MAP I-442

DEPARTMENT OF THE INTERIOR
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GEOLOGIC MAP OF THE DUNCAN AND CANADOR PEAK QUADRANGLES ARIZONA AND NEW MEXICO

By

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MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-442

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PRECAMBRIAN ROCKS

GRANITE

The granite is red, pink, and pinkish gray, generally coarse-grained and equigranular, but locally porphyritic. It is composed of red to pink feldspar—mostly microcline with variable quantities of oligoclase and locally perthite—quartz, and commonly small quantities of biotite. Pegmatite, aplite, and diorite dikes and quartz veins occur locally. The south and southwest boundaries of the granite area are faults having more than 4,000 feet displacement.

A profound erosion surface, probably of low relief, separates the granite from the overlying Beartooth Quartzite. Beneath this surface the upper few feet of the granite is deeply weathered to a dark-red grus.

The granite closely resembles granite of probable Precambrian age exposed in the Big Burro Mountains–Redrock area (Hewitt, 1959, p. 66–78) east of the mapped area, Knight Peak area (Ballman, 1960, p. 9–10) east of the mapped area, and near Clifton, Ariz. (Lindgren, 1905).

CRETACEOUS ROCKS

BEARTOOTH QUARTZITE

The Beartooth Quartzite is mainly light-gray to almost white sandstone and orthoquartzite consisting of medium-coarse-, and granule-sized grains. The maximum thickness is about 85 feet. The lower two-thirds of the formation is well-bedded quartzose sandstone that is locally crossbedded on a small scale. The beds are generally 1/2–3 feet thick. The well-rounded quartz grains commonly have overgrowths of secondary quartz that firmly cement the rock, making this part of the formation a cliff former. Fine-pebble sandstone and fine-pebble conglomerate interbeds are locally present; the pebbles are chert that probably was derived from chert-bearing Paleozoic limestone exposed elsewhere in the region. The basal several feet is arkosic and was derived from the underlying granite. The upper third of the formation is interbedded sandstone and gray to black shale. The top of the formation is placed at the top of a 2-foot bed of hard silty orthoquartzite.

The formation, which was deposited in a transgressive inland sea, is nonfossiliferous, and is considered by Paige (1916) to be Late(?) Cretaceous in age; some more recent workers consider it equivalent to the Lower Cretaceous Dakota of northeastern New Mexico and adjoining areas.

COLORADO FORMATION

The Colorado Formation consists of marine shale, sandstone, minor limestone, and conglomerate and conformably overlies the Beartooth Quartzite. Poor exposures and faulted zones preclude accurate determination of the thickness of the Colorado, but the apparent maximum exposed thickness is at least 500 feet and possibly as much as 700 feet.

The lower part, about 230 feet thick, is gray to black generally calcareous shale, interlayered with a few to many black concretionary limestone beds. The middle part, about 200 feet thick, consists of zones of olive-gray and gray to locally black shale alternating with approximately equally thick zones of pale-gray to white locally pink and tan sandstone that are well bedded to thick bedded and locally cross-bedded on a small scale. The upper part, about 100 feet thick, is mainly light-olive to black calcareous shale interbedded with sandstone.

Calcareous shale about 30 feet above the base of the Colorado Formation, in the NW1/4NE1/4 sec. 20, T. 18 S., R. 20 W., yielded the shallow-water marine pelecypods *Cyprimeria*(?) sp. and *Exogyra columbella* Meek (identified by W. A. Cobban, U.S. Geol. Survey). *Exogyra columbella* is in rocks equivalent to the Graneros Shale and the lower part of the Greenhorn Limestone. In the SW1/4SE1/4 sec. 17, T. 18 S., R. 20 W., a limestone bed approximately in the middle of the formation yielded the shallow-water marine pelecypods *Ostrea soleniscus* Meek and *Exogyra* cf. *E. olisiponensis* Sharpe (identified by W. A. Cobban), which suggest a Late Cretaceous age, equivalent to that of the lower part of the Greenhorn. The Colorado Formation apparently is approximately equivalent in age to the Pinkard Formation of the Morenci and other areas in southeastern Arizona.

CRETACEOUS AND TERTIARY(?) ROCKS

NONMARINE SHALE, SANDSTONE, AND CONGLOMERATE

A unit consisting of nonmarine shale, sandstone, and conglomerate, overlying the Colorado Formation with apparent conformity, is exposed in the slightly dissected area of pedimented bedrock north of Riley Peaks. This unit is the approximate equivalent of the Virden Formation, named by Elston (1960) and described by Pradhan and Singh (1960), who considered the Virden to be unconformable on the Colorado. Poor exposures, especially in sheared zones, make it difficult to assess the effect of the faults on repetition and omission of beds, but the apparent maximum exposed thickness of the formation is about 1,500 feet.

