

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Measured stratigraphic sections of uranium-bearing
Upper Triassic rocks of the Dockum Basin, eastern
New Mexico, west Texas, and the Oklahoma Panhandle
with brief discussion of stratigraphic problems

by

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Open-File Report 83-701

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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1983

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STATEMENT

The stratigraphic sections contained herein were measured as part of the study of the uranium potential of Triassic rocks of the Southern High Plains of eastern New Mexico, west Texas, and the Oklahoma Panhandle. The study was started by the late James C. Wright in 1967 and continued, after Dr. Wright's death in 1968 by Warren I. Finch from 1968 through 1972. Most of these sections were made available in draft form to the Bureau of Economic Geology, University of Texas, in 1974 as part of a grant from the U.S. Geological Survey to study the Triassic rocks of west Texas. That unedited draft was referenced as "Open-File Report 1975" in McGowen and others (1979), a product of the grant study. Because of that reference these sections have been requested by the public. Many of these sections were used to construct two geologic cross sections, one north-south in west Texas (Finch and others, 1976a) and the second east-west extending from near Tucumcari, New Mexico to Palo Duro Canyon, Texas (Finch and others, 1976b). There are 29 measured sections and their general locations are shown on plate 1. Their lines of measurement are shown on portions of either 7.5-minute or 15-minute topographic maps (figs. 1-29). Because many of the section localities are on private land, they are difficult to access.

Color names and their numerical designations were determined from a rock-color chart (Goddard and others, 1948, 1970). All sections were measured using a Jacob's staff marked in the English system of units; a calculated equivalent in the metric system is given for each measured unit.

The Dockum basin of eastern New Mexico, west Texas, and the Oklahoma Panhandle is a distinct basin (McKee and others, 1959, pl. 4) and is separated from the Colorado Plateau Chinle basin to the west by absence of outcrops in a belt 25 to 50 miles wide marked by the Rio Grande trough. Correlation of rock units across this gap has not been done in any detail. For this reason extension of the name Chinle across into the dockum basin is only provisional. Other Triassic stratigraphic nomenclature in this report is also provisional. Local state and regional names are used with minimum attempts at correlations.

The Triassic Dockum basin is in need of extensive research to unravel stratigraphy and depositional history relative to the Colorado Plateau Chinle basin and relative to plate tectonics. This reconnaissance study revealed several areas that unusual changes in stratigraphy take place. Many of these areas seem to correlate with major tectonic structures.

On the west side of the Dockum basin one notes a marked thinning of the Triassic section against the Rocky Mountain front from Las Vegas, NM

northward. The Triassic thins about 10 miles (16 km) north of the New Mexico-Colorado border (Johnson and Baltz, 1960), and the stratigraphic sequence recognized at Santa Rosa, NM is not apparent along the mountain front. Another observation along the western edge of the basin is that near the Rio Grande Trough south of Santa Fe thick very coarse conglomerate lies at the base of the Triassic section.

In the northern part of the Dockum basin a very dramatic change occurs in the stratigraphy between Triassic rocks that crop out in the area north of Tucumcari and southeast of Las Vegas and those that crop out to the north in the Cimarron River Valley. The covered area between the two outcrop areas marks the boundary between the Tucumcari basin on the south and the Raton basin to the north.

Along the Canadian River east of Tucumcari at the New Mexico-Texas state line a marked change in the Triassic stratigraphy is noted (Finch and others, 1976b), and this is a very real "state-line fault boundary", which is the cause for problems in matching geologic mapping between the two states, particularly within the Tucumcari 2⁰ quadrangle. Extension of the northeast-trending Bonito fault system (Dobrovolsky and others, 1946) crosses the river at the state line. In addition to changes within the Dockum, one notes regional but distinct changes in Late Jurassic and Cretaceous rocks. The Morrison Formation and Summerville-like beds extend southward just to the north of the fault and the Entrada Formation barely extends across the fault. The Purgatoire Formation of Early Cretaceous age extends southward only in part across the line and the Edwards Limestone extends from the south northward barely to the line. There appears to have been a long-standing tectonic influence on sedimentation in this part of the Dockum basin.

In West Texas, the broad Matador arch apparently influenced Triassic sedimentation because shale of the Tecovas Formation does not extend over the arch area and there is a thick buildup of sandstone in the lower Dockum just north of the arch (Finch and others, 1976a). These changes may be important to uranium exploration in this area.

In the literature the name "Santa Rosa Sandstone" is used extensively for basal Dockum sandstones, particularly in the subsurface. Yet, in the outcrop it appears that the Santa Rosa Sandstone of the type area does not extend to the east much beyond the "state-line fault boundary" mentioned above and to the south beyond Fort Sumner along the Pecos River. Work by McGowen and others (1979) shows a large number of source areas entirely around the periphery of the basin, each generated a local sandstone in the lower part of the Dockum.

Finally, the isolated Triassic conglomerate in the Glass Mountains in Brewster County south and outside the Dockum basin requires new study to describe the tectonic setting of southern edge of the basin.

Each of these problems suggests a relation between structural growth and sedimentation. It is important to note that the problem areas are located around the edges of Dockum basin where the thickness of the Dockum is around 500 feet (150 m) or less whereas in the buried central part of the basin the section

attains thicknesses of as much as 2,000 feet (600 m) (McKee and others, 1959, plate 5). Any research to solve the stratigraphic problems of this basin must include the subsurface well records at the outset.

MEASURED SECTIONS

New Mexico

Guadalupe County

Santa Rosa Railroad-cut Section

Section measured in cuts of Chicago Rock Island and Pacific, Southern Pacific Railroads, along north banks of El Rito Creek, and on slopes of the western-most lake of Tres Lagunas in the Santa Rosa 7.5-minute quadrangle (fig. 1; pl. 1, locality 1). Approximate altitude of base of section is 4,630 ft. This section is well exposed and was readily assessable to N. H. Darton in 1919 when he named the Santa Rosa Sandstone (Darton, 1922); it may have been his type section.

[Measured by W. I. Finch, October 26-27, 1971]

	<u>Feet</u>	<u>Meters</u>
Triassic.		
Dockum Group:		
Chinle Formation (incomplete):		
8. Siltstone, pale-red (5R 6/2), weathers light-red, sparse very fine quartz, calcareous, micaceous (colorless) along bedding planes; hard; thin wavy bedding due to pervasive ripple marks, ripple marks cause irregularly lined surface; forms weak ledge; interlenses with upper 5 ft (1.5 m) of unit 7.....	3.	0.9
7. Claystone and siltstone, intermixed, grayish-red (10R 4/2), calcareous, micaceous (colorless), thinly laminated to poorly bedded; soft, shaly; most forms a covered slope.....	<u>16.</u>	<u>4.9</u>
Total of Chinle Formation (incomplete).....	<u>19.</u>	<u>5.8</u>

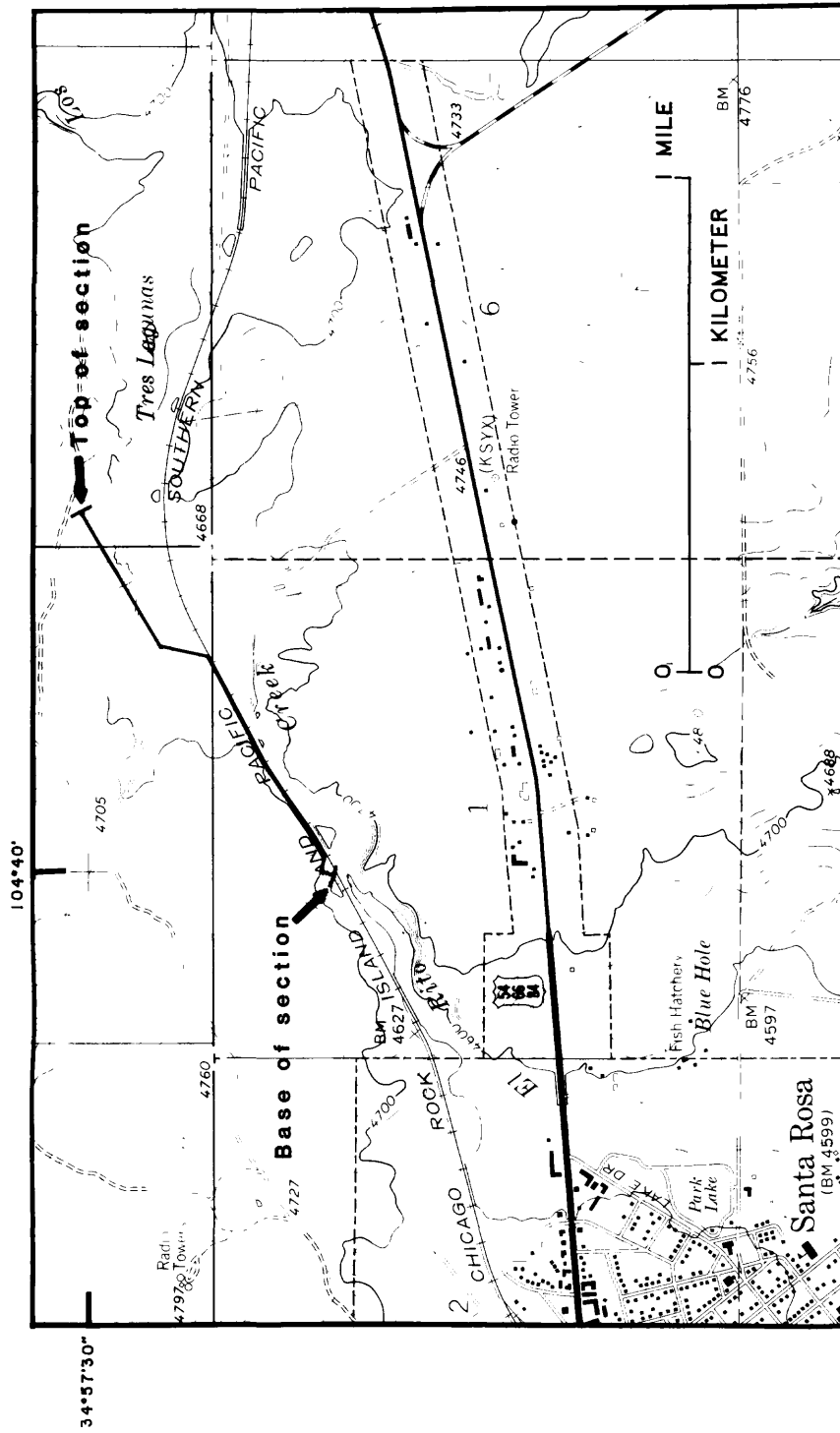


Figure 1.--Location of the measurement of the Santa Rosa railroad-cut section (pl. 1, locality 1) within the Santa Rosa 7.5-minute topographic quadrangle, Guadalupe County, New Mexico

Feet Meters

Santa Rosa Sandstone (Member terminology is that of Gorman and Robeck, 1946):

Upper sandstone member:

6. Sandstone, brown and yellowish-brown (limonite) speckled white and pale-gray, most weathers light-brown, minor pale-red (5R 6/2); very fine clear quartz, silty and clayey, micaceous (muscovite and biotite) along bedding planes, calcareous; shaly zone from 3-6 m below top, upper part of this zone is grayish- and yellowish-green claystone, this zone extends hundred meters to north where it lenses out; strongly crossbedded in upper 1.5 m of unit, which is well displayed on dip slope between top of unit and first outcrop of unit 7 about 200 m to east; lower part thin-bedded ripple-marked, and flat bedded; unit forms two 1.5± m ledges separated by steep slope, large rounded angular blocks of lower ledge 1.5-12 m across lie on slopes lie on slopes of unit 5..... 30. 9.1

Shale member:

5. Claystone, grayish-red (10R 4/2), calcareous, soft, weakly bedded, shaly; forms covered slope to shore of lake; base marked by irregular 15-30 cm thick brown-weathering siltstone bed that dips about 25° eastward..... 45. 13.7
4. Claystone, light-olive-gray (5Y 6/1) to yellowish-gray (5Y 7/2), calcareous; contains carbonized leaf and twig fossils that are locally abundant; soft, shaly; contains sporadic irregular thin (2.5-15 cm thick) brown siltstone layers that mark edges and bottoms of local-channel-fills within unit; basal part lies on undulatory beds of unit 3 caused by local subsidence; unit appears to be lacustrine or backswamp fillings (clay plugs) of depressions formed by solution of Permian salts at depth; 3.5 m well exposed in canal and 2.5 m at railroad cut, ground between is disturbed by fill and covered partly by colluvium.....~25. ~7.5

Total thickness of shale member (unit variable in thickness regionally and absent in places).....~70. ~21.

Middle sandstone member:

3. Sandstone, yellowish-brown, speckled white and light-gray, weathers light-brown to brown, black desert varnish on old surfaces; well-sorted beds of medium to coarse clear quartz; upper and basal beds are silty to fine-grained, inconspicuous dark grains, mostly clean, calcareous, white interstitial clay common, hard to friable; iron-oxide-replaced flattened fossil wood pieces and impressions on bedding planes throughout; beds tend to be thick (1-4 m, 3-15 ft), crossbedded, and continuous, such beds extend for hundreds of feet; 5-10 ft (1.5-3 m) above base is continuous zone 5-10 ft thick of quartz-chert-limestone pebble conglomerate and greenish-gray (commonly pebbly) claystone, zone interlenses with adjacent sandstone beds, zone contains carbonized and limonitized wood fragments and logs; greenish-gray claystone and mudstone splits common in upper 20 ft (6 m); unit forms nearly continuous ledge; lies with erosional unconformity on unit 2; unit is distinctive and recognizable throughout Guadalupe, San Miguel, and Quay Counties, New Mexico.

Total thickness of middle sandstone
member..... ~60. ~18.

Lower sandstone member:

2. Sandstone, pale-red (5R 6/2), speckled white, weathers brown to reddish-brown, very fine to fine brown-stained and clear quartz, interstitial white clay, calcareous, dirty looking, dense, hard; few thin (30 cm thick) limestone-granule (2-4 mm diameter) conglomerate beds scattered throughout; massive, flat-bedded and crossbedded, one festoon about 15 m across noted near base; beds range from about 5 cm to 2.5 m thick, even-thick to lenticular, 2 cm thick shaly breaks common; weathers as steep slope, partly covered, some 0.25-1.5 m thick rounded ledges; slight erosional unconformity at base; bedding more or less parallel to that of underlying Permian rocks.

Total thickness lower sandstone member..... ~68. ~20.7

Total thickness Santa Rosa Sandstone.....~228. ~69.

Total measured Dockum Group.....~247. ~75.

	<u>Feet</u>	<u>Meters</u>
Permian.		
Artesia Group:		
Grayburg and Queen Formations undifferentiated:		
1. Siltstone, moderate-reddish-orange (10R 6/6), calcareous, massive, bedding suggests ripple marks; soft zone a few centimeters thick about 1.5 m below top; upper surface modified by solution and deposition of carbonate and is grayish orange; forms smooth, irregular, and indurated ledge; measured and described within 150 ft (45 m) of east end of railroad fill where thickness of unit 2 measured; Permian exposed south of tracks is about 7.5 m thick where the beds roll upward to form small anticlinal structure; here individual beds are about 1.5 m thick, separated by shaly breaks, and show flat parallel bedding.....	<u>8+.</u>	<u>2.5+</u>
Total measured Grayburg and Queen Formations (incomplete).....	<u>8+.</u>	<u>2.5+</u>

Sunshine Mesa - State Route 156 Road-cut Section

Section measured in road cut of New Mexico State Route 156 near the western edge of the Sunshine Mesa 7.5 minute quadrangle (fig. 2; pl. 1, locality 2). Base of section is at altitude 4,855 ft where unit 1 becomes covered in the valley extending northwestward nearly to the upper most unit 8 in the Chinle of the Santa Rosa railroad-cut section (pl. 1, locality 1).

[Section measured by W. I. Finch, October 26, 1971]

	<u>Feet</u>	<u>Meters</u>
Pliocene.		
Ogallala Formation:		
3. Gravel, sand, and caliche, mottled white, red and brown.....	55.	16.8
Triassic.		
Dockum Group:		
Chinle Formation (incomplete):		
Middle sandstone member:		
2. Sandstone, yellowish-gray (5Y 8/1), weathers brown; colorless, white, and pale-orange, very fine quartz grains and fairly abundant green and dark grains; calcareous; iron-oxide-replaced flattened fossil wood twigs and smaller pieces; micaceous (colorless and green) along bedding planes; crossbedded, upper few feet thinly bedded and somewhat platy; forms ledge; weathers into flat well-rounded boulders and blocks 2-10 m across strewn over large area of underlying unit; thickness of unit uniform.....	18.	5.5
1. Claystone, dusky-red (5R 3/4), pale-reddish-brown (10 R 5/4), greenish-gray round spots, sparse interstitial medium-quartz grains, slightly calcareous, soft; forms steep poorly exposed slope below sandstone ledge and merges into valley below; base not exposed.....	80+.	24.4
Total measured Chinle Formation.....	98+.	29.9

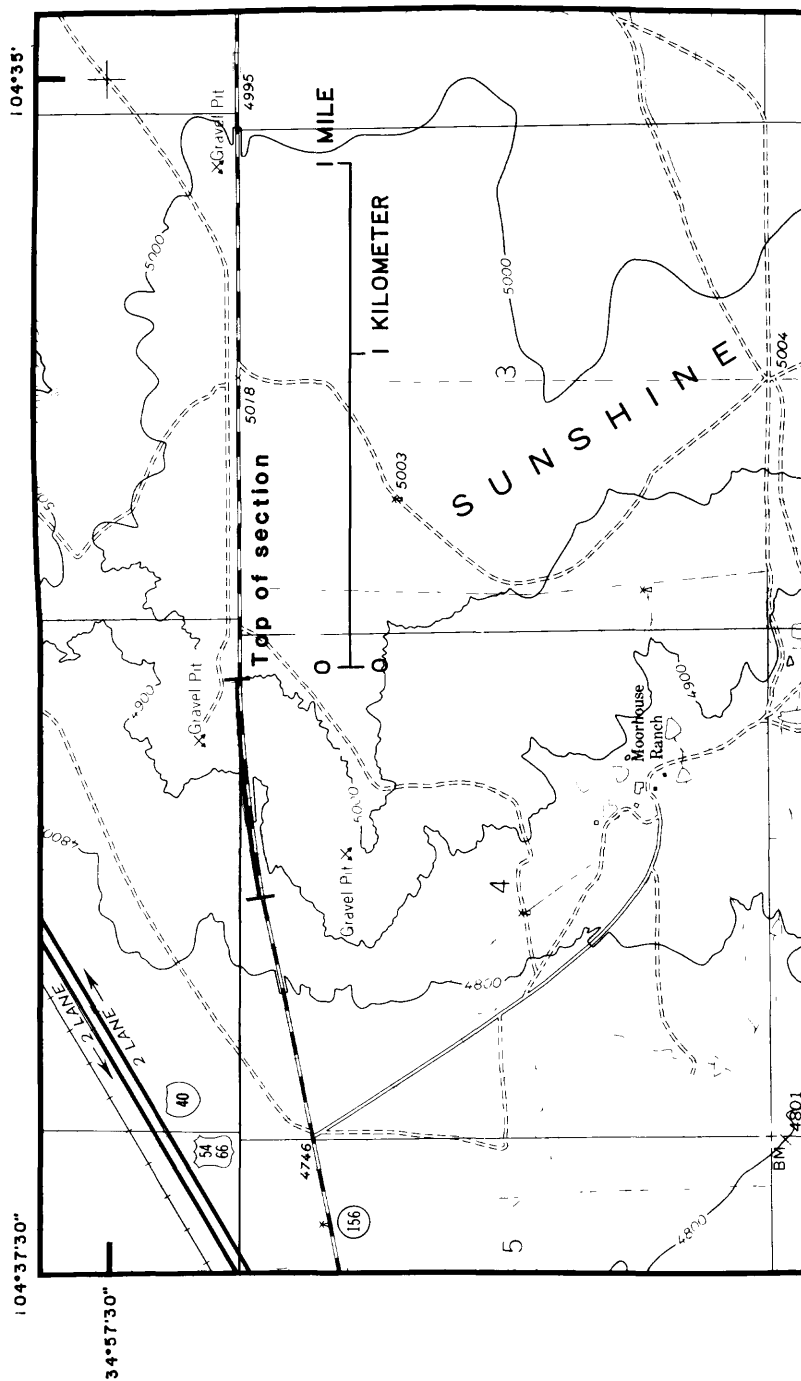


Figure 2.--Location of the line of measurement of the Sunshine Mesa--
State Route 156 road-cut section (pl. 1, locality 2) within the Sunshine
7.5-minute topographic quadrangle, Guadalupe County, New Mexico

Quay County

Dripping Triangulation Station Section

Section measured from 1/4 corner section 24/section 25 marker below normal pool stage of Ute Reservoir to Dripping Triangulation Station in the Hudson 7.5-minute quadrangle (fig. 3; pl. 1, locality 3). Elevation of top of section is 4,104 ft.

