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CENOZOIC SEDIMENTARY ROCKS IN SOUTH-CENTRAL NEW MEXICO

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Cenozoic sedimentary rocks could be designated as those rocks everywhere underfoot, but rarely seen or seriously mentioned. They must be drilled through in any search for oil; in many places they are the reservoir for usable groundwater; and they are the source of significant amounts of industrial minerals and rocks.

Unless one attempts to split the Recent from the Cenozoic, there is no problem in designating the upper boundary; the sky is the limit. The Cretaceous-Cenozoic boundary does pose problems, chiefly because late Cretaceous and Cenozoic deposits are almost entirely terrestrial, invertebrate faunas are sparse,floras are poorly preserved and in part not diagnostic. Similarly, the Tertiary-Quaternary boundary is difficult to place, and perhaps in this area which has not been glaciated during the Pleistocene (excepting the highest parts of the Sierra Blanca) there is little significance in a Pliocene-Pleistocene boundary.

Cenozoic sedimentary rocks in south-central New Mexico, as far as they have been investigated, consist of three general groups: (1) conglomerates, red silts, and gypsum beneath Tertiary extrusive rocks or interlensing with andesitic to latitic volcanic rocks; (2) arkosic, pumiceous, and tuffaceous sandstones interbedded with rhyolitic volcanic rocks; (3) Santa Fe group, lumping sediments ranging in particle size from conglomerates to clays, and of Miocene to Pleistocene age. The relatively consolidated sediments are covered in many places by variable thicknesses of alluvium and are locally difficult to differentiate from their own debris. Thick measurable sections of the Cenozoic sediments crop out only on the edges and in the mountain ranges or where deeply dissected as along the Rio Grande Valley.

On the east side of the Tularosa Basin near Three Rivers, Robert F. Schmalz (personal communication) found several hundred feet of interbedded red silty conglomerates and massive light-gray sandstones, overlain with angular unconformity by Tertiary (?) andesite breccias. These Tertiary (?) sediments appear in places to grade down into the Mesaverde formation so may be Cretaceous in age.

Only a few deep wells have been drilled in the Tularosa Basin. An oil test drilled about six miles northwest of Tularosa went through about 780 feet of clay and sand before going into the Yeso formation. Several miles west of Alamogordo Meinzer and Hare (1915) reported over 1,000 feet of red clay penetrated by a railroad well without reaching hard consolidated rocks, and near Valmont a railroad well bottomed in 1,800 feet of clay and sand. To the south in the Hueco Basin test wells have encountered from 3,000 to 4,920 feet (Sayre and Livingston, 1945) of relatively unconsolidated sediments. The Tularosa-Hueco Basin appears to deepen southward, but there are small isolated fault blocks of Paleozoic rocks out in the basin so that the thicknesses of Cenozoic rocks may vary greatly within short distances.

Meinzer and Hare (1915) noted that the bolson deposits are predominantly calcareous, gypsiferous, reddish clay with lesser amounts of sandy and gravelly sand. The sediments were derived from adjoining bedrock outcrops; for example, near the Organ Mountains the bolson deposits contain a higher percentage of sand, derived from the granites and monzonites of the Organ intrusives. Sand and gravel is more abundant near the mountain ranges and near the present surface. The gypsum and quartz sands of White Sands National Monument lie principally east, windward, of the playa lakes along the lower western side of the Tularosa Basin. In this low alkali flat area, beneath White Sands, and eastward almost to Alamogordo, a large part of the near surface deposits is of stratified gypsum.

Near El Paso, where exposed in the 200-to 350-foot deep valley of the Rio Grande, the Cenozoic deposits are about evenly divided between reddish to brown clay and claystone and grayish to pinkish sand and sandstone. Pliocene and Pleistocene fossils have been found; the bulk of deposits are considered to be Pliocene or older and are referable to the Santa Fe group.

In the Organ Mountains, southern San Andres, and Robledo Mountains, basal Tertiary(?) beds are reddish silty conglomerates, similar to the pre-volcanic conglomerates near Three Rivers. The thickest section is in the southern San Andres Mountains near Love Ranch, where hundreds of feet of interbedded boulder conglomerates overlie Mancos strata. A similar thinner conglomerate overlies Hueco limestones

on the east side of the Organ Mountains and is unconformably overlain by latite to andesite tuffs and breccias. In the Robledo Mountains only a few thin lenses of conglomerate occur unconformable on Hueco limestones at the base of about 300 feet of interbedded silty red clay and gypsum; in the upper part of these deposits are lenses of latitic tuffs and breccias, and above them are more than 1,600 feet of latitic and andesitic volcanics.