The basal part is a distinctive white thick-bedded sandstone, a marker bed that is locally light gray and light tan. It is 40 feet thick, commonly contains eolian-type crossbeds, is well indurated, and forms a persistent minor hogback. This sandstone is the lowermost definitely subaerial unit in the Cretaceous sequence.

The unit is mainly shale, and some sandstone, in its lower part, but it becomes coarser upward, through a middle part that is sandstone and conglomerate, to an upper part about 230 feet thick that is almost entirely andesitic conglomerate. The sandstone is mainly olive green and gray green and locally light tan to light gray, mostly soft but locally hard, and commonly tuffaceous. The shale is mainly olive green, yellow green, and olive gray, and locally dark gray to black. The conglomerate is made up mostly of pebbles, cobbles, and locally boulders. Except at the top of the unit, the roundstones consist of intermediate lavas in a medium to dark olive-gray tuffaceous, poorly sorted sand matrix. At the top of the unit is about 135 feet of conglomerate composed entirely of red granite similar to the Precambrian granite exposed in the mapped area. It is devoid of andesitic debris, although it rests conformably on the andesitic conglomerate that is entirely devoid of granite.

Plant remains are locally abundant in the lower and middle parts of the unit. Sandstone in the middle part yielded the conifer *Araucarites longifolius* (Lesquereux) Dorf (identified by J. A. Wolfe, U.S. Geol. Survey). Pradhan and Singh (1960) reported also *Salix*(?) sp., *Juglans leconteana*, *Virburnum* sp., *Canna*(?) *magnifolia*, and *Cinnamomum* sp.; they considered these fossils indicative of late Montana to early Lance (Late Cretaceous) age.

TERTIARY ROCKS

OLDER ANDESITE

The older andesite is mainly andesite flows and flow breccias, with local andesitic tuff and other intermediate lavas. It is dark gray to black, brown, maroon, and purple. Spotted greenish-gray andesite which has strong platy structure is common. The andesite is commonly vesicular, amygdaloidal, and(or) porphyritic, and contains small phenocrysts of plagioclase and mafic minerals. It is commonly closely sheared and somewhat hydrothermally altered or propylitized. Its total thickness is difficult to estimate because of poor exposures and faulting but it probably is more than 1,000 feet.

Correlation of the exposures on the west side of Old Camp Canyon in the southwest corner of the Duncan quadrangle with those in the northeast corner is problematic; the older andesite possibly belongs in the lower part of the young basaltic andesite unit. Northwest of Riley Canyon, in the Canador Peak quadrangle, the older andesite overlies the nonmarine shale, sandstone, and conglomerate unit conformably or with small angular unconformity.

DATIL FORMATION AND APPROXIMATE EQUIVALENTS

Datil Formation

A sequence of mainly rhyolitic and latitic tuffs, and some tuffaceous sandstone and conglomerate, and local latite(?) and andesite flows in the Canador Peak quadrangle is designated as the Datil Formation in this report. This designation agrees with the previous assignment of these rocks to the Datil by Elston (1960), and is in accordance with the recent general practice of the New Mexico Bureau of Mines and Mineral Resources in assigning volcanic rocks of this general character and age in southwestern New Mexico to the Datil.

The formation unconformably overlies the older andesite and is markedly unconformable beneath the young basaltic andesite and the volcanic conglomerate-older basin fill-tuff unit. Its maximum thickness is at least 1,400 feet. The Datil was first regarded as Oligocene (Winchester, 1921, p. 4), but more recently has been considered to range in age from Oligocene to early Miocene (Cooley and Akers, 1961, fig. 237.2).

The Datil is subdivided into lower and upper units and a local latite-andesite unit. The individual zones (tuffs and flows) within these units differ both in lithologic facies and in thickness, but each unit preserves its general character throughout the area of exposure. The whole sequence appears to be essentially conformable, in spite of small local unconformities. All three units are best exposed in the Gila Lower Box-Canador Peak-Rimrock-Deadman Ridge area.