[Measured by W. I. Finch, October 28, 1971]

	<u>Feet</u>	<u>Meters</u>
Quaternary and Tertiary (?).		
Ogallala Formation(?):		
10. Caliche, off-white, rubbly.....	9.	2.7
Triassic.		
Dockum Group:		
Chinle Formation (incomplete):		
Middle sandstone member:		
9. Sandstone, pale-red (5R 6/2), weathers reddish-brown, very fine quartz (colorless, brown, orange) and dark grains; silty, white interstitial clay, crossbedded, limestone-granule and pebble (1-10 mm) conglomerate bed near top; forms rounded ledged terraced back from top of unit 8; sharp contact with unit 8, outlier forming top of ridge beneath caliche.....	16.	4.9
8. Sandstone, yellowish-gray (5Y 8/1), light-brown (5YR 6/4-5/6); fine- to medium-grained quartz (colorless, white, orange) and very sparse dark grains, sparse interstitial white clay; limonitic in a few places, particularly around fossil wood; calcareous, fairly clean; crossbedded; limestone-granule and pebble conglomerate beds scattered throughout; weathers as massive ledge, divided into two ledges by soft zone in places.....	~70.	~21.

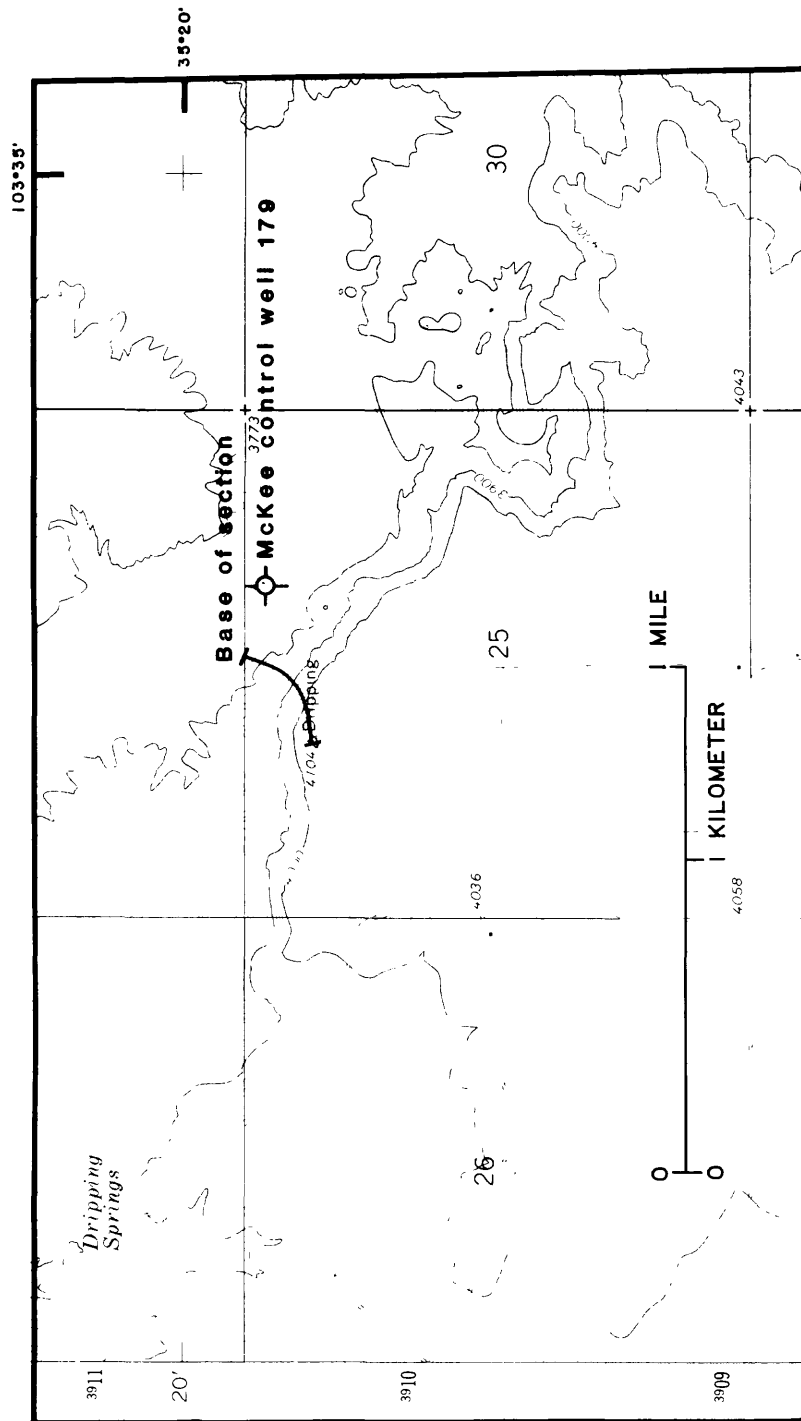


Figure 3.--Location of the line of measurement of the Dripping Triangulation Station section (pl. 1, locality 3) within the Hudson 7.5-minute topographic, Quay County, New Mexico

	<u>Feet</u>	<u>Meters</u>
Lower shale member:		
7. Claystone, pale-reddish-brown (10 R 5/4), minor thin zones and spots of greenish-gray (5GY 6/1); soft, shaly, weathers to form firm but soft surface; mostly steep covered slope.....	152.	46.3
Total measured Chinle Formation.....	<u>~238.</u>	<u>~72.</u>
Santa Rosa Sandstone (incomplete):		
6. Sandstone, pale-red (5R 6/2), very fine quartz (white, brown) and sparse dark grains, sparse mica along some bedding planes; calcareous, white interstitial clay; chiefly curved crossbeds in small (60-90 cm high) to large (3± m high) sets; forms weak ledge.....	13	4.0
5. Siltstone, grayish-red (5R 4/2), calcareous, micaceous along laminae surfaces, white interstitial clay, thinly laminated, soft; forms steep partly covered slope; grades into overlying unit.....	7.	2.1
4. Siltstone, and sandstone, pale-red (5R 6/2), very light gray (N 8) in upper part, very fine quartz (gray, orange) and dark grains, calcareous; hard platy, thinly bedded, wavy beds in places; contains silicified wood, 4.5 m long, fossil log observed west of line of section; 15 cm thick limestone-granule (2-4 mm) conglomerate at base; weak ledge former; interlenses with unit 5.....	20	6.1
3. Claystone, like unit 1.....	15.	4.6
2. Siltstone, pale-red (5R 6/2), light-bluish-gray (5B 7/1) in upper parts, some very fine grains of clear to white quartz and green and dark grains; calcareous, micaceous (colorless and greenish); hard; thin flat to low-angle bedding, weakly ripple marked; weathers into well-rounded massive beds, grayish-red claystone layers near top where unit interlenses with unit 3; 15 cm-thick limestone-granule conglomerate (1-2 mm diameter) at base; forms weak to strong ledge; sharp basal contact.....	23.	7.0

	<u>Feet</u>	<u>Meters</u>
1. Claystone, grayish-red (10R 4/2)4/2), calcareous, soft, shaly; forms mostly covered slope; this is the lowest stratigraphic unit exposed in vicinity of Ute Lake; this unit is exposed at oil well head (control point 179 of McKee and others, 1959) about 0.2 mi (0.3 km) east; unit is about 7.5 m thick across lake to north where it is grayish green in lower half.....	<u>12+.</u>	<u>3.7+</u>
Total measured Santa Rosa Sandstone.....	<u>90+.</u>	<u>27.5+</u>
Total measured Dockum Group.....	<u>328+.</u>	<u>99.5+</u>

Henry Pittman Ranch Section

Section measured from point on Revuelto Creek near center of NW1/4 SE1/4 sec. 2, T. 12 N., R. 33 E. to caprock of rim in SE1/4 NE1/4 sec. 11; units 1-5 measured in sec. 2 and units 6-11 in sec. 11 in Logan 15-minute topographic quadrangle (fig. 4; pl. 1, locality 4). Altitude of top of section is 4,009 ft.

[Measured by W. I. Finch, October 18, 1971]

	<u>Feet</u>	<u>Meters</u>
Quaternary (?).		
11. Caliche, white, rubbly, forms ledge.....	5.	1.5
Triassic.		
Dockum Group:		
Chinle Formation (incomplete):		
Middle sandstone member:		
10. Sandstone and limestone-quartz-chert pebble conglomerate (mostly lower 0.5-1 m), grayish-orange (10YR 7/4), yellowish-gray, white quartz, red and black chert conspicuous; beds of fine- (composition-like sandstone of unit 9) and medium-grained (clear quartz and chert grains like pebbles of conglomerate) sandstone; clean, mostly friable, crossbedded sandstone; sparse iron-oxide replaces wood fragments in conglomerate; forms weak ledge.....	18.	5.5
9. Claystone and siltstone, yellowish-to greenish-gray, some brownish-gray (5YR 4/1); micaceous, calcareous, slightly carbonaceous; few thin limestone-pebble conglomerate lenses; some beds of pale-yellowish-brown (10YR 6/2), grayish-yellow (5Y 8/4) sandstone, very fine quartz and variously colored grains, micaceous (colorless and green), fairly clean, some silt; flat-bedded; forms mostly covered slope.....	28.	8.5
8. Claystone, grayish-red (10R 4/2), calcareous, shaly, poorly exposed.....	9.	2.7

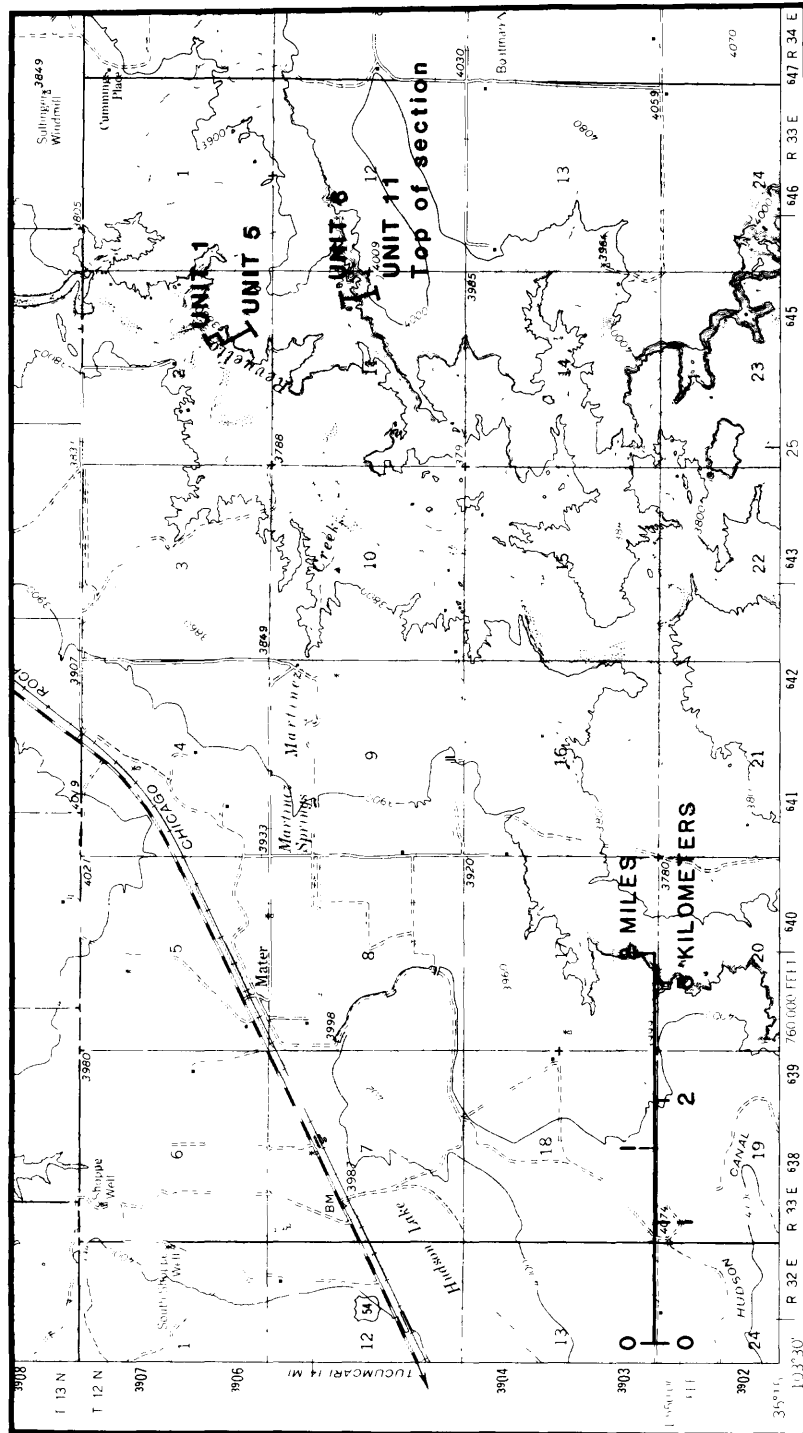


Figure 4.--Location of the line of measurement of the Henry Pittman Ranch section (pl. 1, locality 4) within the Logan 15-minute topographic quadrangle. Quay County, New Mexico

	<u>Feet</u>	<u>Meters</u>
7. Sandstone, grayish-orange to light-yellowish-brown, finely speckled white; composed of fine quartz and green and dark grains similar to unit 5 but cleaner and more quartzose toward top; white interstitial clay, micaceous, calcareous; scattered limonitic and carbonaceous wood fragments; crossbedded, local scour-and-fill structures; few claystone beds and scour fills and limestone pebble and granule conglomerate layers; forms ledge; channels into unit 6.....	<u>42.</u>	<u>12.8</u>
Total measured middle sandstone member.....	97.	29.5

Lower shale member:

6. Claystone, grayish-red (10R 4/2), yellowish-gray (5Y 8/1), weathers light-red; thin layers 3± cm thick scattered throughout upper 0.3-4.5 m; some such layers are siltstone and dirty very fine-grained sandstone similar to unit 5; calcareous; most bedding flat and parallel but some long sweeping angular light-colored bedding indicate deltaic origin; weathers as smooth curved indurated surface; part forms badlands topography; mostly steep covered slope.....	<u>70.</u>	<u>21.3</u>
Total measured Chinle Formation.....	<u>167.</u>	<u>50.8</u>

[Units 5 through 1 measured about 1/4 mi (0.4 km) to north starting at top of dip slope developed on unit 5]

	<u>Feet</u>	<u>Meters</u>
Santa Rosa Sandstone:		
5. Sandstone, light-gray (N7) to greenish-gray (5GY 6/1) in lower two-thirds, pale-red (5R 6/2) in upper one-third; complex unit chiefly of dirty very fine-grained sandstone interlensed laterally with claystone; several 15-30 cm thick limestone granule and pebble conglomerate layers (1-5 percent of lower two-thirds); some sandstone layers are clayey and weather as slopes; sandstone is variably clayey, calcareous, and very micaceous (colorless, green); some layers speckled with limonite; grains consist of quartz, and green and dark clasts; bedding ranges from crossbedded, festoon, flat-even thin bedded, and cut-and-fill scours; upper one-third is predominately poorly displayed, flat even-thick ripple-marked beds; forms weak to strong ledge, base of unit scours into unit 4; contact with unit 6 not exposed here.....	65.	20.0
4. Claystone and siltstone, grayish-red (10R 4/2), micaceous, calcareous, some sandy layers; thinly laminated, shaly; forms mostly moderate to steep slope, mostly covered; base fairly flat and even; thickness uniform except where scoured into by unit 5.....	28.	8.5
3. Sandstone, grayish-yellow (5Y 8/4) to yellowish-gray (5Y 8/1) in lower part, pale-brown (5YR 5/2) to moderate-brown (5YR 4/4) in upper part; silty to very fine quartz (various colors) and green and dark grains; very micaceous, calcareous, most is friable; strongly jointed; flat even-bedded in lower half, crossbedded (some festoon) in upper part, weathers in rounded forms; forms weak ledge, angular blocks cover slope below base; thickness variable, tends to thicken in lows on unit 1, estimated 9 m thick below corral southeast of house across creek.....	15.	4.5

	<u>Feet</u>	<u>Meters</u>
2. Claystone, grayish-red (10R 4/2), mottled greenish-gray (5 GY 6/1) locally, upper foot or so solid greenish-gray beneath unit 3; calcareous, thinly laminated, shaly; forms steep largely covered slope; upper contact flat and even; unit variable in thickness, estimated as much as 12 m thick across creek and upstream in small drainage just south of house visible from line of section.....	13.	4.0
1. Sandstone, pinkish-gray, speckled light-brown and yellowish-brown, weathers brown to light-brown; fine clear quartz, sparse red quartz and very sparse dark grains; abundant white to yellowish-white interstitial clay, micaceous (sparse muscovite); calcareous; few scattered hematitic (dark-brown) wood fragments, rarely carbonized; persistent irregular pebbly zone 7-9 m above base of outcrop with scattered well-rounded flat limestone pebbles and granules 2 mm-1 cm (one is 5 cm across) and less than 1 percent siliceous pebbles; crossbedded, mostly large foresets poorly displayed; individual beds are commonly continuous for tens of meters, undulating with as much as 12 m of relief; forms cliff with smooth faces generally along joints; base not exposed; lithologic, structural, and stratigraphic equivalent to middle sandstone member of Santa Rosa railroad-cut section locality 1.....	45+.	14.0+
Total measured Santa Rosa Sandstone.....	<u>166+.</u>	<u>51.0+</u>
Total measured Dockum Group.....	<u>333+.</u>	<u>102.0+</u>

Rana Arroyo Section

Section measured from alluvium of Rana Arroyo near mouth of Rana Canyon in sec. 15, T. 13 N., R. 36 E., northward and then eastward to rim of mesa in Martin Draw 7.5-minute topographic quadrangle, (fig. 5; pl. 1, locality 5). Beds dip steeply northward. Each unit measured and described where best exposed along strike within 50 ft of line of section. Approximate altitude of top of section is 3,700 ft.

