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KEY OIL TESTS AND STRATIGRAPHIC SECTIONS IN SOUTHWEST NEW MEXICO

by

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ABSTRACT

Significantly thick stratigraphic sections of possibly petroliferous Paleozoic and Mesozoic strata are exposed in 15 mountain ranges and have been drilled in several wildcat oil tests in Hidalgo, Grant, Luna, and western Doña Ana Counties of southwest New Mexico. The deepest well, the Humble No. 1 State BA, was drilled to a total depth of 14,585 feet, and penetrated part of the Mesozoic and most of the Paleozoic formations. Pre-Tertiary Phanerozoic strata include thick Early Cretaceous units; the Permian Concha Limestone, Scherrer Formation, Epitaph Dolomite, Colina Limestone, Earp Formation, and Hueco Limestone; the Pennsylvanian-Permian Horquilla Limestone; the Mississippian Paradise-Helms formations, the Mississippian Escabrosa-Lake Valley limestones; the Devonian Percha Shale; the Ordovician Montoya and El Paso formations; and the Cambrian-Ordovician Bliss Sandstone.

Reservoir beds and possible petroleum traps include Ordovician, Pennsylvanian, and Cretaceous sandstone wedges; Ordovician, Pennsylvanian, Permian, and Cretaceous bioherms and biogenic banks; Ordovician, Silurian, Mississippian, Pennsylvanian, and Permian carbonate solution porosity, and northeast- to northwest-trending anticlines and faults.

RESUMEN

Las gruesas secciones estratigráficas Paleozoicas y Mesozoicas, posiblemente petrolíferas, están expuestas en 15 cadenas montañosas y han sido perforadas en varios pozos de exploración en los candados de Hidalgo, Grant, Luna, y Doña Ana occidental, del suroeste de Nuevo México. El pozo más profundo, Humble No. 1 State BA, perforado a una profundidad total de 14,585 pies, penetra parte de las formaciones del Mesozoico y la mayor parte de las paleozoicas. Los estratos fanerozoicos pre-Terciarios, incluyen gruesas unidades del Cretácico temprano: la Caliza Concha Pérmica, la Formación Scherrer, la Dolomita Epitaph, la Caliza Colina, la Formación Earp y la Caliza Hueco; la Caliza del Pensilvánico-Pérmico Horquilla; las formaciones Misisípicas Paradise-Helms, las Calizas Misisípicas Escabrosa-Lake Valley; l lutita Devónica Percha, las formaciones Ordovícias Montoya y El Paso, y la arenisca Cámbrica Ordovícica Bliss.

Las capas almacenadoras y las posibles trampas de aceite incluyen cuñas de arenisca del Ordovícico, Pensilvánico y Cretácico; biohermas y bancos biogérmicos del Ordovícico, Pensilvánico, Pérmico y Cretácico, y carbonatos de porosidad por solución en la roca del Ordovícico, Silúrico, Misisípico, Pensilvánico y Pérmico, así como anticlinales orientados del noreste al noroeste y fallas.

INTRODUCTION

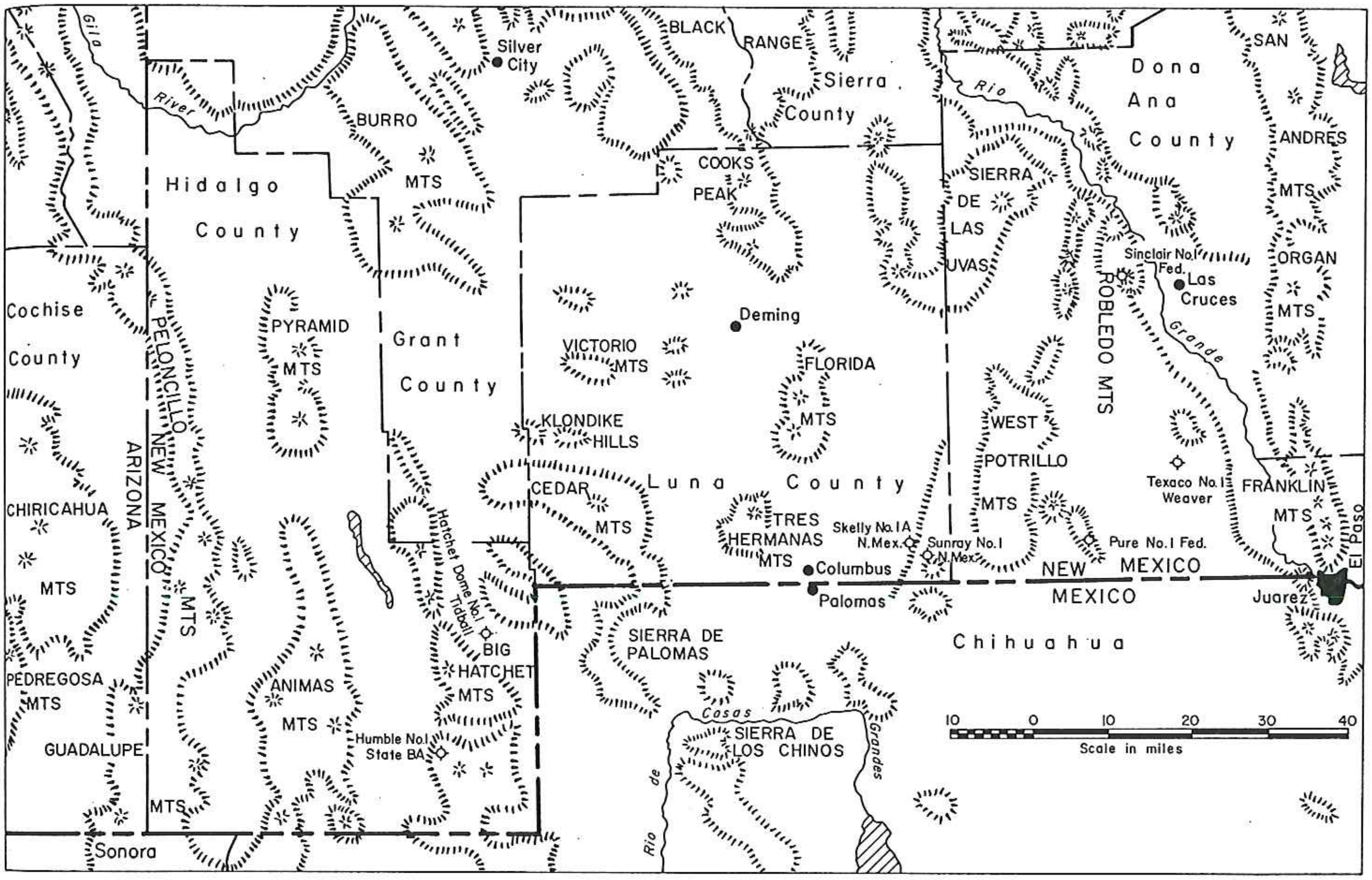
Significantly thick stratigraphic sections of pre-Tertiary Phanerozoic strata are exposed in the Big Hatchet and Peloncillo Mountains of Hidalgo County, in the Cedar, Florida, Tres Hermanas, and Victorio Mountains, Klondike Hills, and near Cooks Peak in Luna County, near Silver City in Grant County, in the East Potrillo, Robledo, and Franklin Mountains vicinity of Doña Ana County, and in the Chiricahua and Pedregosa Mountains of adjacent Cochise County, Arizona (Fig. 1). The thick section in Sierra de Palomas in northern Chihuahua is somewhat similar to that in the Big Hatchet Mountains.