Lower unit.—The lower unit in the vicinity of Gila Lower Box consists of, from top to bottom:

	Approximate thickness (feet)
Lithic tuff, pale-yellow to nearly white, weathers to darker yellow and tan, massive to very thick bedded, well-indurated, prominent cliff former; locally at top is a 20- to 25-foot zone of hard (welded?) rhyolitic lithic tuff, red brown at top, grading downward through pinkish gray to light gray	200
Lithic tuff, red in upper part, grading downward through orange and yellow to pale yellow in lower two-thirds	150
Andesite or latite flow	25
Lithic tuff, greenish-gray; massive in upper part, well-bedded in lower part	150
Lithic tuff, pale-yellow, well-indurated, strongly columnar-jointed; cliff former	10- 30
Lithic tuff, light greenish-gray, locally light-tan; thick-bedded	10-100
Basaltic andesite flow and flow breccia, dark-gray to black, very lenticular	0- 50
Lithic tuff, light greenish-gray to light-gray	100
Total thickness	645-805

The boundary between the lower and upper units of the Datil Formation is placed at the conspicuous and persistent contact between the massive thick yellow tuff below and the green tuffaceous sandstone zone above.

Upper unit.—The upper unit near Gila Lower Box consists of the following zones, from top to bottom:

	Average thickness or range (feet)
Felsite (latite?) flow, dark-red, strongly flow banded	30
Andesite, dark-gray to black, vesicular to platy	70
Tuffaceous (andesitic to felsitic) sandstone and conglomerate, pink to dark-red, well-bedded, water-laid; moderately well indurated in upper part, generally poorly indurated in lower part	75
Lithic felsitic tuff, pale-gray to white, locally pink, massive, indurated (darker and more indurated in lower part); cliff former	40

Welded felsitic tuff, medium-gray, weathers to dark reddish gray, massive, very well indurated; strongly jointed; major cliff former . . .	60
Lithic tuff and tuffaceous conglomerate, light-gray and pink to red, poorly to well-indurated	0–200
Tuffaceous sandstone with some tuffaceous conglomerate and lithic tuff, mostly light greenish-gray and light grayish-green, locally tan, red, pink, gray, to nearly white; well-bedded to almost laminated, water-laid; graded bedding common	100–300—
Total thickness	375–775—

Latite-andesite unit.—The latite-andesite unit consists of thick latite and andesitic flows and some local tuff. Bedding and flow structures are discernible locally. The flows typically are highly lenticular, and they crop out only in a few localities where they underlie hills that have resisted erosion, as at Canador Peak and Baldy Hill. Each locality is so bounded by faults and(or) overlapped by the Gila Formation and younger sediments that the exact stratigraphic relation of the latite-andesite unit to the Datil Formation generally cannot be determined; the limited evidence available suggests that this unit is approximately coeval with the upper part of the lower unit.

Lithic tuffs and rhyolitic flows

This unit is generally well indurated and consists mainly of light-colored lithic tuffs, minor welded tuff, and minor rhyolitic flows in the upper part. It is various shades of gray, pink, tan, green, and red, grading to white. Some tuffs and flows are prominent cliff formers. The unit unconformably overlies the older andesite and unconformably underlies the younger basaltic andesite. Because of extensive faulting a detailed full sequence could not be examined, but probably more than 700 feet is exposed. This unit is probably the approximate correlative of the Datil Formation, although none of its parts could be correlated reliably with any of the Datil in the Canador Peak quadrangle.

Intrusive rhyolite

This unit, exposed in a few places in the Canador Peak quadrangle, consists of rhyolite plugs and a dike. The plugs are light-gray to pink and red rhyolite porphyry that have vertical to steeply dipping flows structure.

YOUNGER BASALTIC ANDESITE

The younger basaltic andesite consists of basaltic flows that are scoriaceous to massive, and locally platy. Cinder beds occur locally, particularly in the lower part of the section at the southeast end of Black Mountain; basaltic alluvial gravel occurs locally in the Duncan quadrangle. The andesite is mainly dark gray to black, but locally various shades of brown, purple, and red. It commonly appears to be olivine basalt, but probably is mostly or entirely basaltic andesite (Halva, 1961). Small plagioclase phenocrysts are common in some flows. The flows are horizontal or dip gently (rarely more than 10°), generally eastward. The andesite's maximum exposed thickness is nearly 2,000 feet west of Whitlock Peak on the western scarp of the Peloncillo Mountains. The andesite overlies or is interbedded with volcanic conglomerate, older basin fill, and tuff at the southeastern end of Black Mountain, where its maximum exposed thickness is about 700 feet, and in several areas within 3 miles to the south and southeast.

VOLCANIC CONGLOMERATE, OLDER BASIN FILL, AND TUFF

This sequence is mostly water-laid volcanic detritus—conglomerate, sandstone, clay, and tuff. It underlies the Gila Formation with pronounced angular unconformity and commonly conformably underlies and is locally intercalated with the younger basaltic andesite. The unit is well indurated. The gravel facies are generally crudely bedded and poorly sorted and consist of subangular to subrounded pebbles. The unit lacks megascopic fossils and its principal areas of exposure are widely separated; this, together with the widespread faulting and marked sedimentary facies gradations, makes exact correlation impossible between the outcrop areas, although the unit probably is approximately the same age everywhere.