[Measured by W. I. Finch, November 19, 1969]

	<u>Feet</u>	<u>Meters</u>
Triassic.		
Dockum Group:		
Tecovas Formation:		
6. Sandstone and conglomerate, grayish-orange (10YR 7/4), pale-grayish-yellow (10Y 8/2); mostly medium grains but partly coarse grains, granules, and pebbles of quartz, chert (yellow, brown, black, red), and limestone; scattered pebbles in sandstone and conglomerate layers; calcareous; low-angle bedding; upper 30 cm conglomeratic with white well-rounded quartz pebbles; forms ledge.....	22.	6.7
Total measured Tecovas Formation.....	<u>22.</u>	<u>6.7</u>
5. Claystone, pale-olive (10Y 6/2), mottled color of underlying unit, a probable reduction feature beneath sandstone; gradational lower contact.....	6.	1.8
4. Claystone, pale-reddish-brown (10R 5/4), micaceous; silty bottom part becoming sandy in upper part; forms steep slope largely covered by blocks of sandstone.....	53.	16.2
3. Sandstone, grayish-yellow (5YR 8/4), weathers red and gray, very fine quartz, micaceous, calcareous, thinly laminated, weathers shaly; forms ledge.....	2.	0.6
2. Sandy siltstone, grayish-yellow-green (5GY 7/2); very fine quartz, micaceous, white efflorescence; thinly bedded, shaly, upper 0.6 m contains lenses of overlying unit; forms bare steep slope, covered most other places.....	7.	2.1

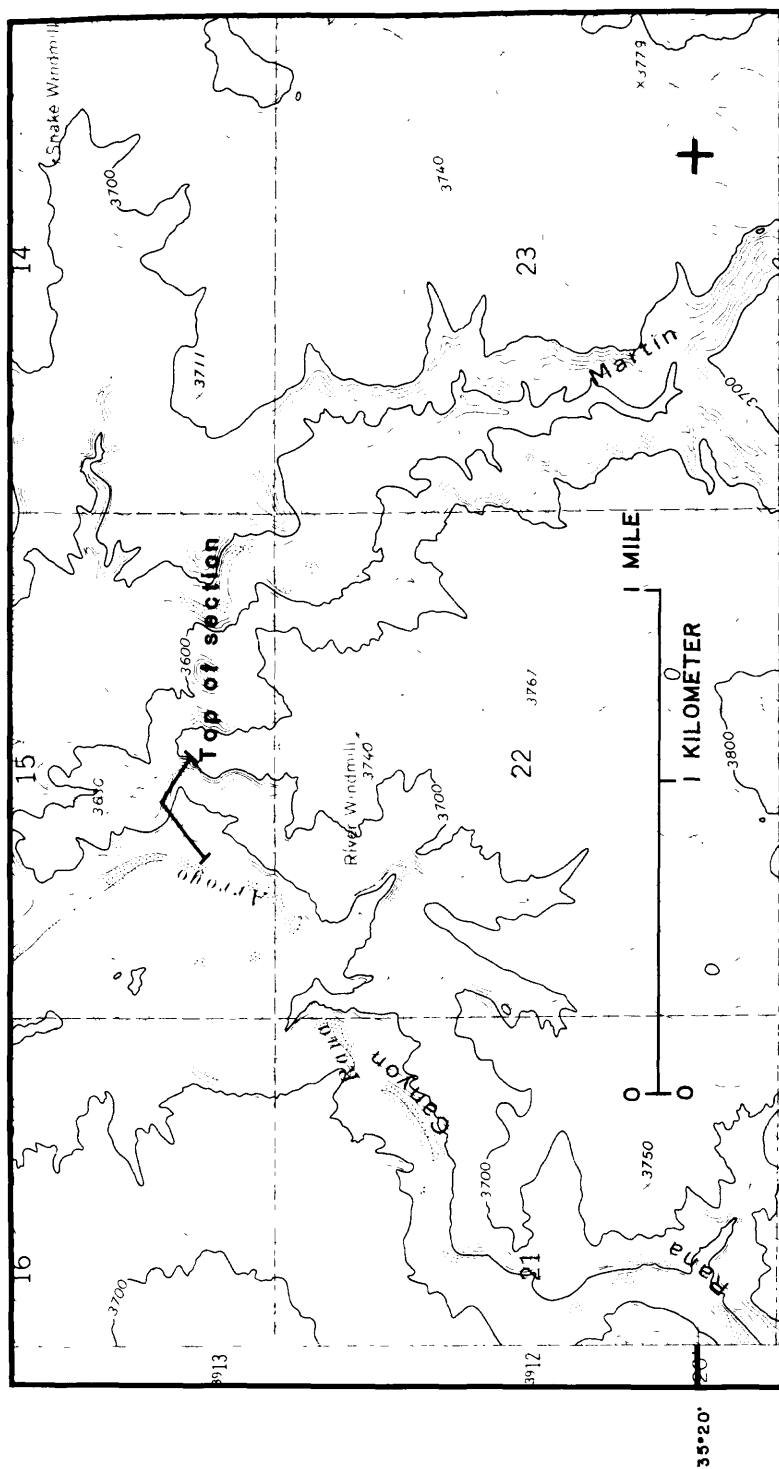


Figure 5.--Location of the line of measurement of the Rana Arroyo section (pl. 1, locality 5) within the Martin Draw 7.5-minute topographic quadrangle, Quay County, New Mexico--Oldham County, Texas

	<u>Feet</u>	<u>Meters</u>
1. Sandstone, very pale orange (10YR 8/2) to grayish-orange (10YR 7/4), very fine quartz, micaceous, soft, low-angle bedding; weathers in blocks; forms rim.....	<u>26.</u>	<u>7.9</u>
Total measured Tecovas Formation.....	<u>94.</u>	<u>28.6</u>
Total measured Dockum Group.....	<u>116.</u>	<u>35.3</u>

Revuelto Creek-U.S. Route 66 Section

Section measured along north side of U.S. Route 66 east of Revuelto Creek bridge in NW1/4 sec. 29, T. 11 N., R. 33 E., in San Jon NW 7.5-minute topographic quadrangle (fig. 6; pl. 1, locality 6). Altitude of base of section is 3,875 ft.

[Section measured by W. I. Finch, October 10, 1969]

	<u>Feet</u>	<u>Meters</u>
Triassic.		
Dockum Group:		
Chinle Formation (incomplete):		
Middle sandstone member:		
8. Sandstone and limestone-pebble conglomerate, interlayered in about equal amounts, character similar to unit 6 below.....	3.	0.9
7. Sandstone, yellowish-gray, very fine clear, red, brown, and green quartz; dirty; forms ledge.....	8.	2.4
6. Sandstone and limestone-pebble conglomerate, yellowish-gray (5Y 8/1), very fine clear, red, and green quartz; dirty; flat-bedded to crossbedded; conglomerate forms thin layers in lower foot and upper few inches; unit forms mostly covered slope.....	11.	3.4
5. <u>Unio</u> bed, greenish-gray (5G 6/1), <u>Unio</u> shells 30-50 cm across and sparse limestone granules in calcareous mudstone matrix; hard, forms distinct bed about 30 cm thick and 3-4 m long about 45 m north of roadway, thins to less than 30 cm thick northward.....	1.	0.3
4. Claystone, pale-reddish-brown (10YR 5/4); forms steep partly covered slope.....	30.	9.1

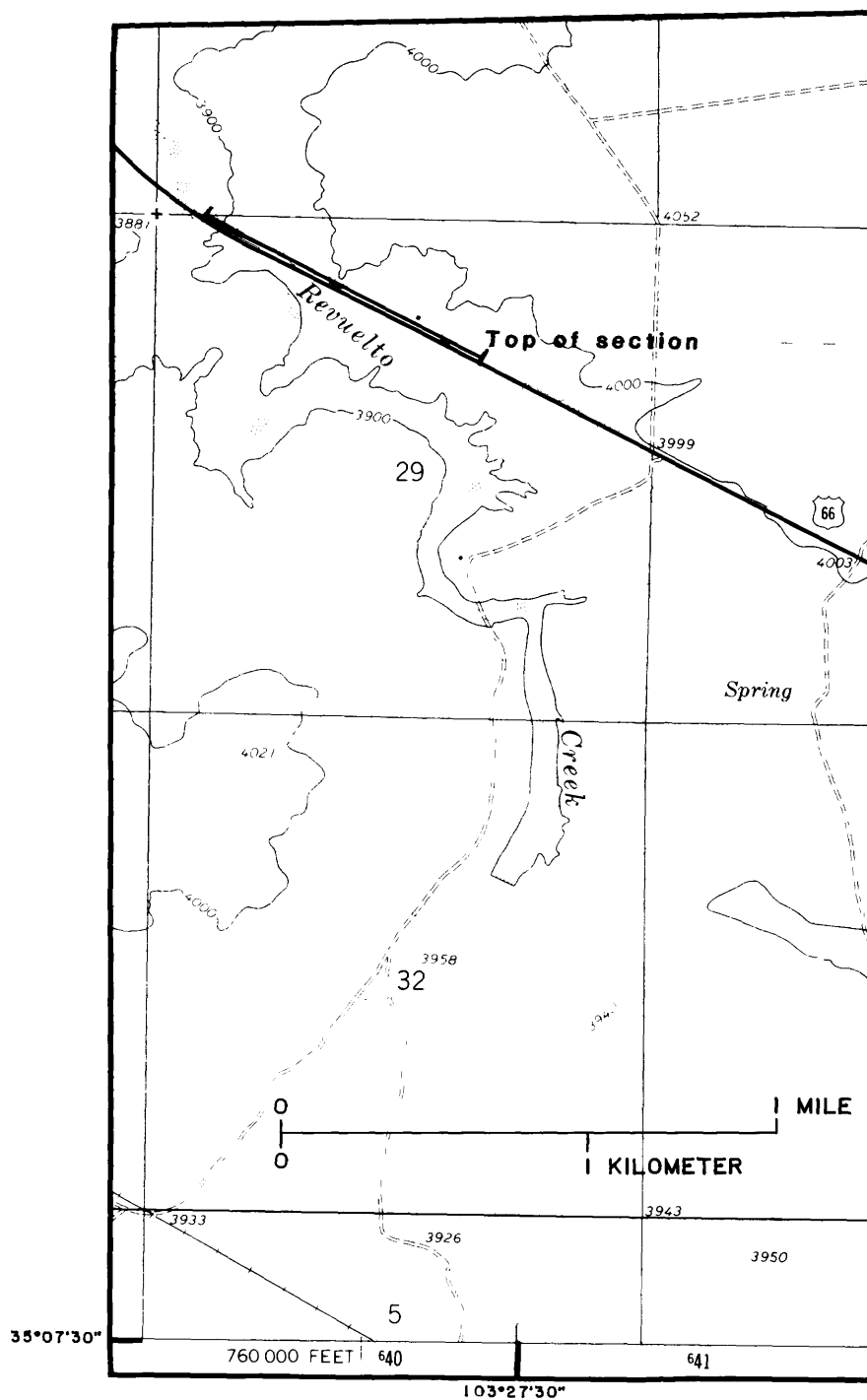


Figure 6.--Location of the line of measurement of the Revuelto Creek-U.S. Route 66 section (pl. 1, locality 6) within the San Jon 7.5-minute topographic quadrangle, Quay County, New Mexico

	<u>Feet</u>	<u>Meters</u>
3. Sandstone, yellowish-gray (5Y 8/1), weathers light-olive-gray, brownish in places; very fine to fine-grained, locally coarser; chiefly clear, white, orange, and red quartz and abundant dark grains, micaceous; calcareous; pebbly in part, pebbles 4-8 mm across consist mostly of yellow, black, and brown chert, sedimentary rock fragments (mainly light gray limestone and calcareous shale), and white quartz; crossbedded, scour-and-fill structures, irregularly bedded, thin shaly splits and beds most abundant in lower 1.5 m; radioactive carbonized and limonitic fossil wood fragment about 1.5 m above base.....	40.	12.2
2. Conglomerate, greenish-gray (5GY 6/1); chiefly rounded limestone pebbles and granules, generally less than 10 mm diameter but as much as 75 mm at base; sparse red, gray, and black chert and yellow quartz pebbles; few <u>Unio</u> fossils; thickness uneven, erosional unconformity at base; in arroyo 50 m to south unit is 1.5 m thick and contains geodes 25-125 mm in diameter, septarian concretions, and shale clasts as much as 0.3 m long; shale clasts 10-15 cm across concentrated at base.....	<u>3.</u>	<u>0.9</u>
Total measured middle sandstone member.....	<u>96.</u>	<u>29.2</u>
Lower shale member:		
1. Claystone, dark-reddish-brown (10 R 3/4) upper 6 m, pale-reddish-brown (10R 5/4) lower 6 m, sparse light-gray sandstone lenses as much as 30 cm thick; weak, very high angle foreset bedding as much as 5 m high suggests deltaic deposition.....	<u>40+.</u>	<u>12.2+</u>
Total measured lower shale member.....	<u>40+.</u>	<u>12.2+</u>
Total measured Chinle Formation.....	<u>136+.</u>	<u>41.4+</u>

TEXAS

Armstrong County

State Route 284 - Pleasant Creek Section

Section measured along west side of State Route 284 up hill east of Pleasant Creek, just south of center of Pleasant Creek 7.5-minute quadrangle (fig. 7; pl. 1, locality 16). Altitude of base of section is 2,680 ft. Base of Triassic not exposed in road cut, part of lower part of section measured in slump blocks and thickness is adjusted.

[Measured by W. I. Finch, Nov. 18, 1970]

	<u>Feet</u>	<u>Meters</u>
Pliocene.		
Ogallala Formation:		
Caliche, thickness not measured:		
Triassic.		
Dockum Group:		
Trujillo Formation:		
7. Sandstone (90 percent) and limestone-pellet conglomerate, yellowish-gray (5Y 8/1), very fine to fine quartz and green grains, calcareous, crossbedded to flat flaggy beds, scour at base; on point west and across road unit is 25-30 ft (7.6 -9 m) thick.....	19.	5.8
6. Sandy claystone, dark-reddish-brown (10R 3/4) coarse to very coarse quartz; some 1/4 in. (0.3 m)- thick, horizontally bedded, flaggy sandstone layers near top; mainly forms covered slope; this and unit 7 measured south of entrance to rest stop.....	43.	13.1

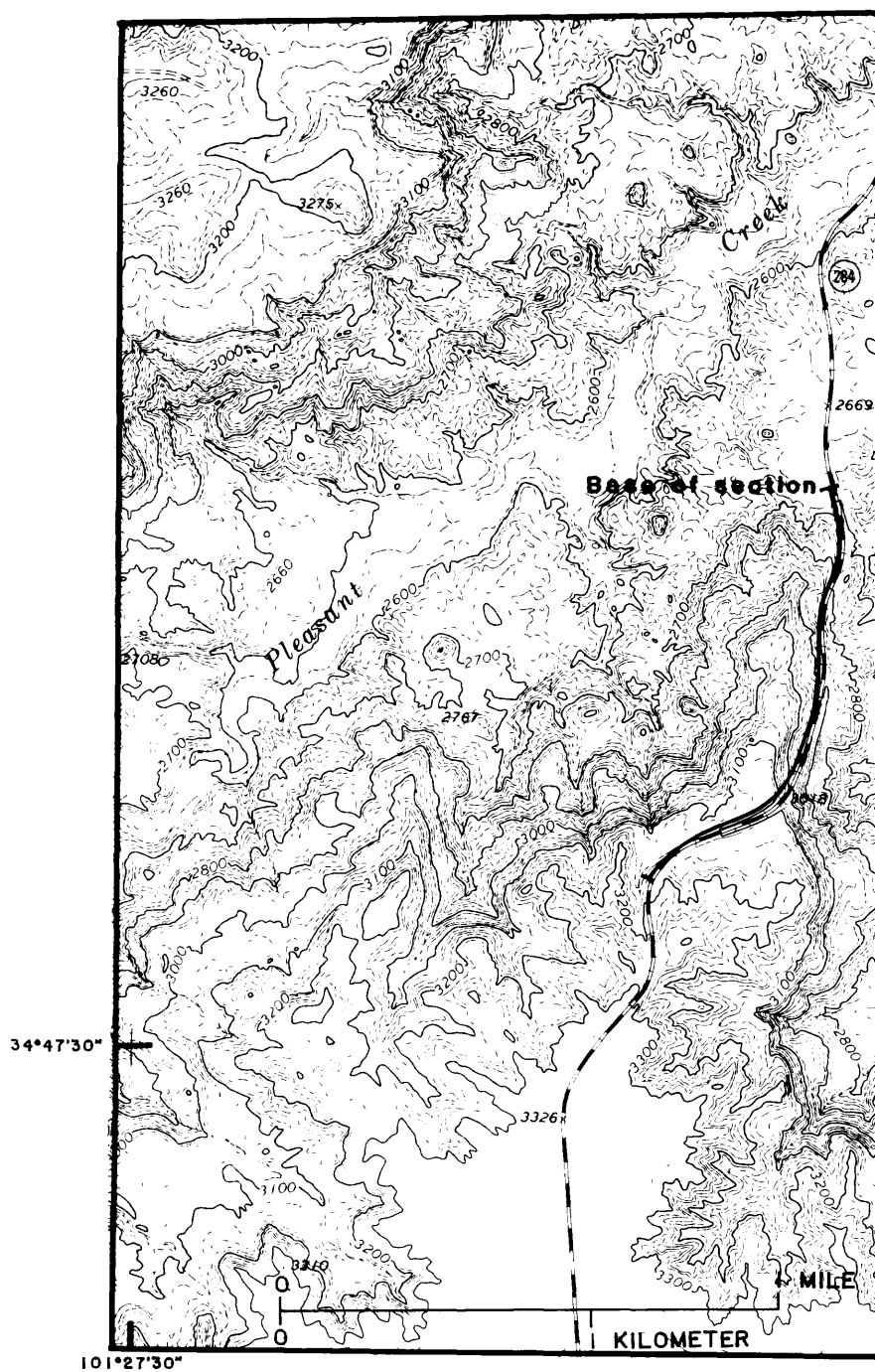


Figure 7.--Location of the line of measurement of the state Route 284-Pleasant Creek section (pl. 1, locality 16) within the Pleasant Creek 7.5-minute topographic quadrangle, Armstrong County, Texas

	<u>Feet</u>	<u>Meters</u>
5. Sandstone (90 percent), gray limestone-pebble conglomerate (5 percent near top), and red and greenish-gray claystone (5 percent); sandstone: yellowish-gray, dirty, poorly sorted fine-grained, calcareous, white interstitial clay, fluvially crossbedded; unit formed by three parts: lower part is 25-30 ft (7-9 m) thick and scours into underlying unit, uneven claystone layer 5± ft (1.5 ± m) thick, and main upper ledge that locally cuts out claystone and truncates the lower sandstone; thickness of unit ranges from 25-52 ft (7.6-15.8 m).....	52.	15.8
4. Sandstone (60 percent), limestone-pebble conglomerate (35 percent), and red claystone (5 percent); sandstone: yellowish-gray (5Y 8/1); well-sorted medium-grained clean calcareous; flat to undulatory sandstone beds a few inches (cm) to 10 ft (3m) thick; very complex unit; 30-ft (9-m) thick channel filled with pale-reddish-brown (10R 5/4) very fine grained clayey sandstone that cuts out part of unit; unit 5 nearly cuts out this fine-grained channel fill; forms ledgy slope; thickness ranges from 45 ft (13.7 m) in line of section to 70 ft (21.3 m) a short distance away.....	45.	13.7
Total thickness of Trujillo Formation.....	<u>159.</u>	<u>48.4</u>
Tecovas Formation:		
3. Claystone, sandstone, and conglomerate, varicolored, reddish-, purplish-, and yellowish-gray; flat chips and blocks measure a few inches long in clayey sand matrix; clasts differ in color from matrix, shaly, some irregular siliceous layers as much as 1 ft thick; gradational with unit 2; 37 ft (11.3 m) exposed here overlain by some rubble; section covered for 200 yds (180 m) up hill where similar lithology is exposed; small- to large-scale crossbeds, wavy beds in upper 10 ft (3 m); some scours filled with limestone-pellet conglomerate.....	50±.	15.2±

	<u>Feet</u>	<u>Meters</u>
2. Claystone and sandstone, pale-reddish-brown (10R 5/4), pale-red (10R 6/2); lower 2 ft (0.60 m) grades upward into friable, micaceous, poorly sorted medium-grained clayey sandstone; lies on unit 1 with erosional unconformity; half-in. (1.2 cm) wide and 1.5- ft (0.45 m) tall mud-crack filling into unit 1, some filled with siliceous light-colored quartz sand; irregular yellowish-gray clean fine quartz sandstone layers scattered throughout; main sand is dirty, noncalcareous; the 8 ft (2.4 m) exposed here covered by landslides for 100 yds (90 m) up road where on east side of road base and 11 ft (3.3 m) are exposed and overlain by unit 3, weathers like shale.....	11±.	3.4±
1. Sandstone and quartz-chert pebble conglomerate, light-brown (5YR 6/4) to moderate-reddish-orange (10R 6/6), upper 2-3 ft yellowish-gray (5Y 8/1); poorly sorted medium-grained quartz and chert, micaceous, noncalcareous; pebbles chiefly of white and yellow-stained quartz and dominantly greenish yellow chert but also black, gray, red, and sedimentary-layered chert (some contain fossils), sparse brick-red pebbles, and brown and gray silicified shale clasts; pebbles are scattered and in two 2±-ft (0.6 m) thick layers, one near top and one near base; unit somewhat friable and forms fluted surface in roadway; base not exposed but surely not far below; several irregular zones near middle are impregnated with oil residue; unit is mostly reworked Permian (Quartermaster Formation) with addition of grains and pebbles from older rocks.....	25+.	7.6+
Total thickness of Tecovas Formation.....	86+.	26±.
Total thickness of Dockum Group.....	<u>245±.</u>	<u>74.6±</u>

Feet Meters

Permian.

