beds of sand or fine to very fine quartz and shell sand, interpreted laminae of clay, algal-bound sand, shell fragments, and microgypsum crystals. Commonly bioturbated and interlayered, burrowed locally. Chiefly sand with very thin interbeds of clay. Clay accumulates on flats during relatively enclosed conditions; wind-driven flood tides, producing alternating laminae of clay and blue-green algae. Flats usually subaerial; exposure—well-developed evaporite salts accumulates in this beds. Flats are locally alkaline; finely crystalline dispersed evaporite ferms coarser crystals of gypsum, commonly with back-island slope sand and silt (msc), in places, cut by tidal channels filled with sand mixed with broken clam and oyster shells and skeletal material of bryozoa and coral. Mapped areas include local eolian sand as shown separately. Thickness 0.5–2 m.

mxl LAGOON AND TIDAL-FLAT SILT AND CLAY—Light- to dark-gray silt, clay, and very fine sand intermixed and interbedded; includes marine and, locally, eolian deposits on tidal flats and lagoons, chiefly on coast, and seaward of Matagorda Peninsula north of Pass Cavallo. Thickness 0.5–2 m.

msc BACK-ISLAND SLOPE SAND AND SILT—Light-gray, very light gray, or brown fine sand and silt grading landward to sandy clay. Sparse interbeds of blue-gray mud, 30–50 cm thick, in lagoons, confined to local depressions on back-barrier flats. Laminated or massive, mottled, silty. Contains oyster and other pelecypod fragments. Forms gentle landward edge of Matagorda and San Jose Islands includes wash-over fan sediments deposited by hurricane washovers and storm surge over the islands. Channel sand is interbedded with planar-bedded sand which replaces it landward and in turn merges with lagoonal mud. Medial to distal parts of planar-bedded sand are 10–50 cm thick. Grades upward from a basal layer of clay pebbles and shell hash into fine sand and silt. Sand is characterized by channel and erosional disconformities. Mapped areas include small dunes, coppice sand mounds, ponds, swales, channels, and marshes. Thickness 0.5–3 m.

bb BEACH SAND AND SHELL SAND—White to light-gray, very well sorted, angular, fine to very fine quartz sand, shell sand, and shells with subordinate feldspar, rock fragments, and heavy minerals. Shell fragments form lag concentrates in places. Underlies beach, and, rest disconformably on deposits of the Pleistocene and Holocene. Thickness 1–8 m.

HOLOCENE AND LATE PLEISTOCENE

afa ALLUVIAL-FAN DEPOSIT—Yellowish- to brownish-gray gravel, coarse to medium sand, and minor silt, intermixed and interbedded; structureless to poorly bedded. Clasts chiefly angular to subrounded pebbles and cobbles of limestone, dolomite, and chert. Forms fans at several levels in Edwards and Fro River watersheds. Thickness 3–6 m.

afb ALLUVIAL-FAN GRAVELLY LOAM—Pale-brown, yellow, light-yellowish-brown silty clay; calcareous, friable; contains interbeds of pebbly sand to sandy silt. Clasts chiefly subangular to subrounded pebbles of limestone, dolomite, and chert; local pebbles of basalt and pyroclastic rock. In places layers of nonexistent and sand and coarse pebbly soil, white to very pale yellow calcium carbonate. Underlies broad, very gently sloping, [1 percent slope] alluvial fans in valleys entrenched beneath alluvial gravel (**ago**, **agg**). Thickness 3–12 m.

es EOLIAN SAND—Yellowish-red, reddish-brown, reddish-yellow, fine to very fine quartz sand; silty, slightly clayey. Mapped areas include cover sand and stabilized dunes on uplands. Forms gentle swales and low-relief undulates blowouts and flats. Relict orientation of pre-existing dunes is apparent on aerial photographs. Thickness 1–3 m.

HOLOCENE TO MIDDLE PLEISTOCENE

cga CHERTY CALCAREOUS CLAY COLLUVIUM—Light-reddish-brown clay to silty or sandy clay and red clay. Where underlain by limestone, contains abundant solution-rounded subangular fragments of limestone and scattered chert. In places, secondary calcium carbonate present in lower 0.5 m. Residuum is in sharp contact with limestone and penetrates it along fractures. Residuum grades down into marl, clay, or soft sandstone. Forms horizontally bended layers of stony and stone-free clay residuum on stepliike benches underlain by alternating flat-lying thin beds of hard limestone and softer rocks. Mapped areas include numerous bedrock exposures, chiefly limestone, and deposits of stony clay colluvium on frontal slopes of benches and steep to moderate slopes of valleys that dissect the limestone. Thickness 0.2–2 m

rcv STONY CALCAREOUS CLAY SOLUTION RESIDUUM—Chiefly dark reddish brown or pale- to grayish-brown clay, in places enclosing several square kilometers of loamy residuum. Where underlain by limestone, lower part of residuum is in abrupt contact with zone of clay and remnant solution-rounded limestone fragments comprising 30–80 percent of the material. Fragment zone grades down into fractured limestone bedrock. Where underlain by shale, residuum and shale are in abrupt contact; where underlain by chalk or marl, contact is more gradational. In Bell County, rolling hills and nearly level uplands are veneered with dark-brown silty clay that grades down through soft, white marl and a clay and fragment zone into hard, fragmented limestone. Similar variation in the residuum also is apparent in southwest Edwards Plateau, where residuum covers uplands and hillslopes underlain by interbedded limestone, marl, sandstone, and chalk. Mapped areas include bedrock outcrops and, where slopes are steep to moderate, accumulations of pale-brown, calcareous loamy colluvium, 1–2 m thick, that contains abundant fragments of limestone, shale, and secondary calcium carbonate. Thickness of residuum 1–2 m

uxa FELDSPATHIC SANDY FINE GRUS—Pink-tan, angular fragments, 2–4 mm in diameter, in clayey, medium to very coarse sand; matrix composed of quartz, feldspar, and biotite crystals and crystal fragments weathered from granite, gneiss, and schist. Mapped areas commonly include colluvium and local bedrock outcrops. Thickness 1–2 m

[1]COLLUVIUM is a general term applied, for purposes of this map, to unconsolidated rock and soil material transported and deposited by mass-wasting processes.
[2]SOLUTION RESIDUUM, for purposes of this map, is defined as material derived by in-place solution of carbonate rock or carbonate-cemented rock, with no appreciable subsequent lateral transport.
[3]DISINTEGRATION RESIDUUM, for purposes of this map, is defined as material derived by in-place mechanical breakup of rock with no appreciable subsequent lateral transport.
[4]DECOMPOSITION RESIDUUM, for purposes of this map, is defined as material derived primarily by in-place chemical weathering of clastic rock with no appreciable subsequent lateral transport.
[5]THICKNESS is approximate because deposit thickness seaward, the base is usually buried, and underlying strata are undescribed. In the Gulf of Mexico, the base of the Quaternary is a time-stratigraphic boundary that may be inadequate to aid in locating base of unit. In practice, the base may be assigned in drill holes at the top of a buried paleosol, a major change in dominant grain size, firmness of clay, a change from gray to reddish-brown clay, a seismic-reflector horizon, or another characteristic that is interpreted to represent a major stratigraphic change.
[6]GRUS, for purposes of this map, is defined as material derived by in-place chemical and physical weathering of crystalline rock with no appreciable subsequent lateral transport.

CONTACT
FAULT—Bar and ball on downthrown side
DUNE RIDGE CREST
TEPHRA LOCALITY—Lava Creek B (Pearlette ⓪) ash bed
f ARTIFICIAL FILL

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