The most important oil tests include the Humble No. 1 State BA, Hatchet Dome No. 1 Tidball-Berry Federal, Skelly No. 1 A New Mexico "C", Sunray Mid-Continent No. 1 New Mexico-Federal "R", Sinclair No. 1 Federal-Dona Ana, Texaco No. 1 Weaver-Federal, and Pure No. 1 Federal "H".

A part of the Mexican highlands section of the Basin and Range physiographic province, this region is structurally in the Sonoran-Chihuahuan part of the Basin and Range system and is the locale of intersection of the north-trending Cordilleran Mountain system and the older west- to northwest-trending Ouachitan-Sonoran tectogenic system.

The petroleum potential is concentrated in the southern extension of the Late Paleozoic Orogrande basin in Dona Ana County-Southeastern Luna County and southward, and in the Paleozoic and Mesozoic Pedregosa basin area of southern Hidalgo and southeast Cochise Counties and northern Chihuahua. Shoreline and nearshore sandstone lenses, algal reef mounds, and shelf-edge biogenic carbonate banks of Pennsylvanian and early Permian age, associated with nearby black organic-rich basinal facies, are prime petroleum targets in these late Paleozoic basin areas, as are the porous middle Permian dolomites.

The thick Lower Cretaceous sequence in southern Hidalgo and southeast Cochise Counties, as well as northwest Chihuahua, contains sandstone wedges, rudistid and coralline reefs, and biogenic banks as possible reservoirs. Porous



Ordovician and Silurian dolomites, especially where overlain unconformably by black argillaceous Devonian strata are possible stratigraphic trap reservoirs, as are the locally porous, biohermal, crinoidal-hash limestones of the Mississippian.

The traps in which one may expect to find commercial oil and gas are northeast and northwest to north-trending anticlines, northwest-trending faults, biohermal and barrier carbonate-rock reefs, wedging sandstone and dolomite trends, and wedging solution porosity in carbonate rocks genetically related to disconformities.

This region presents to the exploratory geologist two major difficulties: (1) results of overly active multiple tectonism, especially on the north, west, and southwest; and (2) valley fill and volcanic rock in some areas. All of the stratigraphic data and some structural data must be derived from the exposed cores of mountains, and from the relatively few oil tests between 2000 and 14,000 feet in depth which have penetrated the Mesozoic and Paleozoic strata. The problem of the search for oil and gas may be resolved by: (1) avoiding the most complicated areas; (2) assuming that the valley-intermontane areas mask structure simpler than that found in the mountains, and rationalize that the broad sand-gravel alluvial plains cover structures that become less complex eastward, as is true in the mountains; and (3) make full use of the very highest type of geologic imagination coupled with full cooperation of the exploration geologist and geophysicist.

BIG HATCHET MOUNTAINS AREA

The stratigraphy of the Big Hatchet Mountains has been described in great detail by Zeller (1965). Pre-Pennsylvanian beds total about 3490 feet, the Pennsylvanian and Permian sequence is about 7850 feet thick, and the Early Cretaceous strata total about 9975 feet in thickness; therefore, pre-Tertiary sedimentary section of more than 21,000 feet is available for testing in the general vicinity of the Big Hatchet Mountains.

The basal Paleozoic unit, the Late Cambrian-Early Ordovician Bliss Sandstone, ranges in thickness from 190 to 330 feet. Basal beds include arkose and boulder conglomerate whereas upper beds, which grade into the overlying El Paso Formation, include dolomitic sandstone. The Early Ordovician El Paso is 915 to 1070 feet thick, comprised of lower cherty dolomite and dolomitic limestone and an upper bioclastic limestone, whose uppermost beds are dolomitized. The Middle and Late Ordovician Montoya Dolomite disconformably overlies the El Paso carbonate sequence, is about 385 feet thick, and consists of the basal Cable Canyon dolomitic sandstone, dark-gray massive Upham dolomite, cherty Aleman dolomite, and upper Cutter dolomite.

The Silurian Fusselman Dolomite is absent, owing to its removal by erosion during late Silurian and early Devonian time. The Late Devonian Percha Shale, with several nodular limestone lentils in the upper part, is 280 feet thick. The Early and Middle Mississippian Escabrosa Limestone is about 1260 feet thick. The lower part is thin-bedded limestone with some shale interbeds, the middle unit is thin-bedded cherty limestone, and the upper part of the Escabrosa is biohermal crinoidal limestone. The overlying late Mississippian Paradise Formation is about 315 feet thick, and consists of thin-bedded yellowish-brown-weathering biogenic and oolitic limestone interbedded with shale and some sandstone lenses near the top.

Pennsylvanian strata make up the lower two-thirds of the Horquilla Limestone, and total about 2400 feet in thickness. The lower half is of biogenic oolitic and crinoidal limestone, with some cherty beds. The upper half of the Pennsylvanian and the lower part of the Wolfcampian strata, which compose the upper third of the Horquilla Limestone, consist of three facies: on the north-northeast, a shelf facies of light-gray biogenic limestone; a medial reef facies of massive biogenic partly dolomitized limestone; and a southern basinal facies of dark-gray shale and black thin-bedded limestone. The Wolfcampian part of the Horquilla Limestone is about 1200 feet thick.

Permian units overlying the Horquilla are the Earp Formation, about 1000 feet of interbedded siltstone and claystone with some red beds; the Colina Limestone, 350 to 500 feet thick, consisting of black limestone; the Epitaph Dolomite, about 1500 feet thick, locally containing gypsum interbeds; the Scherrer Formation, 5 to 20 feet of interbedded sandstone and limestone; and the Concha Limestone, 1375 feet thick, containing many chert nodules and silicified brachiopods.

Early Cretaceous strata lie disconformably on the underlying Permian rocks. The basal unit, the Hell-to-Finish Formation, comprises about 1275 feet of red arkose, sandstone, siltstone, and shale. The overlying U-Bar Formation is 3500 feet thick and is biogenic petroliferous limestone alternating with thin gray shale and a few lenses of sandstone. Upper massive limestones are interpreted as rudistid-stromatoporoid reefs (Zeller, 1965), similar to those exposed in the Sierra del Presidio of northern Chihuahua. At the top of the Cretaceous is the Mojado Formation, about 5200 feet thick, consisting of interbedded sandstone and shale, with some fossiliferous marine beds in the upper part. Overlying Tertiary units, angularly unconformable on the Cretaceous, consist of limestone fanglomerate beneath thick sequences of volcanic rocks.

PELONCILLO MOUNTAINS

In the central Peloncillo Mountains, about 50 miles northwest of the Big Hatchet Mountains, Gillerman's (1958) measured sections include: Bliss-Bolsa Sandstone 60-400 feet, El Paso Limestone 550 feet, Montoya Dolomite 0-100 feet, Percha Shale 235 feet, Escabrosa Limestone 460 feet, Paradise Formation 215 feet, Horquilla Limestone about 1900 feet, Earp Formation 830 feet, Colina Limestone 500 feet, Scherrer Formation 0-50 feet, and Concha Limestone 800 feet. The overlying Early Cretaceous strata are about 2400 feet thick, and consist of a threefold sequence similar to that in the Big Hatchet Mountains, except the medial limestone unit is much thinner, limestone conglomerates are prominent, and volcanic rocks are interbedded near the middle of the sequence.