Quartermaster Formation:

Not measured:

Borden County

Muchakooago Peak Section

Section measured on the southwest side of Muchakooago Peak (Mushaway Peak on some maps) about 4 mi (6.4 km) south-southeast of Gail, Borden County, Texas in Mushaway Peak 7.5-minute topographic quadrangle (fig. 8; pl. 1, locality 25). Compare to section of Drake (1892, p. 237) and Hoots (1925, p. 89). See also well 523 of McKee and others (1959) located about 1 mi (1.6 km) west-southwest of section. Approximate altitude base of section is 2,500 ft.

[Measured by W. I. Finch, May 24, 1969]

	<u>Feet</u>	<u>Meters</u>
Lower Cretaceous.		
Edwards Limestone:		
9. Limestone, very-pale-orange (10YR 8/2), fossiliferous, Exogyra K fossils	5.	1.5
Triassic.		
Dockum Group:		
Chinle Formation:		
8. Claystone, dark-reddish-brown (10R 3/4), covered for most part, lower 15 ft (4.6 m) forms sloping bench, upper 25 ft (7.6 m) forms steep slope covered with rubble from overlying limestone.....	40.	12.2
7. Siltstone, light-olive-gray (5Y 5/2), lower 6± ft (1.8 ± m), dark-greenish-brown (10R 3/4) upper part, colors laminated at contact of two colors; very fine grained quartz, clayey, calcareous, thinly flat-bedded.....	12.	3.7
Total thickness of Chinle Formation.....	<u>52.</u>	<u>15.9</u>

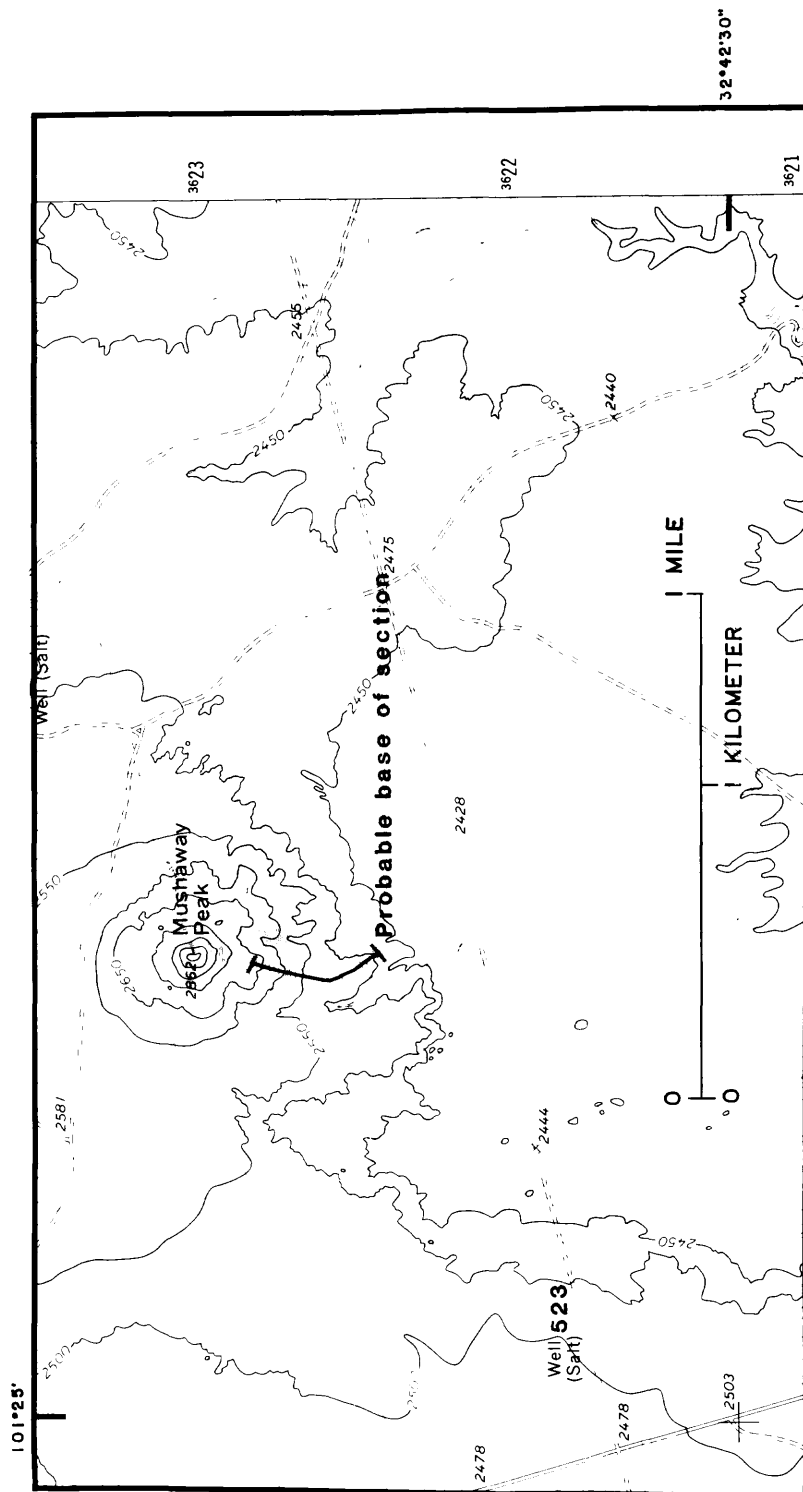


Figure 8.--Location of the inferred line of measurement of the Muchakooago Peak section (pl. 1, locality 25) within the Mushaway 7.5-minute topographic quadrangle, Borden County, Texas

	<u>Feet</u>	<u>Meters</u>
Trujillo Formation:		
6. Pebbly sandstone, grayish-yellow (5Y 8/4), medium-grained quartz, micaceous, slightly calcareous; most pebbles are white-stained yellow quartz; probably equivalent to upper part of unit 5; black-surfaced iron-stained calcareous flat rounded concretions as much as 2 ft (0.6 m) in diameter weather out.....	5.	1.5
(Units above were measured at head of tributary to east)		
5. Quartz-pebble conglomerate, grayish-orange (10YR 7/4) matrix; most quartz pebbles are white, many stained light-yellow, red, and gray; about 1 percent bluish-gray silicified sedimentary rock pebbles; some limestone pebbles and boulders; calcareous matrix; upper surface forms terrace that extends northward about 1/4 mi (0.4 km) toward summit of peak, upper surface of terrace contains very abundant gray to black banded silicified sedimentary rock pebbles; fossil tooth removed from matrix in middle of unit; contact with lower unit is irregular, some interfingering of two units.....	8.	2.5
4. Limestone-pebble conglomerate and limestone-granule sandstone, yellowish-gray (5Y 7/2); a calcareous, micaceous, crossbedded very fine to coarse-grained quartzose sandstone lense about 5 ft (1.5 m) thick in center part.....	<u>20.</u>	<u>6.1</u>
Total thickness Trujillo Formation.....	<u>33.</u>	<u>10.1</u>
Tecovas Formation (incomplete):		
3. Claystone, dark-reddish-brown (10R 3/4), upper 1.5-2 ft (0.15 - 0.60 m) pale-olive (10Y 6/2), micaceous.....	28.	8.5
2. Limestone-granule sandstone and limestone-pebble conglomerate, (10R 5/4), light-gray in irregular zone 0-6 in (0 - 2.4 cm) thick at base, chiefly limestone and shale granules and small pebbles as much as 0.5 in (1.2 cm) in diameter, some coarse quartz grains; crudy appearance; crossbedded; forms ledge.....	7.	2.1

	<u>Feet</u>	<u>Meters</u>
1. Claystone, pale-reddish-brown (10R 5/4), sparse gray mottling along weak bedding, sparse coarse quartz grains, noncalcareous, soft; forms rubble-covered slope, somewhat frothy surface suggests montmorillonitic clay.....	<u>35.</u>	<u>10.7</u>
Total measured thickness Tecovas Formation..	<u>70+.</u>	<u>21.3+</u>
Total measured thickness Dockum Group.....	<u>155+.</u>	<u>47.3+</u>

Briscoe County

The Narrows-Tule Creek Section

Section measured along steep trail on the west side of Tule Creek about one-half mi (0.8 km) north of "The Narrows" in the Cope Creek 7.5-minute quadrangle, Briscoe County, Texas (fig. 9; pl. 1, locality 17). Parts of section not described in detail. Some thicknesses are only approximate and based on those intersected in drill hole about 2,000 ft (610 m) to northwest. Local absence of Tecovas and thick sandstone development here may be important for uranium exploration. Altitude of base of section is 2,700 ft.

[Measured by J. C. Wright August 27, 1967, and modified by W. I. Finch October 16, 1969]

	<u>Feet</u>	<u>Meters</u>
Tertiary.		
Pliocene:		
Ogallala Formation:		
5. Caliche caprock at top about 35 ft thick; underlain by interbedded clay, silt, sand, and gravel, poorly cemented, forms steep slope.....	~200.	~61.
Triassic.		
Dockum Group:		
Chinle Formation:		
4. Claystone, reddish-brown, light-colored streaks outline large-scale crossbeds as much as 60 ft (18 m) high, very silty, greenish-gray sandstone channel-fills 10-30 ft (3-9 m) thick form ledges mainly in lower half; unit forms steep slope here and cliffs in main part of The Narrows.....	~180.	~55.
Total measured Chinle Formation.....	<u>~180.</u>	<u>~55.</u>
Trujillo Formation:		
3. Sandstone and conglomerate, sandstone: light- colored, quartzose; crossbedded, scour and channel fills; conglomerate: gray, chiefly limestone and siltstone granules and pebbles, fairly flat even-thick layers; unit forms cliff.....	75.	22.9

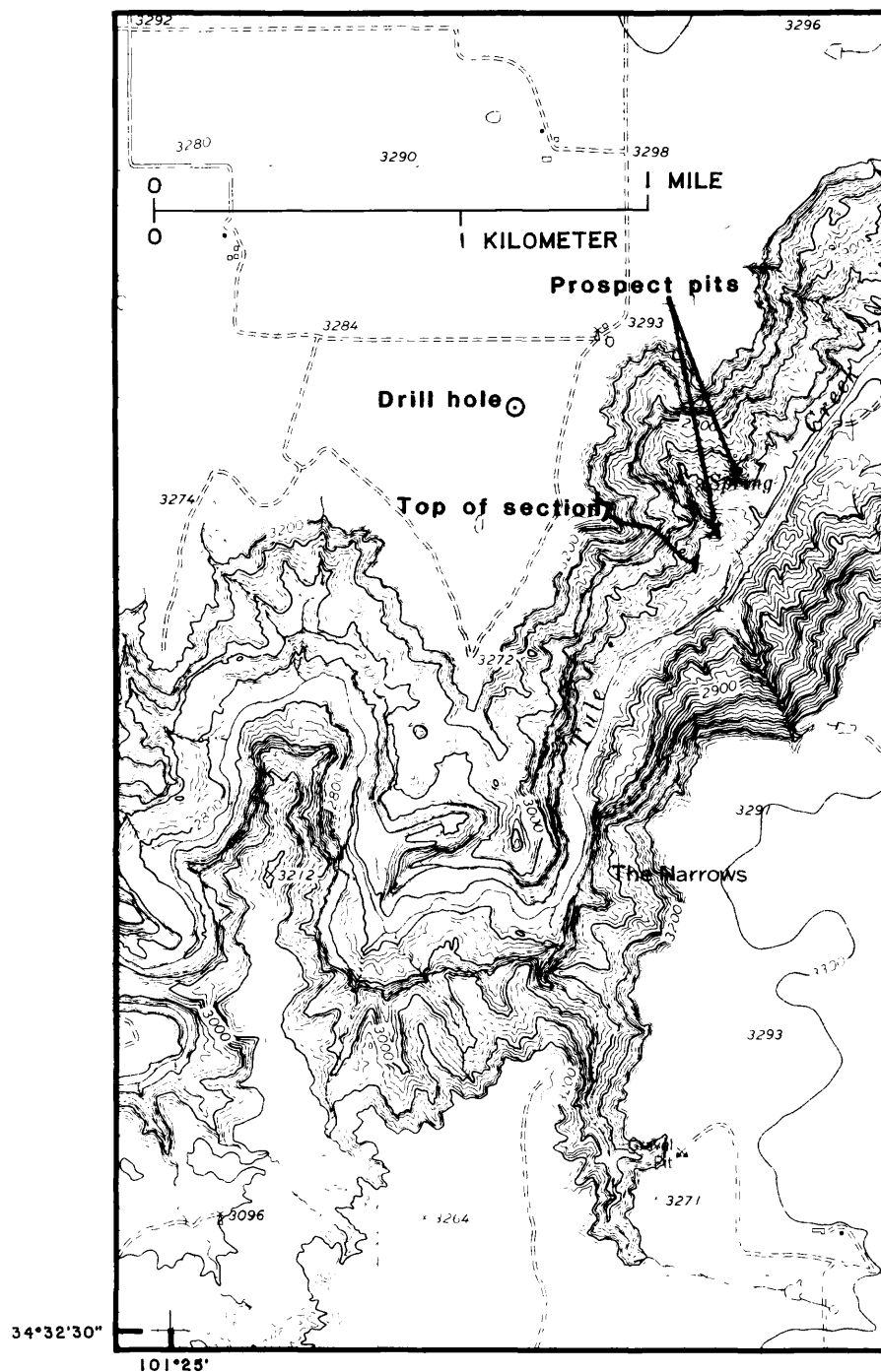


Figure 9.--Location of the line of measurement of The Narrows-Tule Creek section (pl. 1, locality 17) within the Cope Creek 7.5-minute topographic quadrangle, Briscoe County, Texas

2. Claystone, reddish-brown, mostly covered steep slope.....	~55.	~16.8
1. Sandstone, yellowish-white, well-sorted fine quartz, sparse white clay grains, clean, friable; 8-10 ft (2.4-3.0 m) of black claystone about 20 ft (6.1 m) above base of unit, contains abundant carbonized and fossil wood and leaf imprints, fish fossils 4-6 in. (10-15 cm) long, and coprolites; radioactive spots and layers as much as 1-ft (0.3 m) thick (1,200-2,000 counts per second radioactivity in prospect pit across draw about 600 ft (180 m) to north, autunite and andersonite(?) associated with limonite and jarosite; ferrimolybdite reported (S. R. Austin, U.S. Atomic Energy Commission, written commun., 1961); base of unit not examined; unit forms steep slope with bench at carbonaceous claystone horizon; thickens to 70 ft (21 m) to south.....	50.	15.2
Total measured Trujillo Formation.....	<u>~180.</u>	<u>~55.</u>

Tecovas Formation:

Absent here

Total measured Dockum Group.....	<u>~360.</u>	<u>~110.</u>
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Permian.

Quartermaster Formation:

Not measured

Mexican Creek Hill-State Route 256 Section

Section measured along south side of road cut of State Route 256 parallel to Mexican Creek, Briscoe County, Texas in Theo 7.5-minute quadrangle (fig. 10; pl. 1, locality 18). Altitude of top of section is 3,005 ft.

[Measured by W. I. Finch, Nov. 19, 1970]

	<u>Feet</u>	<u>Meters</u>
Pliocene.		
Ogallala Formation:		
Conglomerate and caliche. Not measured.		
Triassic.		
Dockum Group:		
Trujillo Formation:		
8. Claystone, pale-reddish-brown, calcareous, sandy in part; thinly laminated pale-reddish-brown and grayish-green siltstone and limestone-pellet beds in upper 5 ft; (1.5 m); dips westward and is also truncated by Ogallala Formation.....	20.	6.1
7. Limestone-pellet conglomerate (40 percent) and soft clayey sandstone (60 percent); conglomerate forms ledges 6 in. (15 cm) to 3 ft (0.9 m) thick, yellowish- to greenish-gray; clayey sandstone beds 3-8 ft (0.9-2.4 m) thick, light-brown to greenish-gray, sparse black carbonaceous films in lower 10 ft; (3 m) unit dips westward 2°-3° and is truncated by Ogallala Formation.....	40.	12.2
6. Claystone and siltstone, pale-reddish-brown, sandy, well-rounded claystone and siltstone chips in poorly sorted coarse sand matrix, flat and curved 1-2 ft (0.3-0.6 m) thick beds of limestone-pellet conglomerate and Permian-like (unit 1) sandstone in basal part; gradational and interlenses with units 5 and 7; shaly; forms covered slope along the creek.....	70.	21.3

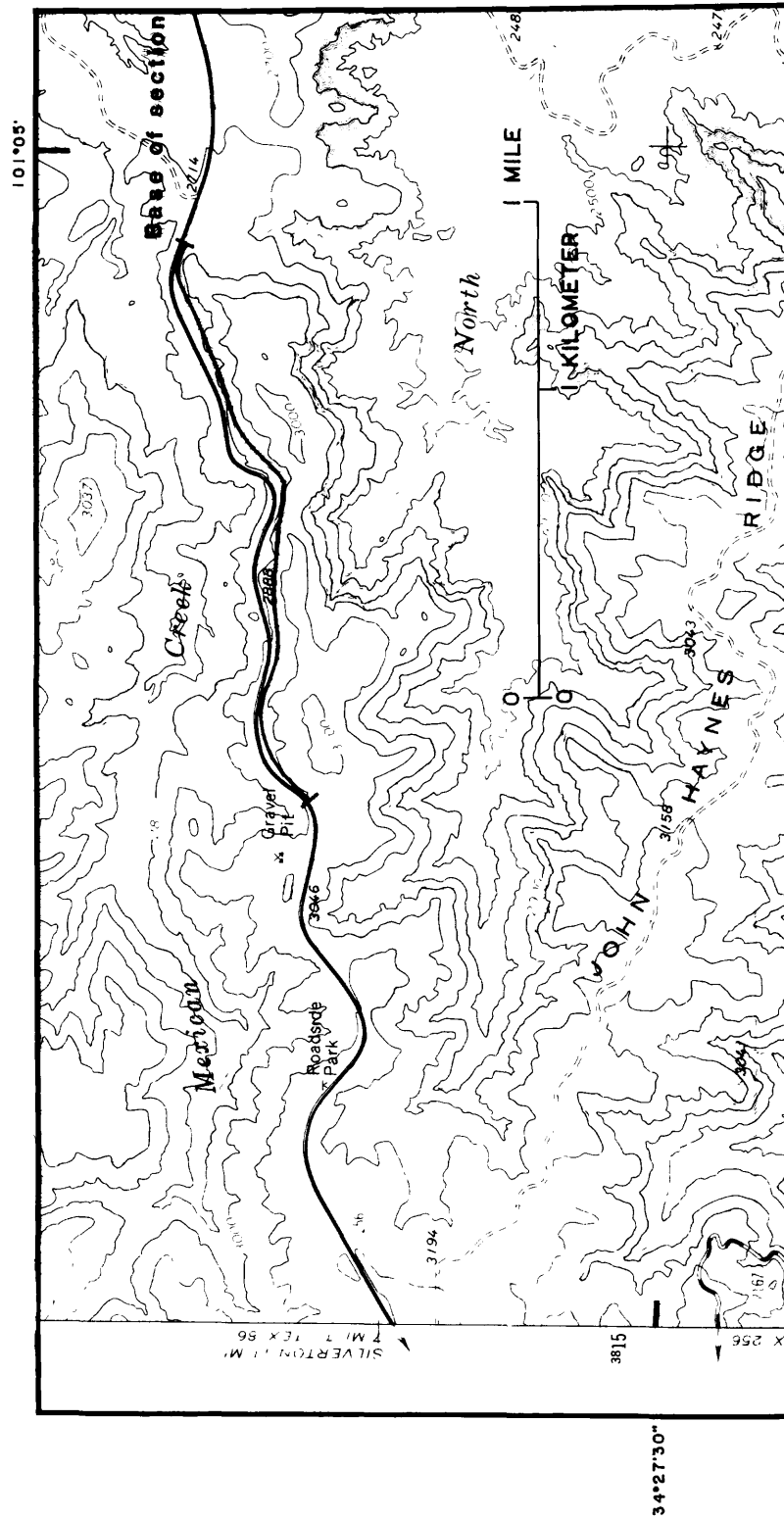


Figure 10.--Location of the line of measurement of the Mexican Creek Hill-State Route 56 section (pl. 1, locality 18) within the Lake Theo 7.5-minute topographic quadrangle. Briscoe County, Texas