In seven separate areas, seven main facies are recognized:

(1) The principal facies, which occurs within 4 miles of the south edge of the Duncan quadrangle, consists of pebble- to cobble-conglomerate and tuff breccia, underlain and overlain by the younger basaltic andesite. It is composed mostly of gray, tan, pink, brown, and red fragments of felsite, felsite porphyry, and hard lithic tuff, locally with some andesite, latite, and basaltic andesite, in a nearly white, light gray, light tan, to pink tuffaceous silt-to-sand matrix. It is well indurated, generally crudely bedded and poorly sorted, with subangular to subrounded pebbles. It probably is mostly stream laid.

In this area the upper contact of the conglomerate and tuff breccia lies 900–1,200 feet below the uppermost younger basalt flows; the base of the unit rests on an undulating erosion surface and is as much as 550 feet above the lowest exposed part of the younger basaltic andesite on the east side of Old Camp Canyon. In this general area the unit thickens southeastward, suggesting that it was derived from the areas of rhyolitic volcanic rocks in the Peloncillo Mountains a few miles south of the mapped area (Gillerman, 1958). The maximum exposed thickness, at Round Mountain, is about 250 feet. Six hundred ten feet of conglomerate (which may be this unit), underlying 200 feet of basalt, was penetrated at the bottom of the 870-foot well drilled at Big Tank.

(2) In the northern part of the Duncan quadrangle, about 70 feet of basaltic tuff breccia and basaltic and felsitic conglomerate is intercalated with the younger basaltic andesite unit. About 3 miles to the west, along U.S. Highway 70, about 100 feet of well-bedded white felsitic conglomerate and tuffaceous sandstone is exposed underlying the younger basaltic andesite.

(3) From Mexican Canyon to Moore Box, in the northwestern part of the Canador Peak quadrangle, this unit is a volcanic conglomerate consisting of pebbles, cobbles, and small boulders, and some local tuffaceous sandstone. Most rock detritus is basaltic andesite typical of the younger basaltic andesite, but some light-colored indurated lithic tuff, latite, and andesite typical of the Datil Formation are also present. The conglomerate is subrounded to well rounded, moderately to poorly sorted, crudely bedded, and well indurated. The beds dip 5°–30° northeastward, and in

general the unit becomes coarser northeastward, that is, toward the present highlands. Its exposed thickness is impossible to determine because of faulting, but probably is at least a few hundred feet.

(4) Along the lower part of Riley Canyon this unit consists of red-tan to red-brown clay and silty clay, with a few interbeds of light-tan to pale-gray calcareous sandstone and one 2- to 3-inch bed of white diatomite.

(5) Near the southeastern end of Black Mountain this unit locally underlies or is intercalated with the younger basaltic andesite. The lower several hundred feet of the unit in this area is moderately indurated and massive to well-bedded. The upper part, which is 50–150 feet thick, commonly overlies the lower part with a small angular unconformity. It is mostly sandy pebble-conglomerate, and composed almost entirely of basaltic andesite. It is light tan-gray to pink and locally red, moderately indurated, rudely to fairly well bedded, and locally somewhat crossbedded. Locally, as opposite the mouth of Blue Creek, it contains a basaltic flow 30 feet thick, and contains as many as three flows 5–10 feet thick.

(6) The unit in the areas south and southeast of Gila Lower Box is mostly silty to sandy poorly sorted pebble-conglomerate that is locally cobbly. It is light tan-gray, well indurated, and rudely bedded to locally well bedded. This pebble-conglomerate is composed of subangular to subrounded pebbles of dark-gray, black, and red andesite and hard pink, gray, and white lithic rhyolite tuff and rhyolite in a tuffaceous sand matrix.

Some fault zones in these areas contain manganese minerals, as at the Consolation, Constellation, Cliff-Roy, and Poe Mines.

(7) White pumiceous tuff and tuffaceous sandstone, generally water-laid and well bedded and as much as 100 feet in exposed thickness, underlie the younger basaltic andesite on the west side of the Summit Hills.

TERTIARY AND QUATERNARY ROCKS

GILA FORMATION

The Gila Formation in the mapped area consists of alluvium, playa, and shallow-lake sediments, deposited while the intermontane basin between the Peloncillo Mountains and the mountains to the east—here called the Duncan basin—had closed drainage, prior to the development of through drainage by the Gila River. The Gila probably is equivalent to the upper part of the Quiburis Formation and possibly the lower part of the Sacaton Formation of the Gila Group as defined by Heindl (1963).