Compared with the Big Hatchet section, the El Paso Limestone, Escabrosa Limestone, Paradise Formation, Horquilla Limestone, Concha Limestone, and Cretaceous strata are thinner in the Peloncillo Mountains, and the Epitaph Dolomite is absent. The Montoya is thinner and in places absent beneath the erosional surface developed during late Silurian and early Devonian time. Absence of the Epitaph Dolomite suggests nondeposition or removal by erosion during middle Permian time before deposition of the Scherrer-Concha units.

CHIRICAHUA AND PEDREGOSA MOUNTAINS

To the west in southeast Cochise County, Arizona, thick Phanerozoic rocks crop out in the Chiricahua and Pedregosa Mountains, 15 to 25 miles west of the Peloncillo Mountains. Middle and Early(?) Cambrian beds are present here below and intertongue with the basal beds of the Late Cambrian Bliss Sandstone. These Cambrian units comprise the Bolsa Quartzite and the overlying Abrigo Limestone, which are 400 to 600 feet thick. The El Paso Limestone, beneath an erosion surface and 340 to 675 feet thick, is overlain in most places by dark Devonian shale and nodular limestone, but locally, remnants of the Montoya Dolomite occur between the El Paso and the erosion surface at the base of Late Devonian strata. The Devonian beds are 320 to 400 feet thick. The Escabrosa Limestone thickens southward from 630 feet in the northeastern Chiricahuas to 1200 feet in the Pedregosa Mountains. The Paradise Formation thickens from 150 feet to 290 feet southwestward by an increase in the number of marine limestone lentils.

Pennsylvanian strata show the same southward thickening and similar facies changes from the northeast Chiricahuas to the Pedregosas as occurs in New Mexico from the Peloncillos to the Big Hatchet Mountains, a range from about 1900 feet to 2400 feet. Permian units are anomalous: the Earp Formation thins abruptly southward, the Colina Limestone thins abruptly northward, and the Epitaph Dolomite is absent to the north in the Chiricahua Mountains but is 1350 feet thick in the Pedregosa Mountains. Total Permian thickness is 3450 to 3800 feet. Early Cretaceous beds thicken southward from 4000 feet to 8000 feet and contain the units of the Bisbee Group, as well as volcanic detritus (Sabins, 1957) and rudistid-oyster-coral biostromes (Epis, 1956).

VICTORIO MOUNTAINS, CEDAR MOUNTAINS, AND KLONDIKE HILLS

Only partial or remnant sections of Phanerozoic rock crop out in southwestern Luna County. In the volcanic Cedar Mountains, Griswold (1961) mapped a small exposure of upper Escabrosa Limestone, overlain by a thin sequence of lower Pennsylvanian strata, which in turn is overlain unconformably by several hundred feet of Early Cretaceous clastic beds. A sequence from the Bliss Sandstone to the lower Pennsylvanian crops out five miles to the north in the Klondike Hills. The Bliss Sandstone and El Paso Limestone are relatively thin, and the Fusselman Dolomite thickness (at least 200 feet) is unknown owing to faulting. The Escabrosa Limestone is 800 feet thick (Armstrong, 1962) and the Paradise Formation only 85 feet thick; both appear to thin depositionally from the thicker sections to the southwest.

The upper El Paso Limestone, Montoya Dolomite, and Fusselman Dolomite crop out in the Victorio Mountains (Kottlowski, 1963). A maximum of 340 feet of Montoya Dolomite is present, along with at least 900 feet of the Fusselman Dolomite. Unconformably on the Fusselman and the Montoya are Early Cretaceous clastic beds, 600 to 800 feet thick, consisting of interbedded conglomerate, siltstone, sandstone, fossiliferous limestone, and andesite lenses. Detrital clasts are of quartz, chert, silicified limestone, limestone, and dolomite.

This Victorio Mountains section is near the south edge of the Mesozoic Burro uplift, from which Paleozoic rocks were stripped by erosion during Triassic, Jurassic, and early Cretaceous time. In the Victorio Mountains, the erosion surface truncates at least 1000 feet of section in two miles in a southward direction.

FLORIDA AND TRES HERMANAS MOUNTAINS

Only partial and remnant sections of Paleozoic rocks crop out in southeast Luna County. In the Florida Mountains, the Lobo Formation, an unfossiliferous Cretaceous or early Tertiary red-bed unit, lies unconformably on Precambrian through Permian rocks. Formation thicknesses are: Bliss Sandstone 50 to 185 feet, El Paso Limestone 1025 feet, Montoya Dolomite 400 feet, Silurian Fusselman Dolomite about 1400 feet, Percha Shale 235 feet, middle Mississippian Rancheria Limestone 200 feet, and Wolfcampian Hueco Formation more than 350 feet. This is the thickest Fusselman Dolomite section known, but the exact thickness is uncertain due to thrust faulting. Thin Mississippian dark cherty limestone of the Rancheria facies also occurs to the east in the Franklin Mountains, and contrasts greatly with the Escabrosa Limestone of southwest New Mexico.

Pennsylvanian strata are absent in the Florida Mountains inasmuch as the area was near the Florida "Islands" positive area during Pennsylvanian and early Permian time. The Wolfcampian Hueco Formation, itself thinned by erosion prior to deposition of the Lobo Formation sediments, is erosionally unconformable on the Mississippian limestones. Basal beds are calcarenite, limestone-chert conglomerate, shale, and fossilifeous sandstone, but most of the remnant Hueco is typical dark-gray fossiliferous limestone.

The faulted remnant section in the Tres Hermanas Mountains (Kottlowski and Foster, 1962) exposes part of the Fusselman Dolomite, about 400 feet of marbleized and silicified upper Escabrosa Limestone and a thin remnant Paradise Formation, 560 feet of Pennsylvanian strata, and 525 feet of Wolfcampian Hueco Formation eroded at the top. Fossiliferous calcarenite is typical of the Pennsylvanian sequence; a few thin shale beds and a thick lense of fine-grained silty sandstone are interbeds. The lower 170 feet of the Hueco Formation includes much chert-limestone pebble-cobble conglomerate interbedded with siliceous calcilutites. The upper part of the Hueco is dark-gray limestone, oolitic in part, containing many gastropods and much crinoidal debris.

In the western foothills of the Tres Hermanas Mountains, Early Cretaceous strata are more than 1530 feet thick, consisting of thick alternating units of clastic beds and of massive limestone. Chert conglomerate, limestone conglomerate, arkose, sandstone, and siltstone comprise the clastic units.

In the southeastern corner of Luna County, amid the sand dunes and basalt flows west of the West Potrillo Mountains, several small outcrops of Phanerozoic rocks occur near the Skelly No. 1-A New Mexico "C" and Sunray Midcontinent New Mexico No. 1 Federal "R" oil tests. Unfossiliferous, fractured dolomitic limestone on Coyote Hill, NW-¼ Sec. 5, T. 29 S., R. 5 W., appears to be of Silurian Fusselman Dolomite, but may be Hueco limestone. The unnamed hill two miles to the east in N-½ Sec. 3, is of fossiliferous Hueco Limestone overlain by clastic Cretaceous strata. About seven miles to the north at Eagle Nest, in and near Secs. 27, 28, and 33 to 35, T. 27 S., R. 5 W, Early Cretaceous biohermal limestone, thin-bedded sandstone, and thick conglomeratic strata crop out.