	<u>Feet</u>	<u>Meters</u>
5. Sandstone (85 percent), limestone-pellet and -pebble conglomerate (10 percent), and claystone (5 percent); sandstone, yellowish-gray (5Y 8/1), light-greenish-gray (5GY 8/1); very fine to fine clayey quartz and green and orange grains, micaceous, calcareous; conglomerate, grayish-red and greenish-gray, granule size grains (2-4 mm) well-rounded; first bed at 32 ft (9.8 m) above base forms channel fill of local extent, another bed 40-50 ft (12-15 m) above base of unit contains angular pieces of laminated siltstone as much as 6 in. (15 cm) long at base, other layers above this; claystone, grayish-red, some grayish-green irregular patches; channel-fills more common in lower part, more curved and flat bedded in upper part; quartz-chert conglomerate 1-3 ft (0.3-0.9 m) thick locally present at base.....	85.	25.9
Total thickness of Trujillo Formation.....	<u>215.</u>	<u>65.5</u>
Tecovas Formation:		
4. Claystone and siltstone, grayish-red (10R 4/2) and pale-reddish-brown; micaceous, thinly laminated, calcareous in clayey part; either crossbedded or tilted-because it forms angular contact with overlying unit, cut completely out by adjacent units nearby; base is on planar bevelled surface of under-lying unit.....	0-10.	0-3.1
Total thickness of Tecovas Formation.....	<u>0-10.</u>	<u>0-3.1</u>
Tecovas(?) Formation:		
3. Sandstone, mottled, banded in beds of pale-red (5R 6/2) to yellowish-gray (5Y 8/1) (resembles the Chinle "purple-white bed" of Finch, 1959), poorly sorted, generally coarse quartz, chert, and rock grains; noncalcareous; some lenses of reworked Permian sandstone in lower part; complexly bedded, contorted, wavy, channel fills, some root-like casts; appears to be weathered (soil) zone developed before deposition of normal Triassic rocks; locally elsewhere thickens to 30 ft (9 m).....	25.	7.6

	<u>Feet</u>	<u>Meters</u>
2. Sandstone (80 percent), claystone (8 percent), and quartz-chert conglomerate (2 percent); interlayered and intermixed; sandstone, identical to but coarser than unit 1 becoming coarser toward top, generally pale-reddish- brown, individual crossbeds and flat beds are yellowish-gray, some yellowish- gray bands roll across bedding, bedding is both fluvial and eolian; claystone, grayish-red (10R 4/2), micaceous, noncalcareous, beds a foot (0.3 m) or less thick mixed with pebbles and sand, and galls as much as 1-ft (0.3 m) across in sandstone; pebbly claystone forms base; this unit channels into Permian, represents reworked zone younger than overlying weathered unit 3; intergrades with unit 3.....	<u>30±.</u>	<u>9.1±</u>
Total thickness of Tecovas(?) Formation.....	<u>55±.</u>	<u>16.7±</u>
Total Thickness of Dockum Group.....	<u>270±.</u>	<u>82±.</u>

	<u>Feet</u>	<u>Meters</u>
--	-------------	---------------

Permian.

Quartermaster Formation (incomplete):

- | | | |
|--|-------------|-------------|
| 1. Sandstone, pale-reddish-brown (10R 5/4), very fine quartz and dark-grains, silty, micaceous, slightly to moderately calcareous, some Liesegang bands of lighter shades; some near-vertical calcareous veinlets; eolian crossbedded, forms slickrim on north side of creek; total thickness less than 50 ft (15 m); underlying Quartermaster measured..... | <u>30+.</u> | <u>9.1+</u> |
|--|-------------|-------------|

Lingos Falls Section

Section measured from point half a mile below Falls to the Falls and thence southwestward up tributary of Los Lingos Creek (fig. 11; pl. 1, locality 19). Section is in the north-central part of Edgemon Lake 7.5-minute quadrangle, Briscoe County, Texas. Approximate altitude of base of section is 2,705 ft.

[Measured by W. I. Finch, April 23, 1971.]

Feet Meters

Pliocene.

Ogallala Formation:

Conglomerate and caliche. Not measured

Triassic.

Dockum Group:

Trujillo Formation:

- | | | |
|---|-----|------|
| 8. Claystone, dark-reddish-brown (10R 3/4), calcareous, forms soft surface, largely covered; as much as 50 ft (15 m) thick on north side of Los Lingos Creek..... | 10. | 3.1 |
| 7. Sandstone and limestone-pebble conglomerate; sandstone, grayish-orange (10YR 7/4), yellowish-gray, very fine to fine quartz and orange grains, silty, micaceous, calcareous, crossbedded; conglomerate, yellowish-gray to reddish-brown, limestone granules 1-4 cm diameter, well-rounded; upper part covered: may be thin claystone beds; unit forms ledge; traceable on both sides of Los Lingos Creek canyon..... | 45. | 13.7 |
| 6. Claystone and flat, uneven, thin beds as much as 5 ft (1.5 m) thick of siltstone and very fine grained sandstone chiefly in lower part (40 percent); claystone, grayish-red (10R 4/2), very pale green (10G 8/2) beneath sandstone beds, micaceous (dark-colored), weakly calcareous, conchoidal fractures, forms loose slope largely covered; siltstone and sandstone, very pale orange (10YR 7/4), calcareous, large- and very small scale hackly surfaced crossbeds.... | 53. | 16.1 |

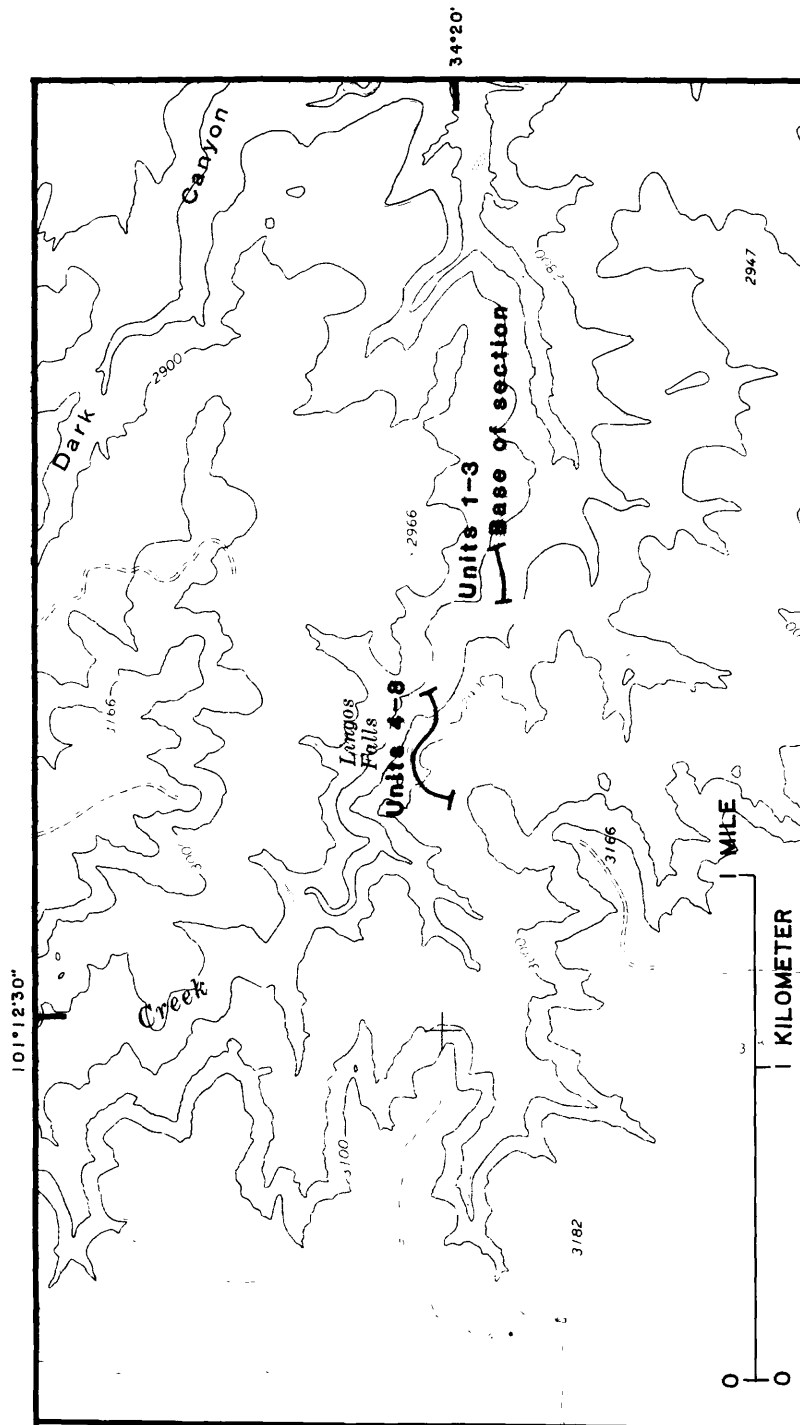


Figure 11.--Location of the line of measurement of the Lingos Falls section (pl. 1, locality 19) within the Edgemon Lake 7.5-minute topographic quadrangle, Briscoe County, Texas

	<u>Feet</u>	<u>Meters</u>
5. Sandstone, claystone, and quartz-chert pebble conglomerate; sandstone, yellowish-gray (5Y 8/1), light-brown (5YR 5/6), beds of well-sorted fine to coarse-grained, chiefly quartz, abundant green grains and some white to cream-colored clay grains, micaceous, calcareous, hard, crossbedded, large festoon-type beds 30 ft (9 m) across and 100 ft (30 m) long; claystone, few lenses 1-5 ft (0.3-1.5 m) thick and 100± ft (30± m) long, dark-reddish-brown (10R 3/4) to grayish-yellow-green (5GY 7/2), one noted 45-50 ft (13.7-15.2 m above base along steep trail out of canyon, others seen across canyon; conglomerate, pebbles dominantly pale-white (many yellowish- and reddish-mottled), conspicuous black chert (1+ percent); sharp erosional contact with underlying unit; forms overhanging ledge; base of unit forms lip of Lingos Falls.....	98.	29.9
4. Sandstone, yellowish-gray (5Y 7/2) to grayish-orange (10YR 7/4) and light-brown (10YR 6/4), well-sorted, locally silty, fine quartz and dark grains, scattered quartz and chert pebbles along bedding in upper 3/4 of unit, friable; forms massive steep smooth walls and rounded forms where not steep, eolian bedding well displayed locally; unit has erosional contact with underlying Permian with some reworking of Permian.....	40.	12.2
Total measured thickness of Trujillo Formation.....	<u>246.</u>	<u>75.0</u>

Permian.

Quartermaster Formation (incomplete):

3. Claystone, dark-reddish-brown (10R 3/4), abundant biotite? noncalcareous, shaly, indistinctly bedded to massive, conformable with underlying unit; unit thins to 3 ft (0.9 m) where it is covered upstream at a point 400 yds (365 m) below falls.....	8.	2.5
2. Siltstone, dark-reddish-brown (10R 3/4), micaceous (green), shaly, noncalcareous.....	11.	3.3

	<u>. eet</u>	<u>Meters</u>
1. Sandstone, pale-reddish-brown (10R 5/4), upper 4-6 in. pale-green (10G 6/2) to greenish-gray (GY 6/11), very fine quartz and dark grains micaceous, well-packed, well-sorted, calcareous; upper surface is flat; base of unit not exposed; unit not exposed far downstream or upstream due to undulatory dip; this exposure on north side of creek is about 500 ft (150 m) long.....	<u>5.</u>	<u>1.5</u>
Total measured thickness of Quartermaster Formation.....	<u>24.</u>	<u>7.3</u>

Crane County

Castle Mountain West Section

Section measured at prominent point west of Castle Mountain starting at well of Cowden Bros. "B" lease east side of U.S. 385 about 6 mi (10 km) south of Crane, Crane County, Texas in Castle Gap 7.5-minute quadrangle (fig. 12; pl. 1, locality 27). Compare to Hoots (1925, p. 96) Red Point section. Altitude of base of section about 2,595 ft.

[Measured by W. I. Finch, April 18, 1970]

	<u>Feet</u>	<u>Meters</u>
Cretaceous.		
Antlers Sand: Not measured		
Triassic.		
Dockum Group (incomplete):		
Trujillo Formation:		
7. Sandstone, various shades of brown, medium to coarse quartz grains, sparse scattered quartz and dark-chert pebbles; unstructured to crossbedded; weathers into tilted blocks as much as 50 ft (15 m) across.....	~35.	~10.7
Total measured Trujillo Formation.....	<u>~35.</u>	<u>~10.7</u>
Tecovas Formation (incomplete):		
6. Covered slope, probably red shale.....	15.	4.5
5. Sandstone, pale-brownish-gray and white-speckled brown, very fine to fine quartz grains, abundant white interstitial clay, micaceous; lower part thinly bedded; lower part forms slope, upper part forms ledge.....	13.	4.0
4. Claystone and shale, grayish-red (10R 4/2), sparse mica, forms mostly covered slope.....	23.	7.0
3. Sandstone, light-brownish-gray, weathers light-brown, sparse limonite speckling, fine-grained quartz, calcareous, well-indurated; upper part thinly bedded, crossbedded; lower half forms massive ledge.....	10.	3.1

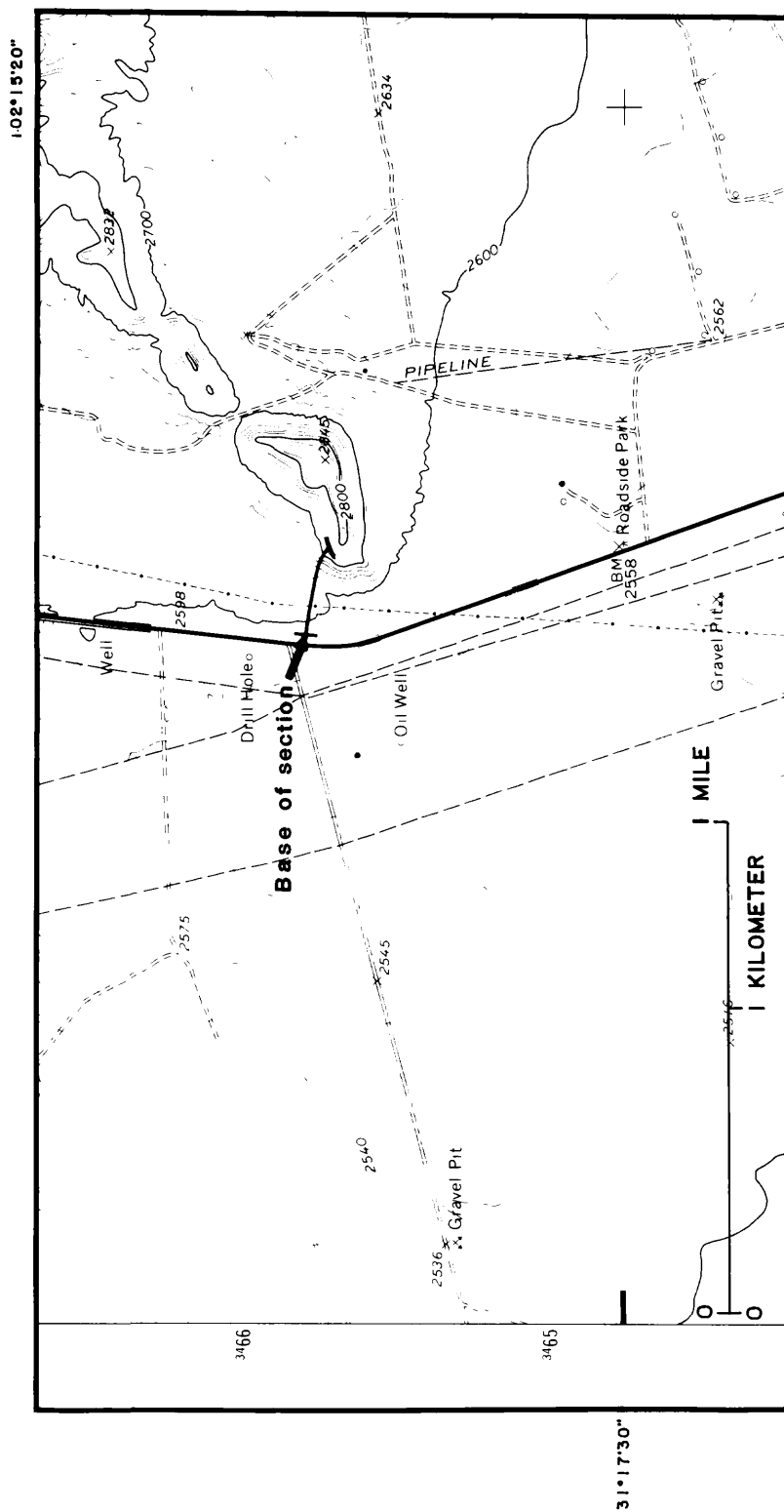


Figure 12.--Location of the line of measurement of the Castle Mountain West section (pl. 1, locality 27) within the Castle Gap 7.5-minute topographic quadrangle, Crane County, Texas

	<u>Feet</u>	<u>Meters</u>
2. Sandy shale and claystone, pale- reddish-brown (10R 5/4), micaceous, flaggy, thinly bedded; minor interbeds of grayish-orange-pink (5YR 7/2), calcareous; few well-indurated, crossbedded, fine-grained sandstone beds.....	26.	7.9
1. Sandstone, pale-red (10R 6/2) to pale-reddish-brown (10R 5/4), very fine to fine quartz grains, calcareous, dense, well-indurated, thin flat beds; mostly covered.....	<u>10+.</u>	<u>3.1+</u>
Total measured Tecovas Formation.....	<u>97+.</u>	<u>29.6+</u>
Total measured Dockum Group.....	<u>132+.</u>	<u>40.2+</u>

Pecos River - Texas 1053 Section

Section measured in road cut 0.4 mi (0.6 Km) north of Pecos River bridge on Texas Farm-Market Road 1053 in the Imperial 7.5-minute quadrangle Crane County, Texas (fig. 13; pl. 1, locality 26). Approximate altitude of base of section is 2,380 ft.