The deeply dissected region north of Pearson and Lordsburg Mesas exposes two major zones in the Gila Formation: a lower zone of fanglomerate, and an upper zone of mostly unconsolidated or poorly consolidated silt and sand, with some gravel. A sharp lithologic break commonly marked by a small angular unconformity generally separates them. The two zones cannot be differentiated at the scale of the map.

The lower fanglomerate zone consists of subangular to subrounded coarse- to medium-sized fan gravel, generally poorly sorted, locally derived, and generally tightly cemented by calcium carbonate. At Nichols Canyon and the canyon of Blue Creek the unit dips east and northeast, generally about 3° and locally more than 5°. Near the mouth of Blue Creek it unconformably overlies flows of younger basaltic andesite that are interbedded with volcanic conglomerate, older basin fill, and tuff. In the lower parts of Picnic and Corral Canyons this zone is especially strongly jointed and locally is displaced by small faults. South of the Gila River in the middle of sec. 11, a maximum thickness of at least 750 feet is exposed.

The upper zone in the western half of the Canador Peak quadrangle is mainly sand which is commonly silty and locally pebbly in its lower part, and mainly silt with some beds of clay, sand, marl, and diatomaceous silt in its upper part. South of the Gila River gravelly zones commonly are interbedded with sandy, silty, and clayey zones. Some of the gravel zones near the western edge of the Canador Peak quadrangle may be lacustrine. South of Pearson Mesa only the upper zone is exposed; it is silt, sand, and a little clay, except bordering the Summit Hills where a gravelly facies extends 200–800 feet from the hardrock contact.

In the northwest corner of the Canador Peak quadrangle the upper zone attains a maximum exposed thickness of about 250 feet. In the area southwest of Black Mountain and Riley Peaks the boundary between the upper and lower zones dips very gently southwestward, and as a result the upper zone thins out toward the mountains. North of Canador Peak and in the vicinity of Gila Lower Box the upper zone is commonly 30 and rarely as much as 100 feet thick. In the northeast corner of the quadrangle this zone consists of alternating silty and sandy beds with sparse to abundant gravelly layers. The lower contact dips generally southeastward, so the upper zone attains a maximum thickness of about 300 feet near the eastern edge of the mapped area.

Only the upper zone is found in the Duncan quadrangle. Here it is horizontal to very gently inclined, rarely more than 3°, and is only slightly faulted. Gravel, which locally is conglomerate, is restricted, except near Pearson Mesa, to a thin selvage along the margins of the older rocks, extending basinward less than 1/3 mile below major mountain canyons and commonly only several hundred feet in intercanyon areas. It is mostly cobble-and-pebble gravel but contains boulder gravel locally; it is typically finer than overlying alluvial gravels but is composed of similar rock types in a given drainage area. Adjoining Pearson Mesa, at places more than 100 feet below its top, gravel occurs in several zones alternating with layers of sand, silt, and clay. These gravels are at least partly lacustrine and contain some igneous and metamorphic rocks from the Big Burro and Little Burro Mountains more than 15 miles east of the mapped area.

In most other parts of the interior of the Duncan basin the Gila Formation is almost entirely alternating zones of light-tan to brown silty sand and silt and olive-gray, tan, brown, and red-brown clay, locally with some interbeds of gravel, sand, limestone, tuff, marl, caliche, diatomite, and chert.

Diatomite occurs north of the Gila River in sec. 12, T. 8 S., R. 31 E., in two beds separated by 50 feet of reddish-tan silt; the lower bed is several feet thick, and the upper bed is as much as 8 feet thick. Several diatomite beds and local chert beds are exposed in bluffs on the southwest side of the Gila River northwest from Duncan. Diatomite and white diatomaceous marly silt are particularly abundant on the southwest side of the main northwest-trending fault about 2/3 mile southwest of Duncan. Diatomite has been quarried on a small scale in the W1/2 sec. 22, T. 8 S., R. 31 E.

Vertebrate collections have been made from beds probably correlative with the upper part of the upper zone, from several localities in the Duncan basin within a few miles south and north of Duncan. These fossils are early Pleistocene ("probably Blancan," according to J. F. Lance, written communications, 1960, 1962).

QUATERNARY DEPOSITS

GRAVEL DEPOSITS

Disconformably veneering the Gila Formation and older units are six age units of gravel deposits that are grouped into three classes: pediment-and-terrace gravel, lake gravel, and stream-terrace gravel. The gravels of the pediment-and-terrace class, which are the oldest, mantle four main pediment surfaces of differing ages that merge into stream terraces along their upstream edges; these gravels are subdivided into four age units, 3 through 6 in order of increasing age (fig. 1). Units 3, 4, and 5 in the pediment-and-terrace gravel class are approximately coeval with the lake gravel class; the lake gravels therefore are also numbered 3, 4, and 5. The stream-terrace gravel class is youngest and comprises two age units, designated as units 1 and 2.