COOKS PEAK

The sequence in northern Luna County on and near Cooks Peak (Jicha, 1954; Elston 1957) consists of: Bliss Sandstone 95 feet, El Paso Limestone 830 feet, Montoya Dolomite 320 feet, Fusselman Dolomite 275 feet, Percha Shale 185 feet, Mississippian Lake Valley Limestone 390 feet, Pennsylvanian strata 40 to 200 feet, Abo Redbeds 150 feet, Early Cretaceous Sarten Sandstone 300 feet, and Late Cretaceous Colorado Shale 300 feet.

The Pennsylvanian sequence thins southwestward from Cooks Peak toward the Florida Islands area, and consists of shoreline-lagoonal deposits, which are limestone-chert conglomerate, black laminated calcilutite, and fossiliferous calcarenite. The Wolfcampian Abo red beds are the northward terrestrial equivalent of the marine Hueco Formation. The Sarten Sandstone is the northern shoreward facies of Early Cretaceous strata.

EAST POTRILLO MOUNTAINS

In southwest Doña Ana County, about 1750 feet of Early Cretaceous strata crop out in the East Potrillo Mountains. This sequence is similar to the one in the Tres Hermanas Mountains, consisting of alternating thick units of clastic beds and of massive fossiliferous limestones. However, most of the conglomerate contains only limestone clasts, detrital chert is relatively rare, and most of the sandstone is highly calcareous.

ROBLEDO MOUNTAINS

In central Doña Ana County, outcrops in the Robledo Mountains consist of upper beds of the El Paso Limestone, 335 feet of Montoya Dolomite, 250 feet of Fusselman Dolomite, 130 feet of Percha Shale, 110 feet of lower Mississippian beds, 670 feet of Pennsylvanian strata, and 1900 feet of intertongued Hueco and Abo beds, unconformably overlain by Tertiary clastic and volcanic rocks. A thin Pennsylvanian section of shelf limestones was deposited between the Florida Islands to the west and Orogrande basin to the east. Among the intertongued Abo-Hueco shoreline strata are small algal bioherms.

FRANKLIN MOUNTAINS

In westernmost Texas and extending northward into southeast Doña Ana County, the Franklin Mountains superbly expose a thick pre-Tertiary section as follows: Bliss Sandstone 250 feet; El Paso Limestone 1360 feet; Montoya Dolomite 420 feet; Fusselman Dolomite 610 to 850 feet, which thins northward; Devonian strata 115 feet; middle Mississippian Rancheria Formation 315 feet and Late Mississippian Helms Formation 100 feet; Pennsylvanian strata 2700 feet; and Wolfcampian Hueco Formation 2200 feet.

In the southwest foothills of the Franklin Mountains and to the southwest on Cerro de Muleros (El Cristo Rey), which straddles the New Mexico-Mexico boundary just west of the Rio Grande, Early Cretaceous strata are more than 1165 feet thick consisting of marl, dark-gray shale, and quartzose sandstone. Older Early Cretaceous rocks occur to the south in the Juarez Mountains (See article by Diego Cordoba, this guidebook). The Late Cretaceous strata near El Paso are more than 950 feet thick, consisting of the basal Woodbine-like sandstone and overlying Eagle Ford Formation, with limestone lentils of Greenhorn age.

FORMATIONS, RESERVOIRS, AND TRAPS

The formations embracing potentially productive reservoir beds in southwestern New Mexico are listed in Table 1, from youngest to oldest (faults may have created combination traps with any of the listed types of traps).

WILDCAT TESTS

In Doña Ana, Luna, Grant, and Hidalgo Counties, only 18 oil tests have been drilled below 2000 feet, and of these only six have penetrated notable sections of pre-Tertiary strata. Wildcat tests in these four counties are listed in Table 2, and descriptions of the rocks encountered in seven of the most important tests are as follows:

PURE NO. 1 FEDERAL "H"
1060 N, 2297 E, SEC. 24, T. 28 S., R. 2 W.
DOÑA ANA COUNTY

The Pure test was located in the East Potrillo Mountains where rocks at the surface are of Early Cretaceous age. Drilling penetrated what appears to be a normal sequence to a depth of 4200 feet. Gouge-like material was encountered at this depth and drilling continued in similar material to the total depth of 7346 feet. Below 6960 feet some

TABLE 1.

SYSTEM	FORMATION	GENERAL LITHOLOGY	INFERRED POROSITY	POSSIBLE TYPES OF TRAPS
Cretaceous	U-Bar and similar limestones	limestone	vuggy	bioherm, anticline
Permian	Concha	limestone	intercrystalline, solution	anticline, facies gradation
Permian	Epitaph	dolomite	intercrystalline, solution	anticline, facies gradation
Permian	Colina	limestone	intercrystalline, solution	anticline
Permian	Hueco/upper Horquilla	limestone	vuggy	bioherm, anticline
Pennsylvanian	lower Horquilla	limestone, dolomite, oolitic limestone	vuggy, interoolite,	bioherm, anticline, facies gradation
Mississippian	Paradise/ Helms	oolitic limestone	interoolite, solution	anticline, facies gradation
Mississippian	Escabrosa/ Lake Valley	limestone	intercrystalline, solution	anticline
Silurian	Fusselman	dolomite	intercrystalline, solution	anticline (only in eastern area)
Ordovician	Montoya	dolomite, sandstone	intercrystalline, solution	anticline
Ordovician	El Paso	limestone, dolomite	intercrystalline, solution	anticline, bioherm