[Measured by W. I. Finch, May 18, 1969]

	<u>Feet</u>	<u>Meters</u>
Quaternary.		
4. Soil, light- to dark-gray.....	2.	0.6
3. Caliche.....	5.	1.5
Triassic.		
Dockum Group (incomplete):		
Trujillo(?) Formation (incomplete):		
2. Sandstone, moderate-reddish-orange (10R 6/6), very fine quartz and sparse dark grains, calcareous, not well-indurated except locally; a few inches (cm) of quartz-granule sandstone and discontinuous quartz-pebble conglomerate at base.....	12.	3.7
Tecovas(?) Formation (incomplete):		
1. Clayey siltstone, moderate-reddish-brown (10R 4/6), laminated, flaggy and shaly, micaceous, calcareous, undulating bedding; lower contact undulates as much as 3 ft (1 m) due to solution of gypsum in underlying Permian.....	<u>18.</u>	<u>5.5</u>
Total measured Dockum Group.....	<u>30.</u>	<u>9.2</u>

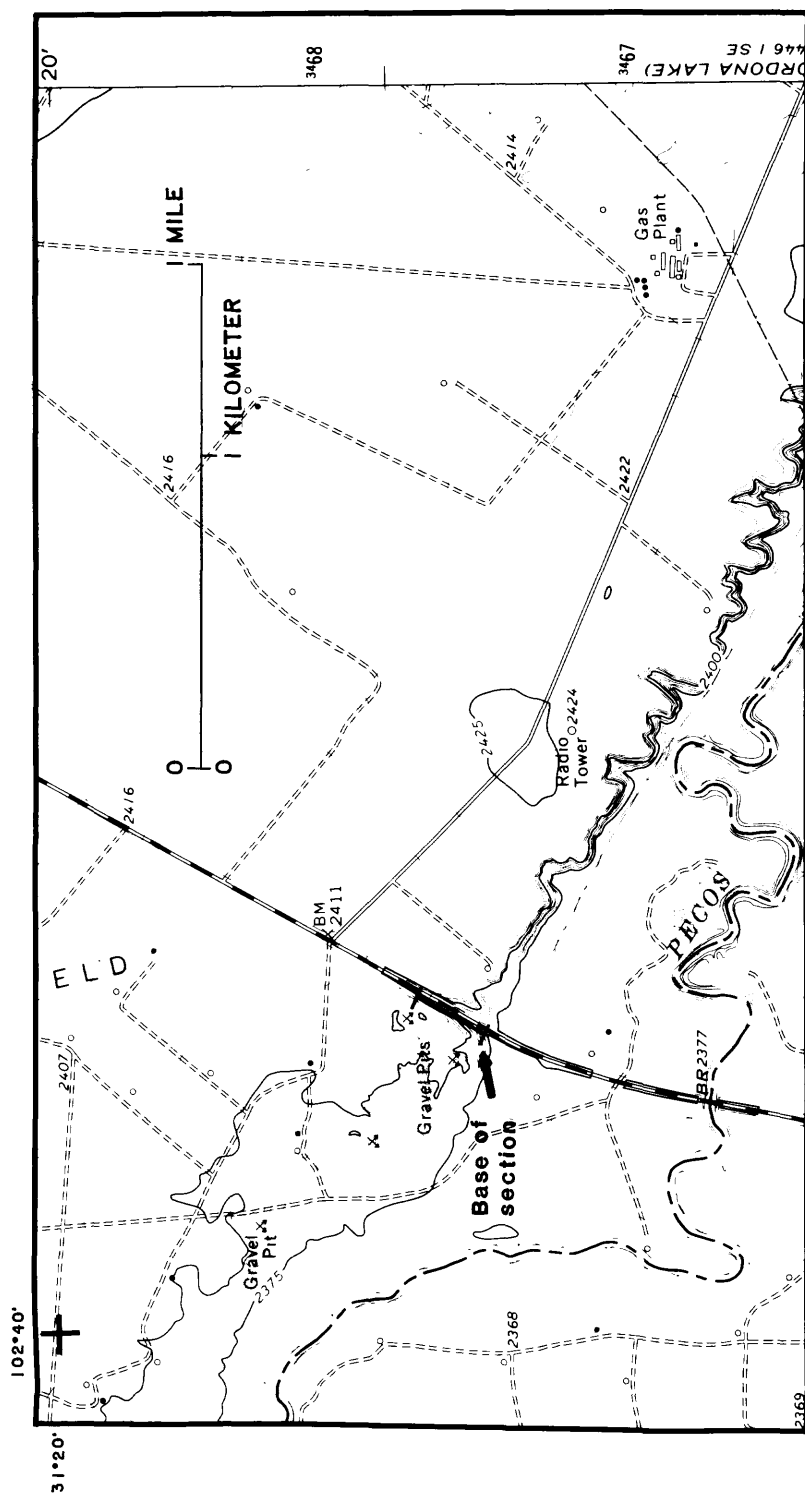


Figure 13.--Location of the line of measurement of the Pecos River-Texas 1053 section (pl. 1, locality 26) within the Imperial 7.5-minute topographic quadrangle, Crane County, Texas

Crosby County

Negro Hill - Sand Creek Section

Section measured on the southeast tip of Negro Hill in the southeast corner Collett Springs 7.5-minute quadrangle and eastward along Sand Creek in the Bunker Hill 7.5-minute quadrangle (fig. 14; pl. 1, locality 20). Altitude of base of section is 2,405 ft.

[Units 2-15 measured by J. C. Wright, May 30, 1968; units 1 and 15-16 measured by W. I. Finch, April 19, 1971.

Feet Meters

Triassic System.

Dockum Group:

Trujillo Formation (incomplete):

16. Sandstone and limestone-pebble conglomerate, various shades of yellowish-gray and greenish-gray; middle 10± ft (3± m) chiefly fine to coarse-grained sandstone, quartz and minor chert; calcareous, micaceous; limestone pellets and pebbles abundant at base; clear and white quartz and variously colored chert pebbles scattered throughout basal 2-3 ft (0.6-0.9 m) of unit and abundant in upper 5 ft (1.5 m) exposed in cut; sandstone crossbedded (dips 23° N. 85 W. to 22° W.); 1 ft (0.3 m) hard, calcareous sandstone ledge forms top of unit and on hilltops to west it thickens to 15 ft (4.5 m); unit not exposed on Negro Hill about 6,000 ft (1800 m) to east.....20+. 6.1+

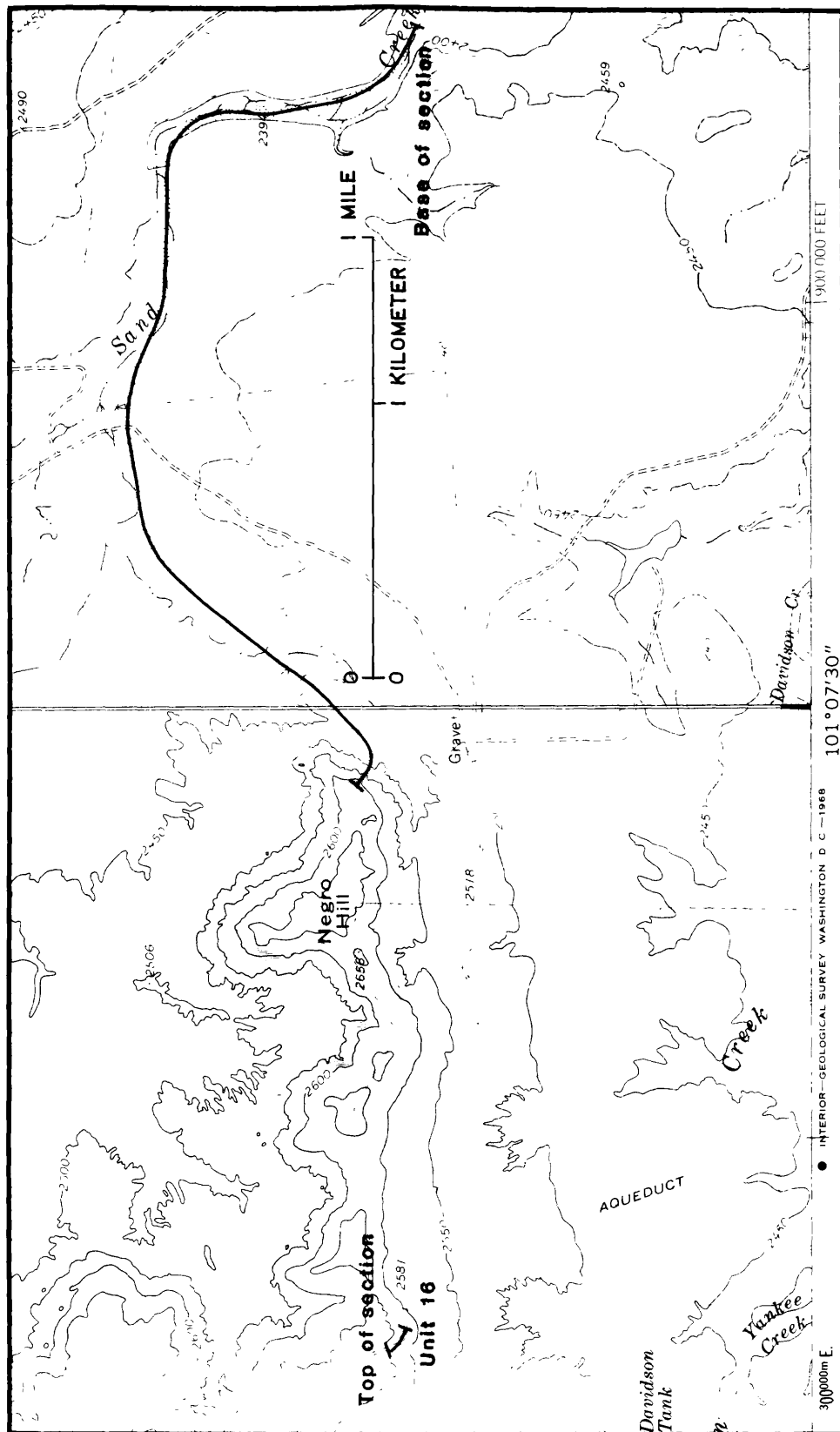


Figure 14.—Location of the line of measurement of Negro Hill-Sand Creek section (pl. 1, locality 20) within the Collett Springs (left) and Bunker Hill (right) 7.5-minute topographic quadrangles, Crosby County, Texas

	<u>Feet</u>	<u>Meters</u>
15. Clayey siltstone and sandstone and subordinate interbeds of pebbly sandstone, greenish-gray, some red silty claystone about 7 ft (2 m) below top; abundant float of milky-white, subrounded quartz pebbles at top of exposure on Negro Hill and a few of them in-place in top few inches of unit; unit traced about 6,000 ft (1800 m) to west where in roadcut the unit consists of claystone, pale-reddish-brown (10R 5/4), upper 1-3 ft greenish-gray (5GY 6/1), brown is noncalcareous, gray is calcareous as are the few thin sandstone and conglomerate beds; sandstone, pale-reddish-brown, sparsely spotted greenish-gray, very fine grained, dirty; other sandstone, brown mottled greenish-gray, medium- to very coarse quartz and limestone grains; minor limestone-pellet and sparse quartz- and dark chert-pellet conglomerate beds.....	19.	5.8
14. Sandstone, medium- to very coarse grained with sparse cream to grayish-white chert and siltstone pebbles 1/16 to 1/2 in. (0.2-1.3 cm) (rarely 1 in; 2.5 cm) across, abundant muscovite; large-scale, moderate-angle crossbeds; single massive ledge former.....	18.	5.5
13. Concealed, must include moderately soft, white sandstone and clay-chip conglomeratic sandstone because float of them are abundant downslope, altitude of base 2,613 ft (797 m).....	<u>6.</u>	<u>1.8</u>
Total thickness of measured Trujillo Formation.....	<u>63+.</u>	<u>19.2+</u>
12. Claystone weathers reddish-orange (10R 5/6) to dusky red (10R 3/2); from distance 1/4 mi away appears crossbedded on large scale; poorly exposed.....	18.	5.5
11. Grit, fine-grained rounded clay pellets of underlying clays, porous, crossbedded; forms very thin ledge, mostly concealed by debris.....	3.	0.9
10. Claystone, weathers reddish-orange (10R 5/6); poorly exposed on slumped and landslide slope.....	19.	5.8

	<u>Feet</u>	<u>Meters</u>
9. Claystone, dark-grayish-orange (10YR 6/4) grading upward to pale-reddish-brown (10R 5/4); weathers frothy on very steep slope that conceals color banding through creep and slump of surface material.....	15.	4.6
8. Clay-pellet grit with clay matrix, sparse chert grains, red (5R 5/6) and pale-yellowish-green (10GY 7/2) bands, pale-red (10R 6/2) weathered beds fairly evident on slope; some float contains very small silicified tubules.....	7.	2.1
7. Claystone, silty and at certain horizons gritty, reddish-orange (10R 6/6); surface is light grayish red (10R 5/2) because of partial armor of white silicified nodules, bone fragments and tubules weather out of claystone.....	20.	6.1
6. Claystone, yellowish-orange (10YR 7/6), weathers same; massive, hard, brittle, breaks into hackly chunks, contains light-greenish-gray concretions with reddish rims not along bedding; contains inclined fibrous calcite veins, mostly in lower half; grades upward into slightly more reddish color.....	20.	6.1
5. Claystone like unit 3, contains a few irregular lumpy concretions about a foot (0.3 m) across, upper part weathers slightly frothy; contact gradational into unit above.....	27.	8.2
4. Nodular concretion zone, pale-reddish-brown, weathers creamy light gray, forms very slight ledge.....	0.5	0.2
3. Claystone, reddish-orange (10R 5/4), weathers frothy; greenish-gray spots.....	5.5	1.6

	<u>Feet</u>	<u>Meters</u>
2. Claystone, silty, mostly pale reddish-orange (10R 7/6), streaked with light-greenish-gray (5G 8/1); hummocky badlands slope almost completely armored with small (1/8-2 in. (0.3-5 cm), mostly less than 1/2 in. (1.7 cm) nodules cemented by carbonate and some perhaps by sulfate; nodule-armored weathered surface grayish-brown (5Y 6/2); locally sparse malachite-stained nodules; one such observed zone about 5-ft (1.5-m) thick extends less than 40 ft (12.2 m) laterally; a 1-foot- (0.3-m) thick limestone-pebble conglomerate layer, a mixture of pale-red (5R 6/2), pale-reddish-brown (10R 5/4) and grayish-orange-pink (10R 8/2) limestone granules and pebbles; calcareous matrix, iron-stained; weakly bedded; forms floor of wash at base of Negro Hill.....	42.	12.8
1. Sandstone, white, mostly soft, partly gritty and pebbly (quartz, chert, clay) and partly very clayey with local laminae rich in carbonaceous trash; crossbedded, trough-sets 0.5-1.5 ft (0.15-0.75 m) thick trend N. 10-25° W.; scour-and-fill beds of hard chert conglomerate cut into soft sandstone; unit locally capped by hard dark-weathering chert-pebble conglomerate; fossil wood (radioactive) and Phytosaur teeth; dark heavy mineral concentrations locally; contact with Permian not well exposed here at 2,405 ft; nearby the base displays scours as much as 3 ft (0.9 m) deep and weak to strong folding of lower beds; gravity slides noted.....	36.	11.0
Total thickness of measured Tecovas Formation.....	213+.	64.9
Total thickness of measured Dockum Group....	276+.	84.1+

Feet Meters

Permian.

Not measured. Very regular thin even-bedded sandstone and siltstone easily distinguished from Triassic.

Dickens County

John Guitar Jr. Ranch Section

Section measured along Dockum Creek near the John Guitar Jr. ranch house and on hills just to the west extending from the northwest corner of Foreman Chapel 7.5-minute quadrangle into northeast corner of Bunker Hill Quadrangle, Dickens County, Texas (fig. 15; pl. 1, locality 21). Section is about 1-mi (1.6- km) north of the old Dockum Post Office and in the vicinity of the type beds of the Dockum Group (Cummins, 1890, p. 189). Altitude of base of section is 2,555 ft.

[Measured by J. C. Wright, Aug. 28, 1967; modified by W. I. Finch, May 30, 1969]

	<u>Feet</u>	<u>Meters</u>
Pliocene.		
Ogallala Formation:		
Poorly exposed, caliche may be younger than true Ogallala caprock, not measured.		
Triassic.		
Dockum Group:		
5. Sandstone, very fine quartz grains, calcareous;; crossbedded; some beds consist entirely of 1/8- 1/4-in. (0.3-0.6 cm) well-rounded limestone grains in calcareous matrix; ledgy with interbedded claystone; holds up benchy hills about 2,000 ft (610 m) NW and N of house....	8.	2.5
4. Claystone, silty, weathers moderate-red (5R 4/4), light-greenish-gray streaks as much as 4-ft (1.2-m) thick; also discontinuous 6-in.-(1.2- cm) thick quartzose sandstone and coarse- grained, calcareous limestone-clast sandstone beds; unit very poorly exposed in badlands just 300 yds (180 m) west of ranch house.....	55.	16.7
3. Pebbly sandstone like unit 2, but less conglomerate and irregularly flat bedded; crops out just upstream from road ford.....	5.	1.5

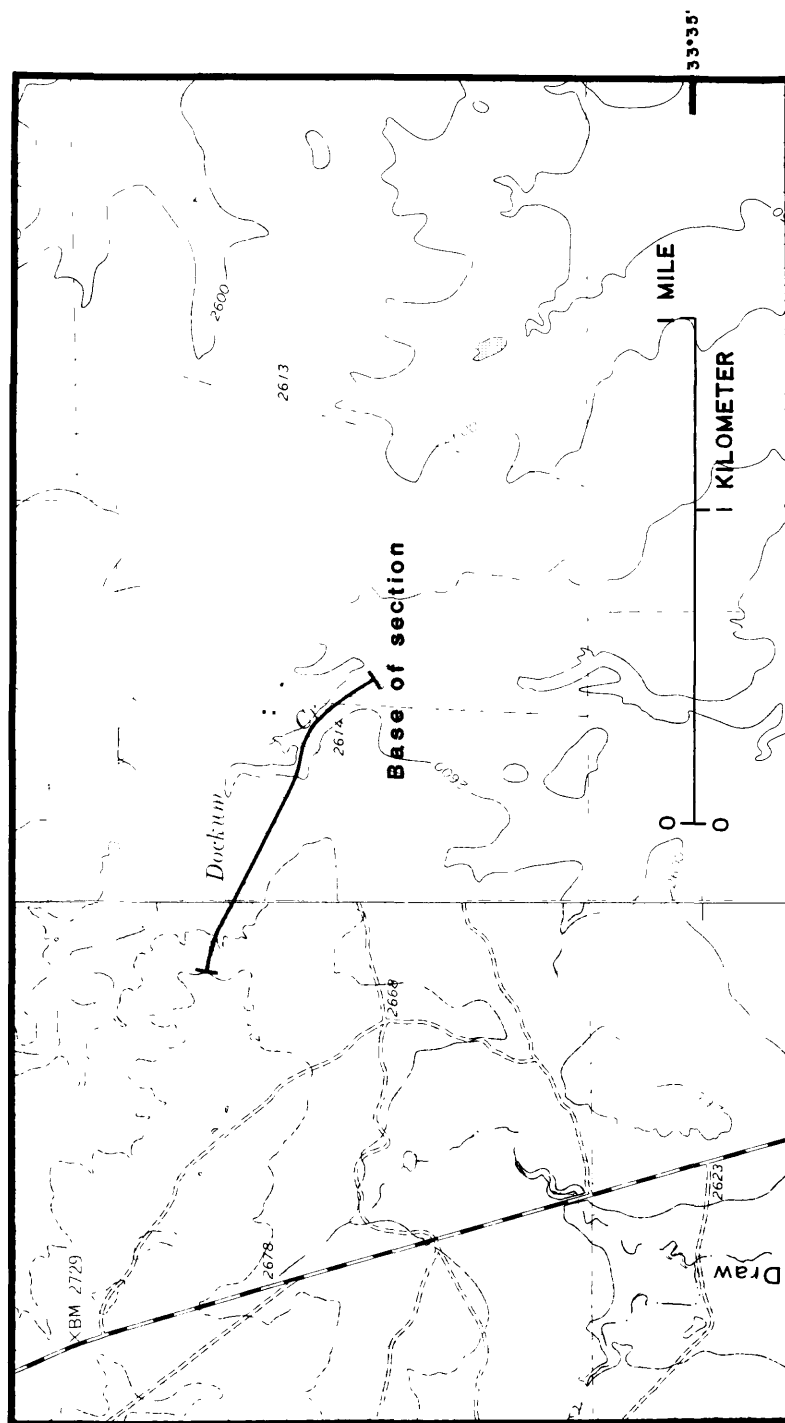


Figure 15.--Location of the line of measurement of the John Guitar Jr Ranch section (pl. 1, locality 21) within the Foreman Chapel (right) and Bunker Hill (left) 7.5-minute topographic quadrangles, Dickens County, Texas

	<u>Feet</u>	<u>Meters</u>
2. Pebble-conglomerate, coarse-grained sandy carbonate matrix; rounded sand grains, subrounded pebbles mostly 1/8-1/4 in. (0.3-0.6 cm) in across but some about 1 in. (2.5 cm) and as much as 2 in. (5.1 cm), limestone and siltstone pebbles mixed, sparse white quartz and red chert pebbles; trough sets 1-3 ft (0.3-0.9 m) thick, thin arcuate crossbeds; this unit thins (bottom irregular) to only 3 ft (0.9 m) at road into ranch, very uniform planar crossbeds here dip N. 58°, 59°, 70°, 80° W. where unit contains a few casts of carbonized twigs and branches 1/2-1 in. (1.2-2.5 cm) by 3-18 in. (7-45 cm) on surfaces....	17.	5.2
1. Sandstone, orange-pink (5YR 7/4), weathers light-brown (5YR 6/4) in massive, smooth slopes; bedding very obscure, at least locally crossbedded; contains irregular nearly flat carbonate-cemented concretions that weather light-colored and project out of smooth rock that suggests mostly flat bedding, some 1-3 in. (2.5-7.6 cm) thick and 6-50 in (15-125 cm) long, locally concretions cement small pockets of granule grit and possibly some plant debris, and most have limonitic, yellow centers; sandstone, fine-grained, well-sorted, subrounded, contains selenite crystals 1-2 mm across and sparse white clay grains interstitial to quartz grains.....	20+.	6.1+
Total measured thickness of Dockum Group....	<u>105+.</u>	<u>32+.</u>

Permian. Not exposed here but certainly directly underlies unit 1.