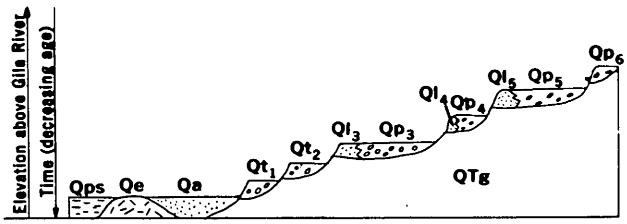

FIGURE 1.—SCHEMATIC DIAGRAM SHOWING RELATIONS OF THE QUATERNARY DEPOSITS TO THE GILA RIVER IN THE DUNCAN AND CANADOR PEAK QUADRANGLES. Qa, alluvial deposits; Qps, playa sediments; Qe, eolian sand; Qt_1, youngest, and Qt_2, oldest stream-terrace gravel; Qp_3, youngest, to Qp_6, oldest pediment-and-terrace gravel; Ql_3, youngest, to Ql_5, oldest lake gravel; QTg, Gila Formation

Pediment-and-terrace gravel

Pediment-and-terrace gravel 6.—Pediment-and-terrace gravel 6 conformably or nearly conformably mantles the oldest and highest surface over the Gila Formation. Unit 6, which is probably more than 50 feet thick locally, is mainly boulder-and-cobble gravel (pediment or fan) derived from adjacent mountain areas.

Unit 6 bears a very strongly developed Pedocal like that on unit 5.

Pediment-and-terrace gravel 5.—This unit is the coarsest and most extensive pediment-and-terrace gravel; it mantles the second highest post-Gila surface generally with slight disconformity. Along the east side of the Peloncillo Mountains and in the west half of the Canador Peak quadrangle unit 5 locally intertongues with and(or) underlies high-shore gravel (lake gravel 5) of an approximately contemporaneous deep lake. Locally below the 4,250 -foot altitude it includes undifferentiated occurrences of this lake gravel.

Areas along the Peloncillo Mountains and the southern margin of the Duncan quadrangle are covered with mainly boulder-and-cobble gravel, derived from the young basaltic andesite unit on these mountains. Areas in the northeast corner of the Duncan quadrangle and in the Canador Peak quadrangle north of the Gila River are covered with gravel almost as coarse, derived from the mountains in the vicinity of Steeple Rock (4 miles north of the mapped area) and from Black Mountain; the gravel consists mainly of rhyolitic to basaltic Tertiary volcanic rocks.

The gravel in the above areas is 3 to about 30 feet thick; it is generally coarser, and extends considerably farther from the mountains than does the gravel in the Gila Formation in the same drainage area. The thickest, coarsest, and most extensive deposits were laid down as alluvial fans by the larger washes, such as Round Mountain Draw and the washes draining Gillispie, Stocks, Woods, Poppy, and Old Camp Canyons from the Peloncillo Mountains, and Blue Creek and the washes draining Steeple Rock, Mexican, Riley, Davenport, and Redrock Canyons in the Canador Peak quadrangle.

Unit 5 in areas south of the Gila River from Pearson Mesa eastward contrasts with the unit in other areas by its different lithology and a better rounding of the pebbles. The unit here consists mainly of pebble gravel with some cobble gravel and interbedded sand and rarely silt, 15 to more than 50 feet thick; here some undifferentiated lacustrine beds are locally present. The gravel in these eastern areas was deposited on a low-gradient alluvial fan delta of the ancestral Gila River that extended over most of Lordsburg and Pearson Mesas. The gravel of the ancestral Gila River consists of rocks of many types, including Tertiary volcanic rocks and igneous and metamorphic rocks from the Big Burro Mountains and Little Burro Mountains region. Along the east edge of the mapped area, south of the Grant-Hildalgo County line, however, unit 5 is mainly reddish arkosic sand and gravel derived from Precambrian granitic rocks in the Knight Peak area about 14 miles to the east.

In all areas pediment-and-terrace gravel 5 bears a very strongly developed Pedocal here this soil has been protected from erosion. The soil has a deep reddish-brown, clayey, strongly structured B horizon as much as 4 feet thick, over a white, very strongly calcium-carbonate-cemented C_{ca} (caliche) horizon 5–8 feet thick. This soil is tentatively correlated with the Yarmouth Interglaciation.

On Pearson and Lordsburg Mesas locally overlying this soil is one to several feet of younger eolian and alluvial sand and silt not differentiated on the map.