TABLE 2. SOUTHWESTERN NEW MEXICO OIL TESTS

WELL	LOCATION	COMP.	ELEV.	T.D.	REMARKS
		Doña Ana County			
Sinclair No. 1 Federal Dona Ana	660 N, 660 W, Sec. 27 T. 22 S., R. 1 W.	1962	4684	6510	See discussion
Armstrong No. 1 Baker	1980 S, 900 W, Sec. 4 T. 23 S., R. 1 E.	1940		60	
Clary & Ruther No. 1 State	106 N, 41 W, Sec. 36, T. 23 S., R. 2 E.	1949		2585	Located near Permian outcrops, top Mississippian reported at 2475′
Picacho No. 1 Armstrong	660 N, 1980 E, Sec. 15 T. 23 S., R. 1 W.	1941	3600 ?	3196	Top Tertiary volcanics at 66′. Top Hueco at 1852′
Boles No. 1 Federal	660 S, 660 E, Sec. 7, T. 24 S., R. 1 E.	1963	4943	5180	
Texaco No. 1 Weaver	660 S, 660 W, Sec. 35, T. 26 S., R. 1 E.	1966	4164	6620	See discussion
Pure No. 1 Fed. "H"	1060 N, 2297 E, Sec. 24 T. 28 S., R. 2 W.	1962		7346	See discussion
		Luna County			
Angelus No. 3 Angelus	1980 S, 1980 E, Sec. 20 T. 21 S., R. 10 W.	1931		6171	Tertiary volcanics and sediments in lowest samples (6070′)
Berry No. 1 Berry	200 S, 2370 W, Sec. 33, T. 22 S., R. 10 W.	1940		1075	
Berry No. 2 Berry	200 S, 2310 W, Sec. 33, T. 22 S., R. 10 W.	1940		1187	
Florida No. 1 State	SWSW, Sec. 14, T. 23 S., R. 10 W.	1921		2315	
Florida No. 3 Bickford	NESE, Sec. 15, T. 23 S., R. 10 W.	1923		2860	Probably Tertiary sediments and volcanics at T.D.*
Angelus No. 4	Sec. 26, T. 23 S., R. 11 W.	1926 ?		80	
Permian No. 1 State	660 S, 660 E,, Sec. 4, T. 25 S., R. 6 W.	1949		4011	Tertiary volcanics in lowest samples (3815′)
Angelus No. 1	SW, Sec. 8, T. 25 S., R. 6 W.	1919 ?		3450	
Angelus No. 2	NESE, Sec. 8, T. 26 S., R. 8 W.	?		3365	Quaternary-Tertiary sediments at T.D.*
Skelly No. 1 New Mexico C	660 S, 1980 E, Sec. 19, T. 28 S., R. 5 W.	1963		670	
Skelly No. 1A New Mexico C	560 S, 1980 E, Sec. 19, T. 28 S., R. 5 W.	1964	4010	9437	See discussion
Sunray Mid-Continent No. 1 New Mexico Fed. R	1980 N, 1980 W, Sec. 27 T. 28 S., R. 5 W.	1962	4096	6616	See discussion
Valley No. 1 Price	Sec. 16, T. 29 S., R. 17 W.	1920		2385	May have been located in R. 7 W.
		Grant County			
Clayton No. 1 Gordon	340 N, 1660 E, Sec. 33, T. 14 S., R. 18 W.	1944		1900	
Colgrove No. 1 State	SESE, Sec. 3, T. 20 S., R. 11 W.	1947	5200	1890	Tertiary volcanics surface to T.D.
Murphy No. 1 Schmitz	1980 S, 660 W, Sec. 31, T. 20 S., R. 11 W.	1951	4920	1607	Tertiary conglomerates at T.D.
Seyfried No. 1 State	NW, Sec. 8, T. 27 S., R. 15 W.	1947		1070	Quaternary-Tertiary sediments to T.D.
Winniger No. 1 Berry-State	1600 S, 850 E, Sec. 16 T. 27 S., R. 16 W.	1943		1490	Reported in El Paso Ls. at T.D. Outcrops of Lower Cretaceous nearby. Probably Lower Cretaceous at T.D.

TABLE 2 (continued)

WELL	LOCATION	COMP.	ELEV.	T.D.	REMARKS
		Hidalgo County			
Black No. 1	SWNE, Sec. 19, T. 21 S., R. 18 W.	1926		730	
Austin-Black No. 2	NE, Sec. 5, T. 22 S., R. 19 W.	1926		100	
Beulah No. 1	SW, Sec. 14, T. 22 S., R. 20 W.	1929		660	
Long & Beck No. 1 State	2310 S, 1650 E, Sec. 14 T. 22 S., R. 20 W. (?)	1944	4250	1495	Tertiary volcanics at 930′ (lowest samples)
Long & Gossum No. 1 State	2310 N, 1650 E, Sec. 14, T. 22 S., R. 20 W. (?)	1949		940	May be same as Long & Beck well
Owens No. 1 State	SESE, Sec. 14, T. 22 S., R. 20 W.	1926		1800	Valley fill or volcanics at T.D.
Rubens No. 1 New Mexico State	656 S, 656 W, Sec. 2 T. 27 S., R. 16 W.	1954		1400	
Rubens No. 1 State	1650 S, 990 W, Sec. 12, T. 27 S., R. 18 W.	1950	4365	1085	
Rowland No. 1 Leggett-Palma	1980 N, 660 E, Sec. 16, T. 27 S., R. 19 W.	1951	4640	395	
Animas No. 1 Gauthiel	SWNW, Sec. 20, T. 27 S., R. 19 W.	1929	4405	1175	
Beal No. 1 Beal Fed.	2270 S, 565 W, Sec. 28, T. 29 S., R. 15 W.	1954	4356	414	Permian reported at 310′
Valley No. 1 Price	Sec. 16, T. 29 S., R. 17 W.	1928 (?)		2385	
Swartz No. 1 Thielking Fed.	755 N, 660 W, Sec. 22, T. 30 S., R. 14 W.	1962		340	
Hatchet Dome No. 1 Tidball-Berry Fed.	1655 S, 2012 W, Sec. 12, T. 30 S., R. 15 W.	1957	4349	2726	See discussion
Humble No. 1 State BA	990 N, 1980 E, Sec. 25, T. 32 S., R. 16 W.	1958	4575	14,585	See discussion
Midwest No. 1 State	660 N, 650 E, Sec. 16 T. 33 S., R. 14 W.	1962		280	

*Drillers' Log

diorite is present in the cuttings. It is suggested that the east-bounding fault zone of the East Potrillo Mountains was penetrated somewhere around 4200 feet and was followed to the total depth.

It is very difficult to make pronouncements regarding the age of the rocks drilled. Cuttings from the upper part are mostly interbedded limestone and shale; in the lower part (above the fault) they consist mostly of dolomite and shale. A great deal of the well was drilled with air and additional petrographic and other methods must be employed to present an accurate interpretation of the lithologies involved. The entire test may have been in rocks of Early Cretaceous age; however, some of the beds above the fault zone may be Permian. One important factor is a partial similarity with the rocks encountered in the Sunray well west of the Potrillo Mountains.

TEXACO NO. 1 WEAVER-FEDERAL 660 S, 660 W, SEC. 35, T. 26 S., R. 1 E. DOÑA ANA COUNTY

The Texaco location is east of the Potrillo Mountains on the La Mesa surface. Rocks penetrated include 2430 feet of valley fill and sands and gravels of the Santa Fe Formation and 4170 feet of volcanics, probably all of Tertiary age. The volcanic sequence consists of flows and tuffs of rhyolitic to andesitic composition interbedded with silty calcareous red shales.

SINCLAIR NO. 1 FEDERAL-DOÑA ANA 660 N, 660 W, SEC. 27, T. 22 S., R. 1 W. DOÑA ANA COUNTY

Beneath 280 feet of conglomerate, composed primarily of volcanic fragments, there is a thick sequence of rhyolite and quartz latite flows and tuffs. The basal unit of this sequence is a black vitrophyre. The fault contact with the underlying Paleozoic rocks is at a depth of 2850 feet and fusulinids were found in the sample interval from 2870 to 2880 feet. These were identified by Wendell J. Stewart (Texaco) as Lower Missourian *Triticites*. The Pennsylvanian appears to consist entirely of limestone, in part containing abundant chert, and much of it highly fossiliferous. A second fusulinid zone was found at a depth of 3330 feet and was identified as containing Lower Desmoinesian *Beedeina*. Two thick rhyolite sills similar to those in the Robledo Mountains to the northeast cut the Pennsylvanian section. Excluding these sills the total thickness of known Pennsylvanian drilled amounts to 385 feet. This is only a partial thickness because the upper contact is a fault.