Red Mud Creek Section

Section measured on west branch of Red Mud Creek and east of Negro Hill in southeast corner of Bunker Hill 7.5-minute quadrangle in Dickens County, Texas (fig. 16; pl. 1, locality 22). Altitude of base of section at 2,545 ft.

[Measured by J. C. Wright, June 5, 1968]

	<u>Feet</u>	<u>Meters</u>
Quaternary.		
Gravel.....	20.	6.1
Triassic System.		
Dockum Group:		
Tecovas Formation (incomplete, middle part):		
6. Claystone, red, unconsolidated, like unit 4; unit 5 grades upward into unit 6.....	5.	1.5
5. Claystone, yellow, unconsolidated, like unit 1, at base is a 3-6 in. (7-15 cm) knubbly concretionary zone that passes laterally to 6 in. (1.2 cm) of laminated limy siltstone.....	17.	5.2
4. Claystone, reddish-orange (10R 5/6) to moderate- reddish-brown (10R 4/6), weathers red (5R 5/6), soft unconsolidated; contains iron(?) -rich nodules that are probably source of shiny ones weathered out lower down.....	8.	2.5
3. Claystone, like unit 1, grades upward into red unit 4, unconsolidated; contains inclined calcite veins and greenish-gray bleached zones extending into base of unit 4; a local reddish- brown zone about in middle of this unit contains silicified tubules and irregular nodules.....	28.	8.5
2. Siltstone, limy, light-greenish-gray, platy to papery; intergrades laterally within 150 ft (46 m) to reddish-brown soft siltstone and then to knubbly concretionary zone.....	0-4.	0-1.2

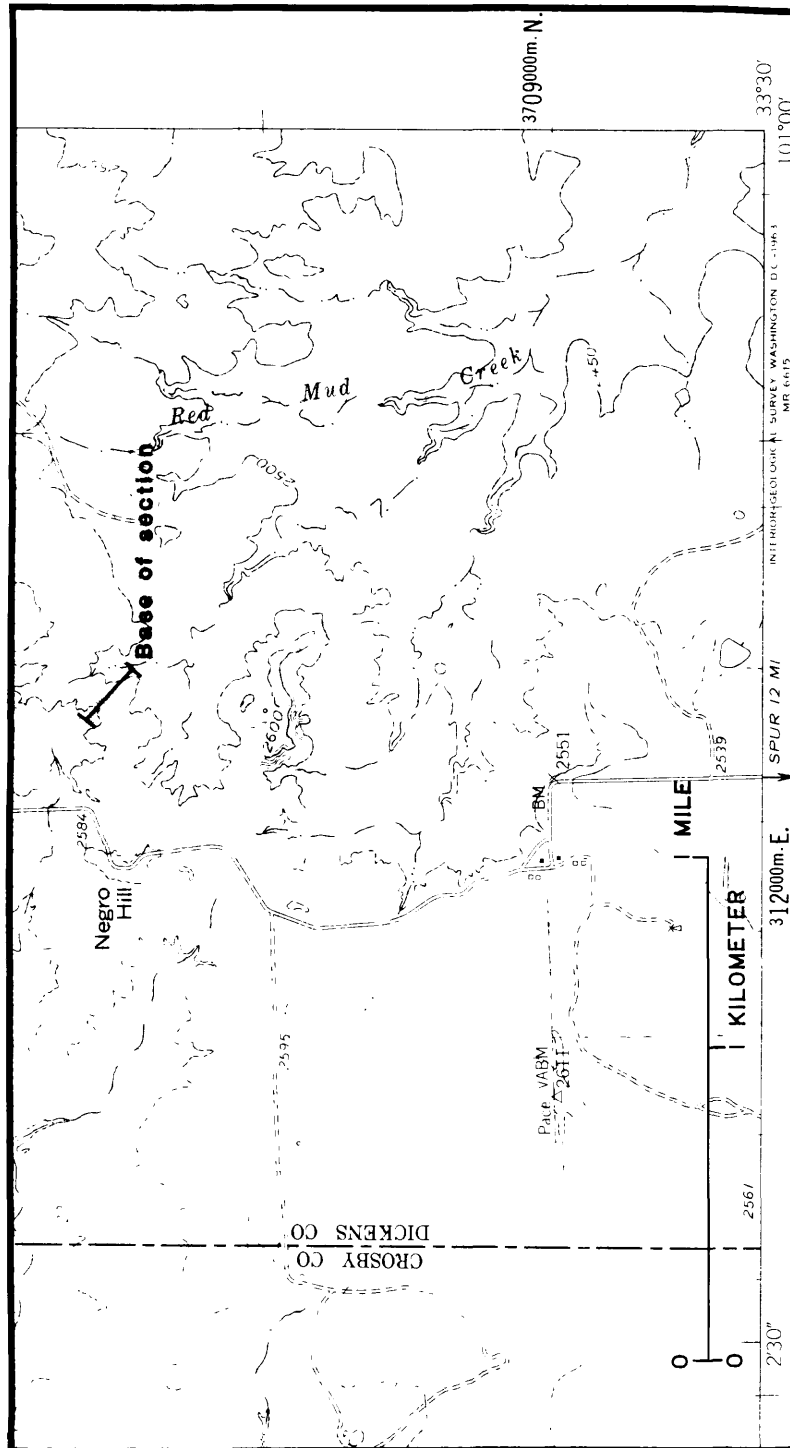


Figure 16.--Location of the line of measurement of the Red Mud Creek section (pl. 1, locality 22) within the Bunker Hill 7.5-minute topographic quadrangle, Dickens County, Texas

	<u>Feet</u>	<u>Meters</u>
1. Claystone, dark-yellowish-orange (10YR 6/6), weathers yellowish- orange (10YR 7/6); hard; hackly to irregularly, fractured, green, round clay patches surrounded by reddish- brown rims; some small grayish- orange, hard, limy(?) concretions (2-4 in, 5-10 cm); perhaps contorted below above unit.....	<u>7.</u>	<u>2.1</u>
Total thickness of exposed Tecovas Formation.....	<u>69.</u>	<u>21.0</u>

Oldham County

Rincon-Ranch Creek Section

Section measured about one-half mile (0.8 Km) south of Rincon Windmill and on east side of Ranch Creek in northwest corner of Halfway Creek 7.5-minute quadrangle, Oldham County, Texas (fig. 17; pl. 1, locality 9). Units 1 through 8 measured starting at creek level and in an eastward direction to top of uppermost ledge. Units 9 through 15 measured starting at a point about one-half mile (0.8 Km) south-southeast. Top of unit 8 traceable between the two points. Altitude of base of section is about 3,290 ft.

[Measured by W. I. Finch, April 27, 1971]

	<u>Feet</u>	<u>Meters</u>
Pleistocene(?) and Holocene.		
Terrace gravel:		
15. Gravel, igneous and metamorphic pebbles and cobbles as much as 15 cm across, poorly exposed.....	10.	3.1
Triassic.		
Dockum Group (incomplete):		
Chinle Formation:		
14. Siltstone, pale-reddish-brown (10R 5/4), clayey, micaceous, calcareous, shaly, poorly exposed.....	16.	4.9
13. Sandstone (50 percent) and limestone-pebble conglomerate (50 percent), yellowish-gray (5Y 8/1) to light-greenish-gray (5GY 8/1), very fine quartz and abundant green grains, micaceous (biotite and muscovite), calcareous; pebbles mostly 2-4 mm, some as much as 3 cm; crossbedded; forms extensive ledge, mappable; much thicker about 1.5 km to north.....	10.	3.1
12. Claystone, moderate-reddish-orange (10R 6/6), sandy, fine quartz and dark minerals, silty, micaceous, calcareous; soft, loose, shaly; forms easy slope to climb.....	37.	11.3

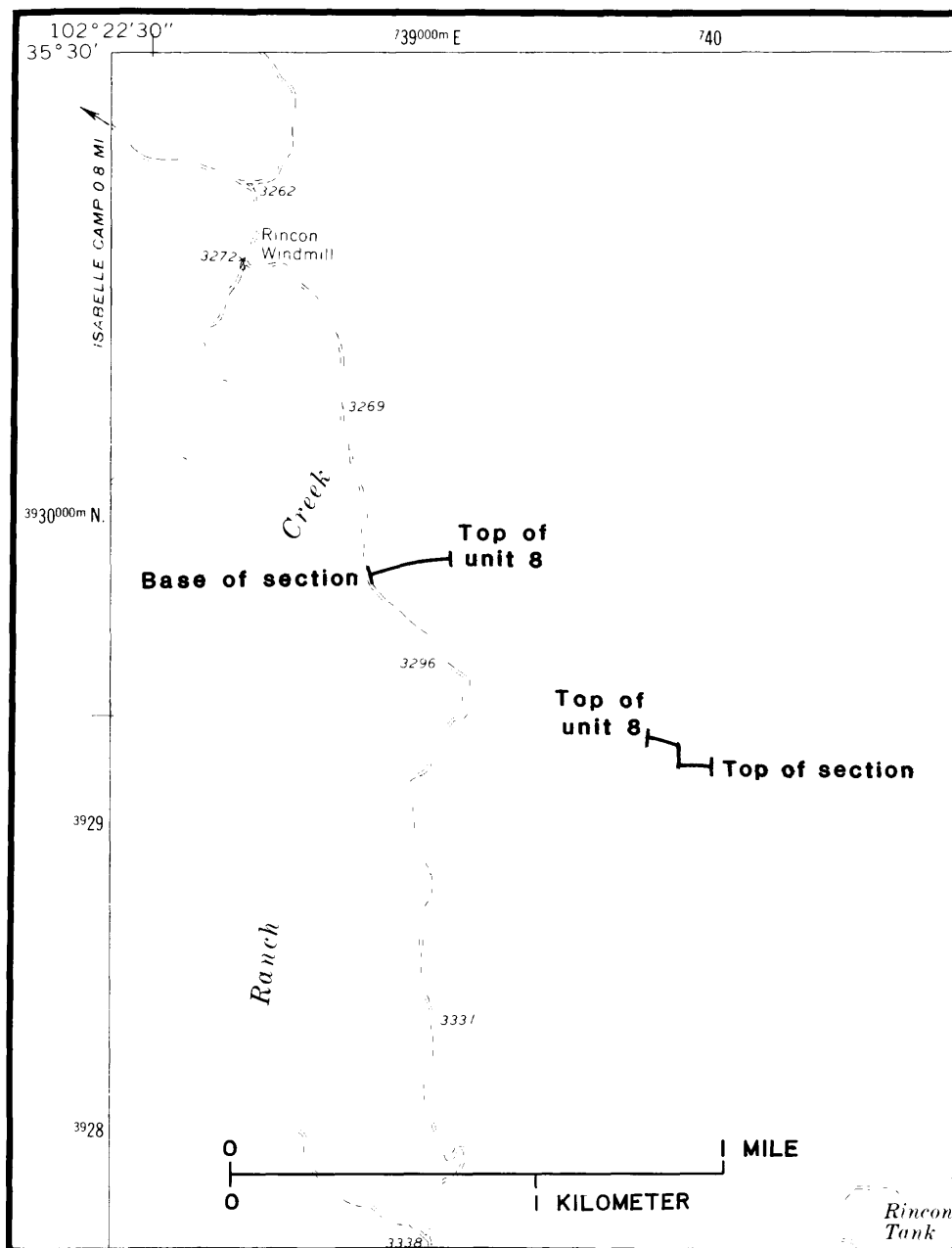


Figure 17.--Location of the line of measurement of the Rincon-Ranch Creek section (pl. 1, locality 9) within the Halfway Creek 7.5-minute topographic quadrangle, Oldham County, Texas

	<u>Feet</u>	<u>Meters</u>
11. Siltstone and claystone, mostly pale-reddish-brown (10R 5/4) and moderate-red (5R 5/4), sparse light-greenish-gray; limestone pebbles occur in calcareous siltstone matrix that are not apparent unless seen under hand lens; more resistant beds commonly dip at steep angles that suggest deltaic sedimentation; forms hard, steep slope with thin ledges; several limestone-pebble conglomerate lenses as much as 1.5 m thick noted in upper part along strike of section.....	55.	16.8
10. Claystone, pale-reddish-brown (10R 5/4), calcareous, structureless; forms hard steep slope; well exposed.....	26.	7.9
9. Siltstone, pale- to moderate-reddish-brown, few beds are light-greenish-gray (5G 8/1); irregularly to flat-bedded, shaly to laminated, micaceous, calcareous; sharp, mappable contact with unit 10; contact with unit 8 concealed.....	<u>10.</u>	<u>3.1</u>
Total of incomplete Chinle Formation.....	<u>154.</u>	<u>47.1</u>
8. Sandstone, light-greenish-gray, very fine to fine quartz and dark grains, calcareous, micaceous, local limonite stains; limestone pebbles abundant in upper 0.6 m; flat bedded, ledge former, several thin (most about 2-cm thick except for 0.5-m thick bed near top) siltstone beds like unit 7 which become thicker and more numerous to east where siltstone dominates; lower part of unit thickens at expense of unit 7 and joins unit 7 as thick channel deposit.....	28.	8.5
7. Siltstone and sandstone; siltstone, pale- to moderate-reddish-brown, particularly micaceous (biotite) along bedding planes, calcareous, laminated, clayey; sandstone, light- greenish-gray, very fine quartz and dark grains, calcareous, silty, forms beds about 5-15 cm thick about every meter apart, forms ribs that ledge out from slope of siltstone, sandstone beds fairly uniform in thickness, except for channels.....	26.	7.9

	<u>Feet</u>	<u>Meters</u>
6. Sandstone, yellowish-gray (5Y 8/1), very fine quartz and dark grains, micaceous (muscovite?), calcareous, hard, well-packed; scattered limestone pebbles like unit 5 concentrated along bedding planes in few places; crossbedded; lower 0.5-1 m forms dip slope 10° due E. along line of measurement for 100 m; thickness corrected for dip.....	20.	6.1
5. Limestone-pebble conglomerate, light-olive-gray (5Y 6/1), irregular limonite stains; pebbles mostly 1-4 mm in diameter; calcareous mudstone matrix; limonitic and minor small coalified fossil wood fragments, leaves, and stems at top; intergrades with unit 6; forms base of ledge.....	2.50	8.
Total of Trujillo Formation.....	<u>76.5</u>	<u>23.3</u>
Tecovas Formation (incomplete):		
4. Claystone, pale-reddish-brown (10R 5/4) to moderate-reddish-orange (10R 6/6), grayish-orange (10YR 7/4) in upper 2 m; contains sparse coarse quartz grains; structureless; forms mostly hard surface on steep slope.....	36.	11.0
3. Limestone-granule conglomerate, greenish-gray (5GY 6/1), granules mostly 2 mm or less in diameter, calcareous mudstone matrix, abundant yellow interstitial uranium mineral; forms ledge.....	0.25	0.1
2. Siltstone, moderate-reddish-orange (10R 6/6) upper 15 cm, grayish- orange (10YR 7/4) lower part, calcareous; thinly and irregularly bedded, unit is lenticular, attains 3+ m thickness across creek; forms weak ledge.....	2.5	0.8

	<u>Feet</u>	<u>Meters</u>
1. Claystone, light-brown (5YR 5/6), calcareous, structureless; forms hard, fine, rubbly mostly covered slope, base not exposed here but outcrops to west side of creek show it to be lenticular and its maximum thickness not much more than apparent here.....	<u>8+.</u>	<u>2.4+</u>
Total of incomplete Tecovas Formation.....	<u>46.75+</u>	<u>14.3+</u>
 Total of incomplete Dockum Group.....	<u><u>277.25+</u></u>	<u><u>84.7+</u></u>

Spring-Las Arches Creek Section

Section measured 100 m upstream from spring marked north of Little Red Tank along Las Arches Creek in northwest corner of Big George Tank 7.5-minute quadrangle, Oldham County, Texas (fig. 18; pl. 1, locality 8). Altitude of base of section is about 3,490 ft.