Pediment-and-terrace gravel 4.—Pediment-and-terrace gravel 4 mantles a minor intermediate pediment-terrace surface. It commonly is preserved only in local remnants on ridge crests, many of which are too small to be mappable. Unit 4 resembles the gravel of unit 5 in the same area, and it locally intertongues with coeval lake gravel 4, as at the headwaters of Cottonwood Canyon.

Unit 4 bears a very strongly developed Pedocal like that on pediment-and-terrace gravel 5.

Pediment-and-terrace gravel 3.—Pediment-and-terrace gravel 3 forms a mantle that is locally discontinuous on a major pediment-terrace surface that is lower than the pediment-gravel 4 surface. This unit is generally somewhat finer than pediment-and-terrace gravel 5 in the same general area. Along the eastern side of the Peloncillo Mountains unit 3 commonly has foreign rock types reworked from lake gravel 5. At altitudes of 4,100±100 feet unit 3 locally intertongues with and(or) underlies approximately coeval lake sediments (lake gravel 3); pediment-and-terrace gravel 3 also includes local areas of this lake gravel that are not differentiated.

Areas downstream from Gila Lower Box within 1 1/2 miles south of the river that are mapped as pediment-and-terrace gravel 3 are not pediment gravel but are somewhat younger strath-terrace gravel deposited by the ancient Gila River after downcutting by the river had drained the lake in which lake gravel 3 was deposited. This strath-terrace gravel is generally somewhat coarser and commonly thicker than the pediment-and-terrace gravel 3 of adjoining areas. The southern margin of the ancient river flood plain appears to have been partly defined by faults.

All areas of pediment-and-terrace gravel 3 bear a very strongly developed Pedocal where this soil is not eroded, which is similar to, though somewhat less well developed than, the soil on pediment-and-terrace gravel 5.

Lake gravel

Lake gravel 5.—Lake gravel 5 is high-shore gravel of the first deep Quaternary lake in the Duncan basin. It is mainly pebble gravel with local cobble gravel and rarely some small boulders; locally it contains some sand and silt. The gravel is well rounded and generally well bedded; locally it shows small-scale crossbedding. The unit is generally unconsolidated but locally it is cemented with calcium carbonate. Algal and thinolite (a euhedral crystalline variety pseudomorphic after aragonite) tufas occur rarely, as in the SE1/4 sec. 11, T. 9 S., R. 31 E. Much-eroded remnants of lake morphologic forms, such as bars (shown on map by special symbol) and shore terraces, are preserved locally, especially in the southeast corner of the Duncan quadrangle.

This unit is 3–60 feet thick, and is thickest between Woods Canyon and the Day Ranch headquarters. The thicker exposures commonly show a zone of sand and silt between lower and upper gravel zones. The unit locally intertongues with and(or) overlies the approximately coeval pediment-and-terrace gravel 5.

Lake gravel 5 commonly differs from pediment-and-terrace gravel 5 by being generally better rounded and sorted, and, particularly, by containing many rock types that are foreign to the adjacent mountain drainage areas, such as granite, gneiss, schist, hornfels, diorite, and skarn. These rocks are characteristic of those of the Big Burro and Little Burro Mountains upstream along the Gila River.

North of the Gila River and along the Peloncillo Mountains lake gravel 5 commonly is high on the sides of the basin (hence generally close to the mountains) in positions where the only conceivable mode of transport of the foreign rocks was lacustrine, not fluvial. Evidently lake gravel 5 was washed into the northeastern part of the basin by the ancestral Gila River, deposited on its early fan delta in the Lordsburg Mesa area, and thence washed to its present locations by waves and longshore currents of the ancient lake. The overall distribution pattern of this unit defines the high-shore zone of the lake. Maximum altitudes reached by the unit, shown below, indicate deformation of the highest shoreline:

Area	Maximum altitude (feet)
North of Woods Canyon	3,950±
South of Woods Canyon	4,200±
Summit Hills	4,240
Black Hills	4,300
1 1/2 miles north of Caprock Mountain	4,390
Southwest side of Black Mountain	4,280–4,310

Although the lowest part of the pass in the Peloncillo Mountains northwest of Indian Rocks is about 4,175 feet altitude, lake gravel 5 is absent near the pass (the highest occurrences in the vicinity are at about 3,950 feet), and there is no evidence that the lake overflowed this pass; presumably the pass area has been downwarped with respect to the higher shorelines to the south and east since this lake maximum.

Lake gravel 5 bears a very strongly developed Pedocal like that on pediment-and-terrace gravel 5. This soil is correlated with the Yarmouth Interglaciation.