Correlation and age of the strata from 3655 to 4130 feet is somewhat questionable. These rocks may include equivalents of Mississippian and the upper part of the Devonian or they may be mostly of Pennsylvanian age. The upper 185 feet of this interval is a white, highly cherty, siliceous limestone similar in some respects to the Lake Valley Formation. However, it is possible that this is an altered, partly assimilated, or contact metamorphosed interval of cherty, normally darker colored, Pennsylvanian limestone. Underlying beds to a depth of 4130 feet are similar to the lower part of the Pennsylvanian, parts of the Lake Valley and Caballero formations, and in the lowermost part to the Box Member of the Percha Shale. Additional work is necessary to establish the identity of these rocks. From 4130 to 4300 feet the sequence is typical of the Ready Pay Member of the Percha Shale. The 170 feet cut in this well compares closely with reported thicknesses in Cooks Range and the Robledo Mountains.

Pre-Devonian strata are quite similar to that found elsewhere in south-central and southwestern New Mexico. The section includes 300 feet of Fusselman Dolomite, 370 feet of Montoya Dolomite (of which 150 feet is the Cutter Member; 120 feet, Aleman Member; 80 feet, Upham Member; and 20 feet, Cable Canyon Member), 740 feet of El Paso Limestone, and 110 feet of Bliss Sandstone. Two rhyolite sills intrude the lower part of the section. The upper sill is 620 feet thick and occurs between the El Paso Limestone and Bliss Sandstone and the well bottoms in a similar sill at the total depth of 6510 feet.

SUNRAY MID-CONTINENT NO. 1 NEW MEXICO FEDERAL "R" 1980 N, 1980 W, SEC. 27, T. 28 S., R. 5 W. LUNA COUNTY

Although located only a few miles east of the Skelly test, cuttings from this well may as well be from a different world, which is expectable for southwestern New Mexico. There are more than 4500 feet of valley-fill sediments at the Skelly location in contrast to a maximum of 520 feet in the Sunray test. Cuttings begin at this depth in volcanics consisting almost entirely of rhyolite to quartz latite flows and tuffs. Volcanic breccia is present only as a minor part of the sequence, contrasting greatly with the Skelly well. Some mineralization is present in the lower part where rims of magnetite and pyrite surround altered phenocrysts of plagioclase in a flow of dacitic composition. Unless samples are terribly mixed the basal 500 feet of this section in the Sunray well consists of interbedded conglomerates of dolomite fragments and quartz latite tuffs that appear to be fluvial deposits. The volcanic section is on the order of 3000 feet thick.

There is understandable uncertainty regarding the pre-Tertiary rocks in the Skelly well, but in the Sunray well we have only confusion. Not withstanding the poor quality of the cuttings, if the section were lower Paleozoic as indicated by Kottlowski and Pray (1967) and from the scout data, it seems that there would be more lithologic similarity with the Fusselman and older rocks than is apparent from the well cuttings, even at this remote location. There is of course always the possibility of faulting to complicate matters, but on the assumption that things are more normal than abnormal there is a strong tendency on lithologic grounds to consider the entire section drilled as Permian. Evidence for this is meager and is based more on intuition and a strong feeling that there exists a certain gross uniformity in Lower Paleozoic stratigraphy of southwestern New Mexico.

From 3500 to 4340 feet, there is a similarity in the dolomites with that of the Fusselman and Montoya formations. The next 130 feet consists of sandstone and shale rather typical of what is found in the rocks of Permian or Pennsylvanian age, but with this exception, the lithology of Devonian beds has never been described from rocks of early Paleozoic age in this part of New Mexico. Included are dark-gray to black shales with embedded fine to coarse well rounded grains of quartz sand; these are *not* exactly a Cable Canyon type of sandstone! Down to this unit, it might be inferred that the overlying carbonates and cherty carbonates are Mississippian, which in some respects they resemble but somehow were totally dolomitized. This then would be underlain by a rather sandy interval of Percha Shale. However this possibility falls apart with the immediately underlying limestones that certainly bear no resemblance to anything in the Fusselman or older Paleozoic rocks. This limestone contains abundant silt to sand size quartz, is fossiliferous, fragmental, and interbedded with some dark-gray silty shale.

A purer limestone continues to a depth of 4870 feet where dolomite is again encountered and continues to a depth of 5950 feet. From here to 6400 feet there is minor dark-gray, fine- to coarse-grained sandstone and silty to sandy dolomite broken by a rhyolite intrusive from 6200 to 6270 feet. Dolomitic sandstone, light-gray and orange in color, makes up the samples to a depth of 6550 feet. This is followed by about 20 feet of dolomite, stained red, silicified, and containing some magnetite. The remainder, down to the total depth of 6616 feet, is coarsely crystalline diorite, more than likely and regardless of age-dates, a Tertiary dike or sill. The date reported for this intrusive is Mississippian; this age is not one that can be considered with overwhelming confidence.

To summarize, some of the lithologies do not fit with a designation of Fusselman or a combination of Fusselman-Montoya-El Paso-Bliss, and can be fitted into the Permian, perhaps in a limited way with the Pennsylvanian, and in part Lower Cretaceous. The fineness of the cuttings precludes much chance of finding diagnostic fossils, including foraminifera.

SKELLY NO. 1-A NEW MEXICO "C" 560 S, 1980 E, SEC. 19, T. 28 S., R. 5 W. LUNA COUNTY

Cenozoic rocks comprise a thick sequence of volcanic rocks and sediments that are worthy of some mention here because of the extreme likelihood that similar rocks and thicknesses can be expected in future exploration efforts in southwestern New Mexico.

The upper 700 feet consist of interbedded calcareous clays and very fine- to medium-grained sands of orange to pink color. The admixed clay to sand-size particles throughout this interval indicate rather uniform conditions of deposition for the latest stage of basin filling in this area. The next 3200 feet of sediments are made up almost entirely of coarse conglomerates that can be correlated with the Gila or Santa Fe formations. Rock material making up the conglomerates consists mostly of andesite and basalt but there are other volcanic rocks and some limestone. The upper 2300 feet of this interval is dark colored with a general overall purplish cast. The lower part shows a distinct change in color to pale red and there is an increase in the content of silty clays.

A striking interval of fine clastics lies between the conglomerate and the thick series of volcanic rocks penetrated in this well. From a depth of 3900 to 4650 feet strata are of reddish-brown, silty, calcareous shales, very likely of playa origin. Beds that occupy a somewhat similar stratigraphic position and are interbedded with or overlie volcanics are found elsewhere in New Mexico, such as the Popotosa Formation of the Socorro area.

The volcanic section in this well begins with a thick sequence of red to purple breccias, or possibly agglomerates, composed of fragments ranging from basaltic to rhyolitic composition including soft to welded tuffs and flows. These rocks are interbedded with shale similar to the overlying playa-like deposits. Interspersed in the lower part of this and in the next two underlying units are lentils of white bentonite.

The stratal section from 5165 to 5365 feet comprises basalt, cinders, and more reddish shale. The basalt has partial to complete vescicle filling of zeolite and alteration of olivine to iddingsite. Beneath this is over 1000 feet of latite to andesite flows and tuffs, generally red to brown or purple in color. This sequence is broken by some interbedded shale and sandstone and beginning at 5640 feet a thin interval of olivine andesite flows. The remainder of the volcanics from 6380 to 8295 feet are mostly breccias of various types of rhyolitic material and minor rhyolite and latite flows.