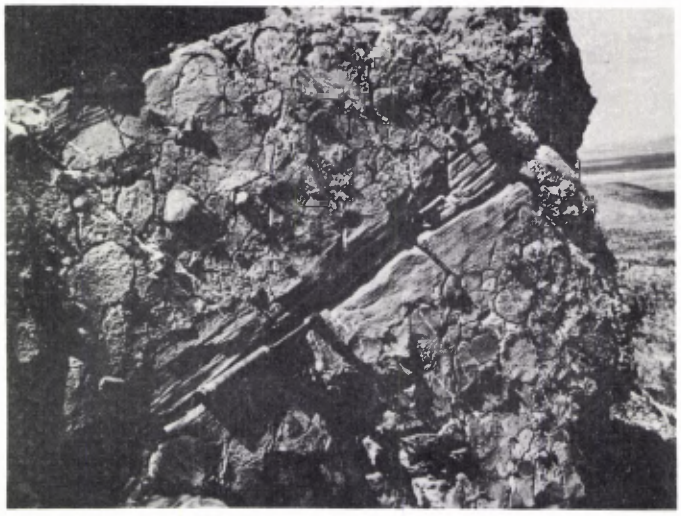


Figure 1. Love Ranch conglomerates.

On the southwest flank of the Caballo Mountains the basal Cenozoic beds are of the Palm Park formation (Kelley and Silver, 1952) which is about 900 feet thick (Kottlowski, 1953) and unconformably overlies Pennsylvanian strata. The lower one-third of the formation is of interbedded red siltstones and coarse conglomerates (Fig. 2), the middle one-third is of light blue-gray to purple porphyritic latite tuff, and the upper one-third is of pinkish tuffaceous sandstones and thin lenticular algal limestones. The Palm Park conglomerates contain cobbles and boulders of Precambrian and Paleozoic rocks as well as many fragments of andesitic lavas while the basal conglomerates in the San Andres, Organ, and Robledo Mountains contain no volcanic fragments. The Palm Park conglomerates, therefore, are probably younger, in part at least, and were derived from the latite and andesite volcanics that overlie the Love Ranch beds.

Sandstones, conglomerates, and upper reddish shales in the Iron Mountains district of Sierra Cuchillo are considered to be of Upper Cretaceous age by Jahns (1944); they unconformably overlie San Andres limestones and are unconformably overlain by Tertiary andesitic volcanics.



Figure 2. Basal Palm Park beds near Caballo Mountains.

On the southwestern flank of the Caballo Mountains, the Thurman formation conformably overlies the Palm Park strata and consists of a basal rhyolite tuff-breccia overlain by as much as several thousand feet of light-gray sandy clays, tuffs, and tuffaceous sandstones. The Thurman formation is a northward lens of and was derived from the Bell Top formation. The Bell Top formation is a thick rhyolitic volcanic series that makes up most of Sierra de las Uvas, where it consists of pumice, rhyolite tuffs, vitrophyre flows, and banded rhyolite flows and domes interbedded with light-colored pumiceous and tuffaceous sandstones.

In the Black Range, Lake Valley, and Animas Hills, lenticular sequences of water-laid tuff, arkosic tuffaceous sandstones, and shales occur below and above a thin to thick rhyolite tuff series (Kuellmer, 1954; Jicha, 1954); the sedimentary and volcanic rocks are probably correlative with the Bell Top and Thurman formations. Near Hillsboro the upper water-laid tuffs contain a Miocene-Pliocene flora.

In Sierra de las Uvas the Bell Top formation is overlain by the Uvas basaltic andesite; southwest of the Caballo Mountains a similar basaltic flow occurs in the upper part of the Thurman formation, and in the Animas Hills a sequence of basaltic andesite and latite overlies the flora-bearing tuffaceous sediments.

Santa Fe beds form the bulk of the Cenozoic deposits along the Rio Grande Valley and the southern part of the Jornada del Muerto where they overlie older Cenozoic sedimentary and volcanic rocks unconformably. In many places the Santa Fe group consists of lower pebbly and conglomeratic sandstone with an interbedded basalt flow (Fig. 3); a medial (thickest) varicolored sequence chiefly of sandstone,



Figure 3. Basalt flow in lower Santa Fe beds near Radium Springs.

but with reddish clays, siltstones, and tuffaceous sandstones (Fig. 4); an upper sequence of bolson and valley fill sediments, poorly consolidated, ranging from conglomerates or gravels to clays. Kelley and Silver (1952) reported 1,165 feet of Santa Fe strata above the Thurman formation near Palomas in a water well in the Rio Grande Valley area. North of Truth or Consequences an oil test (Gartland No. 1 Garner Federal) was still in Santa Fe beds (?) at a depth of 6,524 feet. South of Hatch Santa Fe strata are at least 1,990 feet thick, near Las Cruces more than 1,025 feet thick, and beneath La Mesa northwest of El Paso more than 1,300 feet thick.



Figure 4. Santa Fe outcrops near Hatch.