Lake gravel 4.—Lake gravel 4 is mainly pebble gravel and closely resembles lake gravel 5 in all respects except that it occurs at somewhat lower elevations and appears to be associated with pediment-and-terrace gravel 4 and its surface. Lake gravel 4 may represent recessional levels of the lake in which lake gravel 5 had been deposited or it may represent another younger lake.

Lake gravel 4 bears a very strongly developed Pedocal, where not eroded, like that on pediment-and-terrace gravel 5 and on lake gravel 5.

Lake gravel 3.—Lake gravel 3 is mainly pebble gravel similar to that of lake gravels 4 and 5; it is generally reworked from them and from the various pediment gravels. It is 1 to about 20 feet thick. The vertical range of deposition of lake gravel 3 is from the higher parts of the pediment on which pediment-and-terrace gravel 3 was deposited to about 30 feet below the highest level reached by lake gravel 5 in a given area. The unit locally intertongues with and(or) overlies pediment-and-terrace gravel 3, as on the alluvial fan just north of the wash from Gillispie Canyon. In places, an erosional scarp separates unit 3 from the older lake gravels.

Unit 3 in places is difficult to distinguish from pediment-and-terrace gravel 3 and on the map is not differentiated therefrom, for example, in the northeast corner of the Duncan quadrangle and west parts of the Canador Peak quadrangle. In the Canador Peak quadrangle it is differentiated only south of the Black Hills although it probably is much more widespread.

From its overall distribution in both quadrangles, lake gravel 3 is inferred to have been deposited during the higher levels of a lake that had a maximum width of about 10 miles and a maximum depth of a least 250 feet.

Lake gravel 3 bears a very strongly developed Pedocal, slightly less developed than the soil on the older lake gravels and similar to the soil on pediment-and-terrace gravel 3.

Stream-terrace gravels 1 and 2

Stream-terrace gravels 1 and 2 consist of unconsolidated cobble-and-pebble gravel and, locally, gravelly sand. The total thickness is 3–25 feet. Stream-terrace gravel 1 veneers a lower younger terrace along the Gila River than does stream-terrace gravel 2. Gravel 1 bears a moderately to locally strongly developed Pedocal and gravel 2 bears a strongly developed Pedocal.

ALLUVIAL DEPOSITS

The alluvial deposits consist of unconsolidated alluvial gravel, sand, and silt that underlie the youngest flood plains and stream beds and the lowermost stream terrace. The youngest flood-plain deposits are mapped along the Gila River.

Along all streams other than the Gila River these deposits range in thickness from 1 to rarely 20 feet. Boulder-to-pebble gravel in and near mountain areas grades basinward to pebble gravel, sand, and silt several miles from the mountains. Alluvial deposits on the western part of Lordsburg Mesa are mainly silt and locally clay. Wide flood plains along the lower parts of main washes, such as Rainville, Burro, and Railroad Washes and Hunter Flat, are underlain mainly by silt with local sand and gravel interbeds. Deposits on these wide portions are on a comparatively recent pediment which is developed on poorly consolidated sediments, mainly silt and clay, of the Gila Formation and which commonly extends some distance beyond the mapped limits of the alluvium.

The youngest non-Gila River alluvial deposits lack a weathering profile (soil) and are of Recent age; the older deposits bear a weakly developed Pedocal soil that probably is correlative with the soil of late Altithermal age (Antevs, 1948) that is widely recognized in the Western United States (Morrison, 1961).

The flood plain of the Gila River is mainly silt with some sand and local gravel stringers within a few feet of the surface; it is commonly more gravelly at depth. The present river bed is cobble gravel to sand. The thickness of alluvial deposits in the inner valley of the Gila River ranges from several feet locally near edges of the flood plain to about 75 feet in the wide flood-plain sectors to perhaps locally more than 100 feet in the gorge sectors. The youngest flood-plain deposits (Qay) are differentiated only along the Gila River; they represent that part of the Gila River flood plain which has been inundated by major floods in the last century.

EOLIAN SAND

The eolian sand is fine to medium, unconsolidated, commonly crossbedded; it locally contains stringers of pebbly sand and sandy gravel (slopewash), especially near the mountains and on the eastern part of Lordsburg Mesa. It is 3 to about 25 feet thick. The older deposits locally bear a weakly developed Pedocal soil; rarely they bear an older, moderately developed Pedocal. Dune morphology, generally somewhat subdued by erosion, is locally present.

PLAYA SEDIMENTS

The playa sediments consist of unconsolidated silt and clay, and local sand and gravel stringers, that underlie small playas in undrained or poorly drained depressions, mainly on Lordsburg and Pearson Mesas. Some of the depressions seem to be alined along small faults and some appear to be sinkholes in the caliche cap of these mesas. The playa sediments are 3 feet to locally more than 20 feet thick.

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