It would be helpful to correlate with a greater degree of confidence the pre-Tertiary, post-Precambrian rocks drilled in this well. Even if the available cuttings were better, there would very likely still be some doubt. The uppermost part, cut by some diorite dikes, resembles the Fusselman Dolomite. From 8395 to 8550 feet, the dolomite is similar to the Cutter Member of the Montoya Dolomite, and from 8550 to 8650 feet there is some similarity to the cherty Aleman and the Upham members. A minor amount of white sandstone appears in the cuttings at 8650 feet and may represent the Cable Canyon Member. Dolomite and limestone from 8655 to 8790 feet may be part of the El Paso Limestone. The thinness suggests faulting or perhaps a "high" of Precambrian rocks similar to that in the Florida Mountains to the northwest. The El Paso oolite zone is not present and there are no cuttings that indicate an interval of Bliss Sandstone. However, a thin, red, clayey, arkosic, calcareous sandstone at the base of the sediments could be either gouge material or a non-Bliss-like basal sandstone derived from the Precambrian. The top of Precambrian is somewhere between 8790 and 8915 feet. Cuttings indicate granite at 8810 feet; interpretation of the gamma curve suggests fresh granite at 8915 feet, and possibly weathered granite at 8790 feet. Some biotite schist is present in the cuttings below 9250 feet.

In summary, we believe that pre-Tertiary strata may logically be subdivided as follows: Fusselman Dolomite (100 feet, partial section) 8295 to 8395 feet; Montoya Dolomite: Cutter Member (155 feet) 8395 to 8550 feet; Aleman Member (45 feet) 8550 to 8595 feet; Upham Member (55 feet) 8595 to 8650 feet; Cable Canyon Member (5 feet) 8650 to 8655 feet; El Paso Limestone (155 feet) 8655 to 8810 feet; Precambrian granite and schist (612 feet plus) 8810 to 9422 feet (total depth).

HATCHET DOME NO. 1
TIDBALL-BERRY FEDERAL
1655 S, 2012 W, SEC. 12, T. 30 S., R. 15 W.
HIDALGO COUNTY

The Hatchet Dome well cut a straightforward sequence of pre-Pennsylvanian rocks. Admittedly the section is a bit iron stained, silicified, and includes some diorite intrusives but no great effort is required to correlate the cuttings with surface sections.

The test begins in the Upper Member of the Escabrosa Limestone; its top is at a depth of 220 feet, and the member is about 270 feet thick; somewhat thinner than the 350 feet measured by Zeller in the nearby Big Hatchet Mountains. The Lower Member is 560 feet thick in the well and 545 feet thick in the Big Hatchet Mountains. Although predominately limestone, the member includes interbeds of gray shale in the lower part. Because of these interbeds, the contact with the underlying Percha Shale, which characteristically includes some limestone in the upper part, is difficult to establish. The top of the Percha Shale is picked at a depth of 1050 feet and the basal contact with the Montoya Dolomite at 1395 feet. Eliminating about 30 feet for the several diorite sills or dikes that cut the section, the thickness of the Percha Shale is about 315 feet. This compares favorably with 280 feet measured in the Big Hatchet Mountains where diorite dikes are also present on the outcrop.

Missing samples from 1510 to 1640 feet make it impossible to subdivide the Montoya Dolomite into the four members generally recognized throughout southwestern New Mexico. Strata below 1650 feet are limestone and considering the thickness above the Bliss Sandstone as well as the lithology, should be correlated with the El Paso Limestone. With the top of the Montoya Dolomite at 1395 feet the maximum thickness present is 255 feet; considerably less than the 385 feet Zeller measured to the west. The 115 feet of samples available are lithologically similar to the Cutter Member, thus there is a maximum of 140 feet of section for the Aleman, Upham, and Cable Canyon members. Actually this is quite close to the 150 feet assigned by Zeller to these intervals; the variation in the overall thickness of the Montoya Dolomite being attributable to the Cutter Member. Of course, the upper contact of the Cutter is an erosional unconformity and considerable relief may be present on this surface where overlain by Devonian rocks. This has been observed on the outcrop in the San Andres Mountains (Kottlowski et al, 1956) and is noted by Zeller to the west of the Big Hatchet Mountains.

Based on the above interpretation the El Paso Limestone is approximately 950 feet thick. This is complicated somewhat by the poor quality of the samples from the lower part of the hole. There appears to be about 120 feet of Bliss Sandstone although some of the overlying limestones contain appreciable sand-size quartz grains, a usual transitional problem that occurs everywhere between the Bliss and El Paso formations. Many geologists prefer to place this contact at the top of the sandy intervals but it is not treated consistently. Where hematitic-glauconitic beds are present, the contact is usually at the top of this type of lithology but this is no more accurate as far as regional or local interpretations are concerned.

Fairly fresh feldspar, observed in the lowermost sample from 2720 to 2725 feet, may be in-place Precambrian or a basal arkosic interval of the Bliss Sandstone.

HUMBLE NO. 1 STATE BA
990 N, 1980 E, SEC. 25, T. 32 S., R. 16 W.
HIDALGO COUNTY

One supposes that a geologist should be grateful for the challenge of looking at cuttings drilled with air, but it is always refreshing to examine a set of samples such as these, where engineering and geology outweigh questionable economics. In some areas this is not of great importance because so many wells were drilled before the use of air or gas as a circulating medium. In southwestern New Mexico and similar areas it becomes quite critical; however, it should be pointed out that in most of the wells drilled with air the operators managed to collect excellent samples through the fill and volcanics, an academic approach which is highly commendable.

The Humble well cuts the most complete sedimentary section of any test drilled in this region. Beneath 230 feet of alluvium, rocks of Early Cretaceous age are present to a depth of 995 feet. The base of the U-Bar Formation appears to be at a depth of 470 feet based on the radioactivity log characteristics. The remaining 525 feet are considered equivalent to the Hell-to-Finish Formation. Rocks of Permian age have thickness of almost 5300 feet, excluding Wolfcampian beds in the upper part of the Horquilla Limestone. This is approximately 900 feet greater than the maximum measured thickness reported by Zeller for these rocks in the Big Hatchet Mountains. In itself this might not appear to be too great a thickness difference in the six miles from outcrop to well, but individual units vary so greatly that a different explanation seems necessary. The following gives the Permian formations and the thickness in feet for each unit, first for the Humble well and second the maximum observed by Zeller for the Big Hatchet Mountains: Concha Limestone (527, 1376), Scherrer Formation (8, 20), Epitaph Dolomite (2920, 1519), Colina Limestone (808, 505), and Earp Formation (1007, 997). The thinner Concha Limestone in the well can be explained by the erosional unconformity between this unit and the overlying Lower Cretaceous beds. The main problem is in the Epitaph Dolomite and the Colina Limestone. Sam Thompson III (Zeller, 1965) suggests the presence of a reverse fault and steep dips to account for the expanded section of Epitaph Dolomite. Two intervals of red beds are present in the well cuttings; the first from 2830 to 2930 feet, and the second from 3840 to 3885 feet. Thompson notes a marker horizon at 2850 feet and states that this is repeated at 3820 feet. The two intervals are somewhat different from a lithologic standpoint but this possibly can be explained by variations in sample collecting. Zeller measured two yellow to red siltshale intervals in the lower 405 feet of the Epitaph Dolomite in his Lower Sheridan Tank section. The overlying Epitaph beds are between 1000 and 1100 feet thick. Beds above the upper red section in the well are about 1300 feet thick, hence if the upper redbeds are correlative from well to outcrop, repitition by faulting may have taken place in the lower part of the Epitaph. This part of the section, however, does not appear to be repeated inasmuch as dolomite below the upper red interval is totally dissimilar to the dolomite below the lower red beds. Anhydrite constitutes a greater percentage of the section beneath the upper redbeds than beneath the lower interval, but this of course could be explained by repetition. The question remains unsolved and repetition by faulting still appears to be the most reasonable explanation. Which exact part of the section is repeated continues to be a mystery. The greater thickness for the Colina Limestone is most easily explained by dip.