The Jornada del Muerto contrasts strikingly with the Tularosa Basin. Broad pediments, mantled by gravels, are cut across bedrock on both sides of the Jornada Valley in the latitude of Engle, and even in the central bajada the relatively unconsolidated bolson deposits are only 200 to 450 feet thick, as compared with the thicknesses of 800 to 4,900 feet in the Tularosa-Hueco Basin. At the south end of the Caballo Mountains, near Rincon, the bolson deposits are typical Santa Fe beds, but much of the Cenozoic fill to the north is probably relatively recent sands, silts, and gravels, the central basinal equivalents of the marginal pediment gravels.

Along the north and east edges of the Caballo Mountains, and as bedrock in the Engle to Upham part of the Jornada Valley, is the McRae formation. The lower part of the formation consists of volcanic conglomerates and interbedded siltstones and shales, with local lenses of andesitic breccias, tuffs, and vent agglomerates which transitionally to unconformably overlie the Mesaverde formation. Vertebrate and plant fossils indicate an Upper Cretaceous age for this part of the McRae formation. The upper and thicker part of the McRae is interbedded purplish shales and grayish-green to pink sandstones containing much volcanic and arkosic debris and may be of Tertiary age (Kelley and Silver, 1952). The McRae and Palm Park formations have not been found in contact but they are dissimilar in lithology, consolidation, and position, and the McRae is considered to be the older (Kelley and Silver, 1952).

At the northern tip of the Jornada, in the Carthage area, Wilpolt and Wanek (1951) reported four Cenozoic units. The basal unit is the Baca formation which truncates folded Mesozoic and Paleozoic rocks and consists of conglomerates, red and white arkosic sandstones and red clay. Cobbles and boulders are of Precambrian and Upper Paleozoic rocks—no volcanic material is listed. Vertebrate fossils found near the base of the formation indicate a probable Eocene age. The Baca formation is about 1,025 feet thick near Carthage where it is unconformably overlain by a series of volcanic flows and pyroclastics and interbedded volcanic sediments, of purple, red, and gray colors, referred to the Datil formation. The Datil formation is about 2,000 feet thick near Carthage and may be roughly correlative to the several volcanic series in the Black Range, Sierra Cuchillo, Sierra de las Uvas, Dona Ana and Organ Mountains, as well as the Palm Park, Bell Top, and Thurman formations.

Truncating the Datil formation are rocks referred to the Santa Fe group, South of San Antonio two wildcat tests drilled on the edge of the Rio Grande Valley penetrated at least 2,000 feet of Santa Fe bers and alluvium. The beds are chiefly calcareous, arkosic, pinkish pebbly sandstone with minor amounts of conglomerate and siltstone. Terrace gravels, pedi-

ment gravels, and bolson deposits truncate and conceal the Santa Fe strata in many places at the northwest end of the Jornada. Wells in this area penetrated about 400 feet of Santa Fe strata and up to 500 feet of Datil volcanic rocks.

East of Sierra Cuchillo, Jahns (personal communication) has found the Palomas gravels (Harley, 1934) intertonguing with upper Santa Fe strata. Near the mountains the Palomas gravels consist of an upper purplish-gray, coarse conglomerate with numerous volcanic pebbles and cobbles, and of lower sandstones, tuffaceous sandstones, tuffs, and tuff-breccias resting on flows of fine-grained basaltic andesite. The upper conglomerates have yielded early Pleistocene vertebrates; the basal basaltic andesites are probably correlative with the basaltic andesites that overlie the flora-bearing Miocene-Pliocene lake sediments near Hillsboro and the Uvas basaltic andesite. The Palomas gravels are truncated by the widespread Cuchillo surface, which probably was coextensive with the Palomas, Jornada, and La Mesa (southern extension of Jornada surface southwest of Las Cruces) surfaces.

Between Sierra Cuchillo and the Black Range, Jahns (personal communication) reports a valley fill deposit which he has referred to in mapping as the "Winston beds," a thick sequence of interbedded conglomerates, sandstones, and siltstones which have been traced southward into the type section of the Palomas gravels. The Winston beds are underlain by fine-grained vesicular basaltic andesite, which overlies rhyolite tuffs. Early Pleistocene vertebrate fossils and fresh water mollusks have been collected from the upper part of the Winston beds by Jahns. These beds are truncated by an erosion surface believed correlative with the Cuchillo surface. These erosional surfaces, which are protected in places by basalt flows, and which may be coextensive with thin to thick aggradational stream deposits left by the streams that cut the surfaces, are post early Pleistocene in age and are probably coincident with the Ortiz surface (Bryan, 1938) in the Santa Fe area.

These high surfaces, the Ortiz, Cuchillo, Palomas, Jornada, and La Mesa, have been dissected along the Rio Grande where lower limited surfaces and terraces record more recent periods of downcutting by the Rio Grande and its tributaries.

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