A similar problem exists in the underlying Horquilla Limestone of Pennsylvanian and Wolfcampian age. In the Humble well this interval is 4730 feet thick while the outcrop section is reported to have a maximum thickness of 3530 feet. Again, present efforts could not establish any bed repetition. As noted by Zeller, the Horquilla Limestone is quite different in the well when compared with the outcrop section. The exposed section contains large compound reefs ranging in age from Desmoinesian to Wolfcampian. In the well the upper part of the Horquilla is mostly gray siltstone and shale with limestone prominent only in the lower 1650 feet of the formation. Fusulinids indicate a Morrowan(?) through Virgilian age for the Pennsylvanian part of the Horquilla Limestone.

Strata of Mississippian age are almost 1500 feet thick in the Humble well as compared to 1575 feet on the outcrop. Two formations, generally recognized in this part of southwestern New Mexico, are the Paradise Formation of Chester-Meramec age, and the Escabrosa Limestone of Kinderhook-Osage-Meramec age. In the well 435 feet of interbedded limestone and shale are assigned to the Paradise Formation and 1060 feet to the limestone sequence of the Escabrosa. The base of the Mississippian was selected at the base of the lowest limestone which restricts the Devonian to 360 feet of section consisting of gray to black shale and minor siltstone. This interval is correlative with the Percha Shale of which Zeller measured 280 feet in the Big Hatchet Mountains.

As on the outcrop, the Silurian Fusselman Dolomite is not present in the well and Devonian beds directly overlie the Ordovician Montoya Dolomite which can be readily subdivided into its four members. Comparative thicknesses in feet for each of the members from the well and the Big Hatchet Mountains are as follows: Cutter (135, 235), Aleman (115, 80), Upham (60, 55), and Cable Canyon (20, 15-20).

The remaining section penetrated in the well may also be complicated by faulting. Thompson states that a reverse fault was crossed at a depth of about 14,120 feet and that the El Paso Limestone was displaced over the Escabrosa Limestone. He further points out a marker horizon at 12,230 feet in the Escabrosa Limestone repeated at 14,440 feet. Nothing appears to be lithologically similar anywhere near these two "markers" inasmuch as strata below 12,230 feet are crinoidal limestone while those below 14,440 feet are dolomitic limestone containing algal fragments. Below 14,460 feet, the remainder of the cuttings consist of sandy dolomite and dolomitic limestone lithologically identical to Zeller's description of the upper part of the Bliss Sandstone. From repeated close examination of the Escabrosa Limestone it is interpreted that the Humble test penetrated a normal sequence of El Paso Limestone approximately 1270 feet thick, and that the lower 125 feet drilled is equivalent to the upper part of the Bliss Sandstone as defined by Zeller in the Mescal Canyon section where he measurd 1070 feet of El Paso Limestone, and 190 feet of Bliss Sandstone.

Tops selected from the cuttings, and in some cases the mechanical logs, are as follows: U-Bar Formation—230 feet; Hell-to-Finish Formation—470 feet; Concha Limestone—995 feet; Scherrer Formation—1522 feet; Epitaph Dolomite—1530 feet; Colina Limestone—4450 feet; Earp Formation—5258 feet; Horquilla Limestone—6265 feet; Paradise Formation—10,995 feet; Escabrosa Limestone—11,430 feet; Percha Shale—12,490 feet; Montoya Dolomite—12,850 feet; El Paso Limestone—13,180 feet; Bliss Sandstone—14,450 feet. A drill stem test from 4190-4219 feet in the Epitaph Dolomite recovered a reported 10.27 MCFPD, and dead oil and oil stains also were noted in this formation.

REFERENCES CITED

Armstrong, A. K., 1962, Stratigraphy and paleontology of the Mississippian System in southwestern New Mexico and adjacent southeastern Arizona: N. Mex. Bureau Mines & Min. Res., Mem. 8, 99 p.

Elston, W. E., 1957, Geology and mineral resources of Dwyer Quadrangle, Grant, Luna, and Sierra Counties, New Mexico; N. Mex. Bureau Mines & Min. Res., Bull. 38, 86 p.

Epis, R. C., 1956, Geology of the Pedregosa Mountains, Cochise County, Arizona: unpub. Ph.D. thesis, Univ. Calif., 181 p.

Gillerman, Elliot, 1958, Geology of the Central Peloncillo Mountains, Hidalgo County, New Mexico, and Cochise County, Arizona; N. Mex. Bureau Mines & Min. Res., Bull. 57, 152 p.

Griswold, G.B., 1961, Mineral Deposits of Luna County, New Mexico; N. Mex. Inst. Min. & Tech., State Bur. Mines & Min. Res. Bull. 72, 157 p.

Jicha, H. L., 1954, Geology and Mineral Resources of the Lake Valley Quadrangle, Grant, Luna, and Sierra Counties, New Mexico, N. Mex. Bureau Mines & Min. Res., Bull. 37, 93 p.

Kelley, V. C., and L. E. Bogart, 1952, Gym Limestone, New Mexico, Bull. Amer. Assoc. Petrol. Geol., vol. 36, p. 1644-1648.

Kottlowski, F. E., 1960, Summary of Pennsylvanian sections in southwestern New Mexico and southeastern Arizona; N. Mex. Bureau Mines & Min. Res., Bull. 66, 187 p.

————, 1963, Paleozoic and Mesozoic strata of southwestern and south-central New Mexico; N. Mex. Bureau Mines & Min. Res., Bull. 79, 100 p.

————, R. H. Flower, M. L. Thompson, and R. W. Foster, 1956, Stratigraphic studies of the San Andres Mountains, New Mexico; N. Mex. Bureau Mines & Min. Res., Mem. 1, 132 p.

————, and R. W. Foster, 1962, Pre-Tertiary strata of Tres Hermanas Mountains, Luna County, New Mexico, Am. Assoc. Petroleum Geologists Bull., v. 46, p. 2090-2098.

————, and L. C. Pray, 1967, Silurian outcrops of south-central and southwestern New Mexico; Tulsa Geol. Soc. Digest, v. 35, p. 209-230.

Lasky, S. G., 1947, Geology and ore deposits of the Little Hatchet Mountains, Hidalgo and Grant Counties, New Mexico; U. S. Geol. Survey, Prof. Paper 208, 101 p.

Sabins, F. F. Jr., 1957, Geology of Cochise head and western part of the Vaner quadrangles, Arizona; Geol. Soc. Am. Bull., v. 68, p. 1315-1341.

Wengerd, S. A., 1959, Regional geology as related to the petroleum potential of the Lucero Region, west-central New Mexico; N. Mex. Geol. Soc. Guidebook, West-Central New Mexico, p. 121-134.

————, 1962, Wildcat oil prospects in southwest New Mexico; World Oil, v. 155, no. 2, p. 51-58.

Zeller, R. A. Jr., 1965, Stratigraphy of the Big Hatchet Mountains area, New Mexico, N. Mex. Bureau Mines & Min. Res., Mem. 16, 128 p.

ROCK HOUND AT WORK

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