[Measured by W. I. Finch, April 28, 1971]

	<u>Feet</u>	<u>Meters</u>
Triassic.		
Dockum Group:		
Trujillo(?) Formation (incomplete):		
5. Claystone, greenish-gray (5G 6/1) patches of dark-gray (N-3), weathers light-greenish-gray (5G 8/1), yellowish-brown limonitic zones especially surrounding fossil logs; carbonized, limonitized, and calcified fossil wood logs as much as 30 cm across and 1 m long; black carbonized leaf and stem fragments in dark-gray rock; forms soft, friable, loose surface; intergrades laterally and upward into dusky-red (5R 3/4) to very dark red (5R 2/6) claystone on hills to north.....	32.	9.8
4. Sandstone, very pale orange (10YR 8/2) to pale-yellowish-orange (10YR 8/6) to dark-yellowish-orange (10YR 6/6); very fine to medium quartz grains, black grains, and noticeable white clay grains; few pieces of iron-oxide replaced fossil wood; thin (less than 30 cm thick) lenses of grayish-green claystone; 15 cm thick lens of dominantly black and minor red and brown chert-pebble conglomerate at base; massive ledge former, thickens to north.....	25±.	7.5±
Total of incomplete Trujillo(?) Formation...	<u>57±.</u>	<u>17.3±</u>

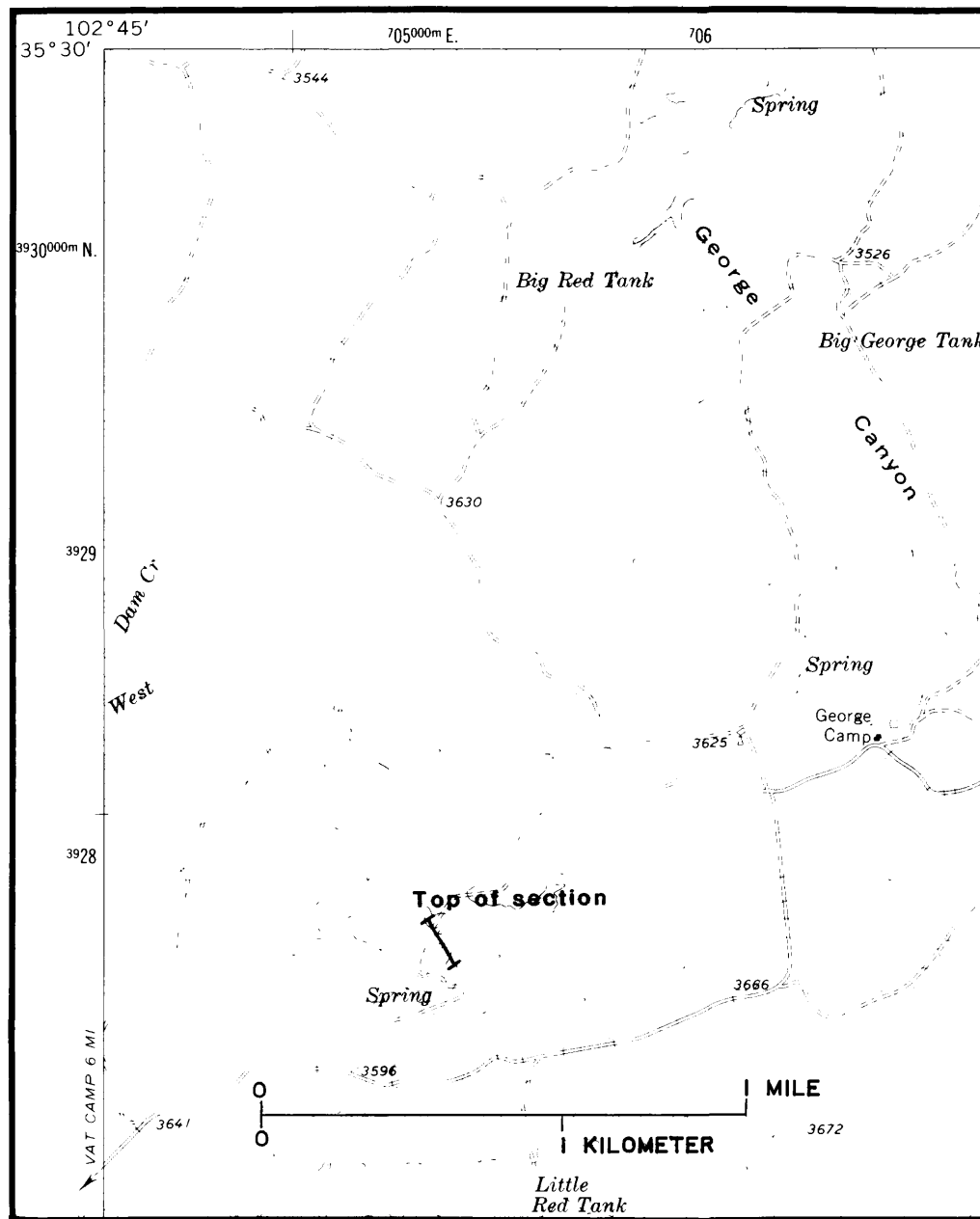


Figure 18.--Location of the line of measurement of the Spring-Las Arches Creek section (pl. 1, locality 8) within the Big George Tank 7.5-minute topographic quadrangle, Oldham County, Texas

Permian.

Quartermaster Formation:

Alibates Dolomite Lentil:

3. Dolomite, pale-yellowish-brown (10YR 6/2), weathers pale-blue; wavy bed dips under here.....	2.	0.6
2. Siltstone, moderate-reddish-brown (10R 4/6), calcareous, medium quartz grains at base.....	4.	1.2
1. Dolomite, pale-red-purple (5RP 6/2).....	<u>1+.</u>	<u>0.3+</u>
Total of incomplete Alibates Dolomite Lentil.....		
	<u>7+.</u>	<u>2.1+</u>

Trujillo Camp Section

Section measured at Trujillo Camp about 3 mi (5 km) above mouth of Trujillo Creek in Trujillo Camp and Vat Camp 7.5-minute quadrangles, Oldham County, Texas (fig. 19; pl. 1, locality 7). Approximate altitude top of section is 3,620 ft.

[Measured by J. C. Wright, May 8, 1968]

	<u>Feet</u>	<u>Meters</u>
Triassic.		
Dockum Group:		
Trujillo Formation (incomplete):		
13. Conglomeratic sandstone, white, weathers light-gray; coarse- to very coarse grained, limestone granules and pebbles commonly 3-10 mm and as much as 50 mm across; calcareous; some fossilized wood; crossbedded; unit passes upward into poorly exposed grayish-red shale a mile or two to southeast; forms extensive capping ledge.....	4.	1.2
Total measured Trujillo Formation.....	4.	1.2
Tecovas(?) Formation:		
12. Claystone and clayey siltstone, light-greenish-gray with subordinate interbeds of sandstone like underlying sandstone.....	16.	4.9
11. Sandstone, light-grayish-orange, weathers white; medium-grained, poorly sorted; crossbedded in regular tabular sets 0.30-1 m thick that dip S. 80° W. to N. 70° W.; sandstone not conglomeratic here but contains pebbles and fossilized wood logs at Chavez Canyon collapse structures about 3 mi (4.8 km) to the north; friable, incompletely cemented with carbonate; a few layers of light-green, clayey shale 15-90 cm thick; case-hardened on surface to form ledges.....	40.	12.2

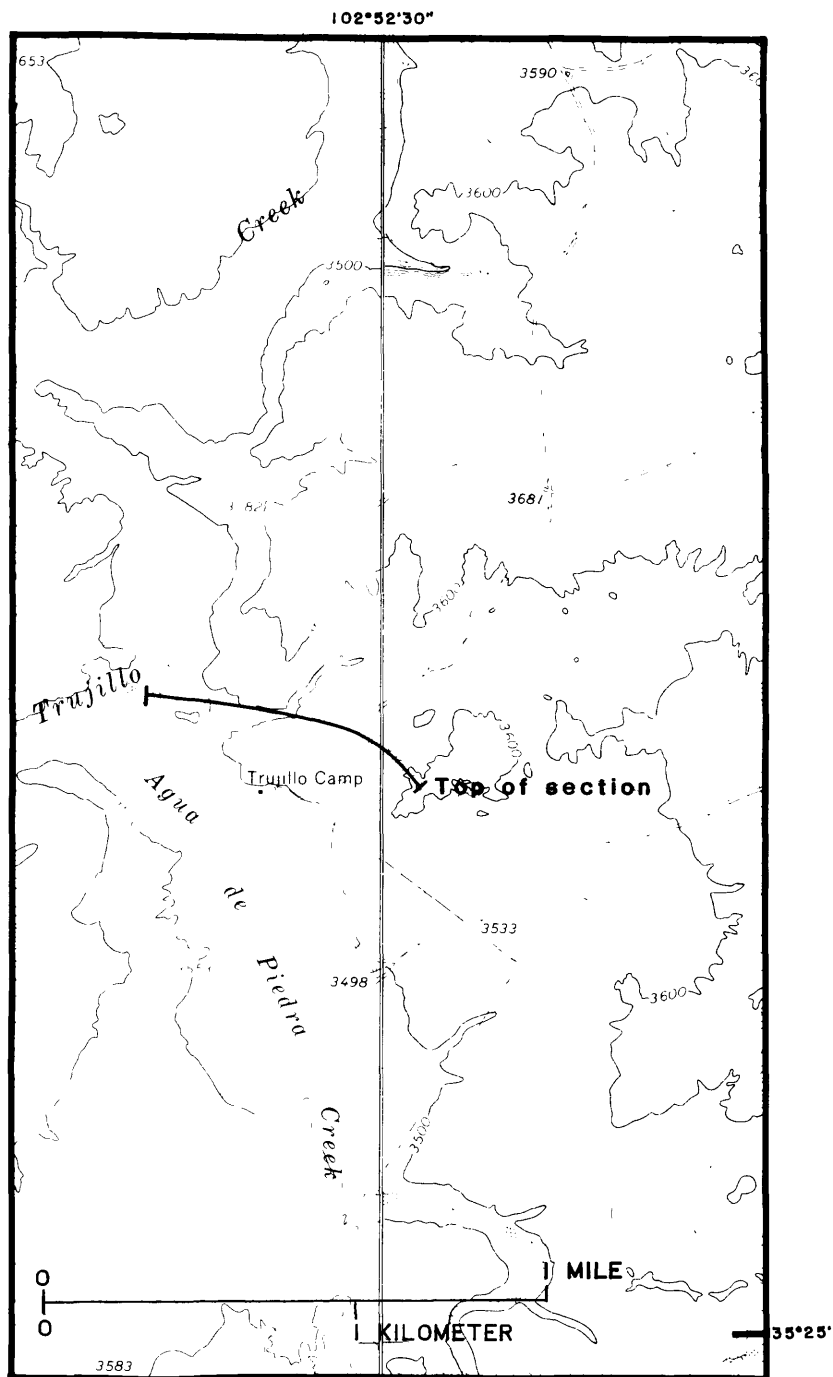


Figure 19.--Approximate location of the line of measurement of the Trujillo Camp section (pl. 1, locality 7) within the Trujillo Camp (left) and Vat Camp (right) 7.5-minute topographic quadrangles, Oldham County, Texas

	<u>Feet</u>	<u>Meters</u>
10. Claystone, lower-half grayish-red, upper-half light-greenish-gray; locally black, radioactive coalified plant matter present, particularly between knolls north of word "Camp" on topographic map; silty, laminated; locally scoured out and replaced by a conglomerate like unit 8 and elsewhere scoured out completely by overlying sandstone.....	3.	0.9
9. Sandstone, reddish-orange (10R 5/6), silty.....	15.	4.6
8. Limestone-pebble conglomerate, pale-reddish-brown; low-angle crossbeds; pock-marked where pebbles have weathered out, contains yellowish pebbles as well as red; contains abraded pelycopod fossils and poorly preserved tree fragments; scour at base.....	<u>3.</u>	<u>0.9</u>
Total Tecovas(?) Formation.....	<u>77.</u>	<u>23.5</u>
Total measured Dockum Group.....	<u>81.</u>	<u>24.7</u>

Permian.

Guadalupe Series:

Quartermaster Formation:

7. Siltstone, reddish-orange (10R 5/6), sandy, poorly sorted; two tabular sets of very low-angle cross laminae; forms massive unit; poorly exposed on slope; top irregularly scoured; this and underlying unit may be part of Tecovas(?) Formation.....	6.	1.8
6. Claystone, pale-reddish-brown, silty, laminated; weathers to irregular shaley chips; assigned to Quartermaster because of even lamination.....	<u>14.</u>	<u>4.3</u>
Total Quartermaster Formation above Alibates.....	20.	6.1

	<u>Feet</u>	<u>Meters</u>
Alibates Dolomite Lentil (most fully exposed in dry wash just north of house):		
5. Dolomite, finely and evenly laminated.....	3.	0.9
4. Siltstone, moderate-reddish-brown, carbonate-cemented; common soft-sediment deformation caused brecciation and slumping of overlying dolomite; forms recess or concealed on slope.....	4.	1.2
3. Dolomite, beds 20-25 cm thick; prominent curved lamination near middle; ledge caps stripped bench in many places.....	3.	0.9
2. Dolomite, similar to unit 1 but thinner beds 5-10 cm thick, finely and evenly laminated with ripple marks; forms minor recess on many exposures.....	5.	1.5
1. Dolomite, medium-dark-gray, weathers grayish orange; beds 10-25 cm thick, most finely and evenly laminated; flint nodules in a cross-laminated bed about 2 m above base.....	>10.	>3.0
Total of Alibates Dolomite Lentil.....	<u>>25.</u>	<u>>7.5</u>
Total of exposed Quartermaster Formation....	<u>45.</u>	<u>13.6</u>

U.S. Route 385-Saddleback Section

Section measured from Saddleback Mesa southward along road cuts of U.S. Route 385 south of its intersection with Texas Farm Road 1061 in Oldham County, Texas. Section partly in northwest corner of Ady 7.5-minute quadrangle, northeast-most corner of Halfway Creek quadrangle, and southeast-most corner of Boys Ranch West quadrangle (fig. 20; pl. 1, locality 10). Approximate altitude of top of section is 3,480 ft.

[Measured by W. I. Finch, October 15, 1969]

	<u>Feet</u>	<u>Meters</u>
Triassic System.		
Dockum Group:		
Trujillo Formation (incomplete):		
4. Sandstone, grayish-yellow (5Y 8/4), weathers yellow to yellowish gray (5Y 7/2); very fine clear, white and brown quartz and sparse dark-colored grains; micaceous (muscovite and biotite); silty; calcareous; horizontal to low-angle bedding; irregular bedding; sparse crossbedding; intercalated greenish-gray shale lenses few centimeters to 1 m thick in upper part.....	<u>70.</u>	<u>21.3</u>
Total of incomplete Trujillo Formation.....	<u>70.</u>	<u>21.3</u>
Tecovas Formation:		
3. Shale, dark-reddish-brown (10R 3/4) to grayish-red (10R 4/2), yellowish-gray (5Y 8/1) streaks, weathers pale reddish brown (10R 5/4), sparse muscovite, slightly calcareous; shaly; about 6 m above base is 0.3-0.6 m ledge of sandstone, pale reddish-brown (10R 5/4), very fine silty and clayey, clear and white quartz, very abundant biotite(?), sparse muscovite, noncalcareous, not continuous but typical of other sandstone lenses scattered throughout shale.....	53.	16.2

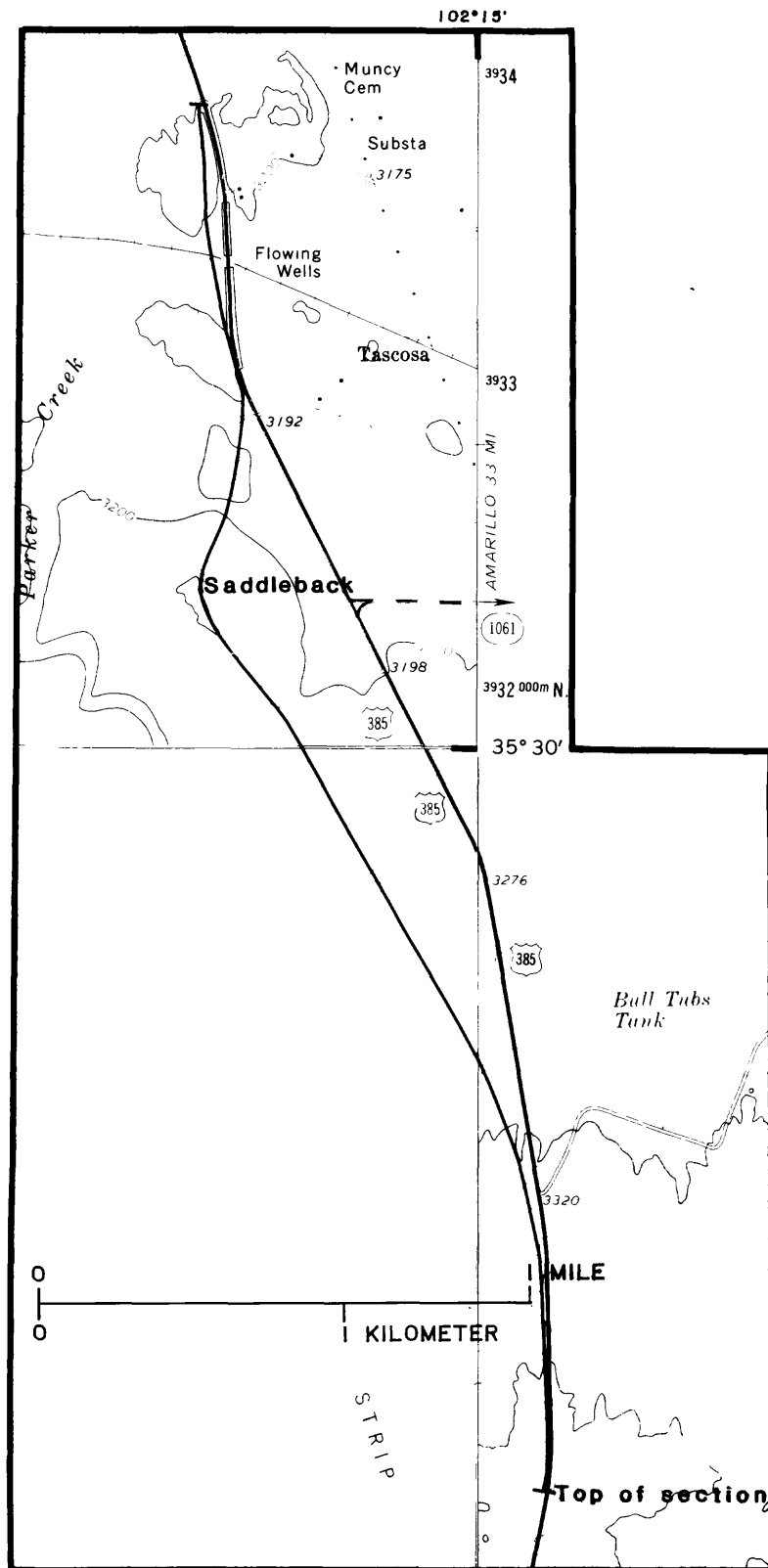


Figure 20.--Location of line of measurement of the U.S. 385-Saddleback section (pl. 1, locality 10) within the Ady (lower left), Boys Ranch West (upper left) and Halfway Creek (right) 7.5-minute topographic quadrangles, Oldham County, Texas

	<u>Feet</u>	<u>Meters</u>
2. Sandstone, yellowish-gray (5Y 7/2), very fine clear, pink, and red quartz and abundant green and dark-colored grains; micaceous (muscovite and greenish variety); calcareous; silty; forms long flat sweeping crossbeds, crossbeds 12° N. 60° E, 8° N 80° E, festoon exposed on both sides of road at top of hill trends N 40° E; weathers to smooth convex upward surfaces (slickrim); base probably unconformable and irregular; top fairly flat for outcrop 300 m northwest shows top at same altitude; unit pinches out east of L-S Ranch headquarters shown on Halfway Creek Quadrangle but is present and fairly persistent 8-16 km to east and southeast; parts weather with white nodular (3-6 mm diameter) surface.....	75.	22.8
1. Sandy siltstone, moderate-reddish-brown (10R 4/6), weathers light-brown, upper part beneath unit 2 is yellowish-gray (5Y 7/2); complex sedimentary structures of intraformational channels filled with fine-grained sandstone and limestone-granule conglomerate.....	<u>5+.</u>	<u>1.5+</u>
Total of incomplete Tecovas Formation.....	<u>133+.</u>	<u>40.5+</u>
Total of incomplete Dockum Group.....	<u>203+.</u>	<u>61.8+</u>

Oldham-Potter Counties

Lost Tubs Springs Section

Section measured near Lost Tubs Springs in Ady 7.5-minute quadrangle, Oldham County Texas (fig. 21; pl. 1, locality 11). Tecovas and basal unit of Trujillo measured east of springs in Potter County. Most of Trujillo measured on cliffs just west of springs in Oldham County. Base of section is in landslide material and alluvium on west side of Sierrita de la Cruz Creek valley. Eolian sandstone noted on low ridge in valley about 1/2 (0.8 km) mi southeast of section. Section base appears to be about 15 ft (4.6 m) above siltstone at Rotten Hill fossil locality section (pl. 1, locality 14). Approximate altitude of top of section is 3,400 ft.

[Measured by J. C. Wright, May 16, 1968]

	<u>Feet</u>	<u>Meters</u>
Triassic system.		
Dockum Group:		
Trujillo Formation:		
17. Sandstone, light-greenish-gray (5GY 8/1), weathers greenish-white (5GY 9/1), feldspathic, micaceous, fair to poorly sorted, mostly very fine grained and silty, horizontal bedded and low-angle crossbeds, some scouring; limestone granule-conglomerate beds near base.....	25.	7.6
16. Claystone like unit 14.....	7.	2.1
15. Claystone, red, purple (5RP 5/2), weathers pale- red-purple (5RP 6/2), frothy surface.....	7.	2.1
14. Claystone, grayish-red (10R 4/2), weathers pale- reddish-brown (10R 5/4), soft, breaks into shaly and conchoidal pieces.....	11.	3.4
13. Claystone like unit 14 above with subordinate interbedded siltstone like unit 12 below.....	7.	2.1
12. Siltstone, pale red (10R 6/2) to greenish-white, weathers and washes pale-red, well-sorted, abundant opaque and green accessories, mica on bedding surfaces; very thinly bedded, internally ripple-laminated; forms slightly ledgey slope.....	13.	4.0

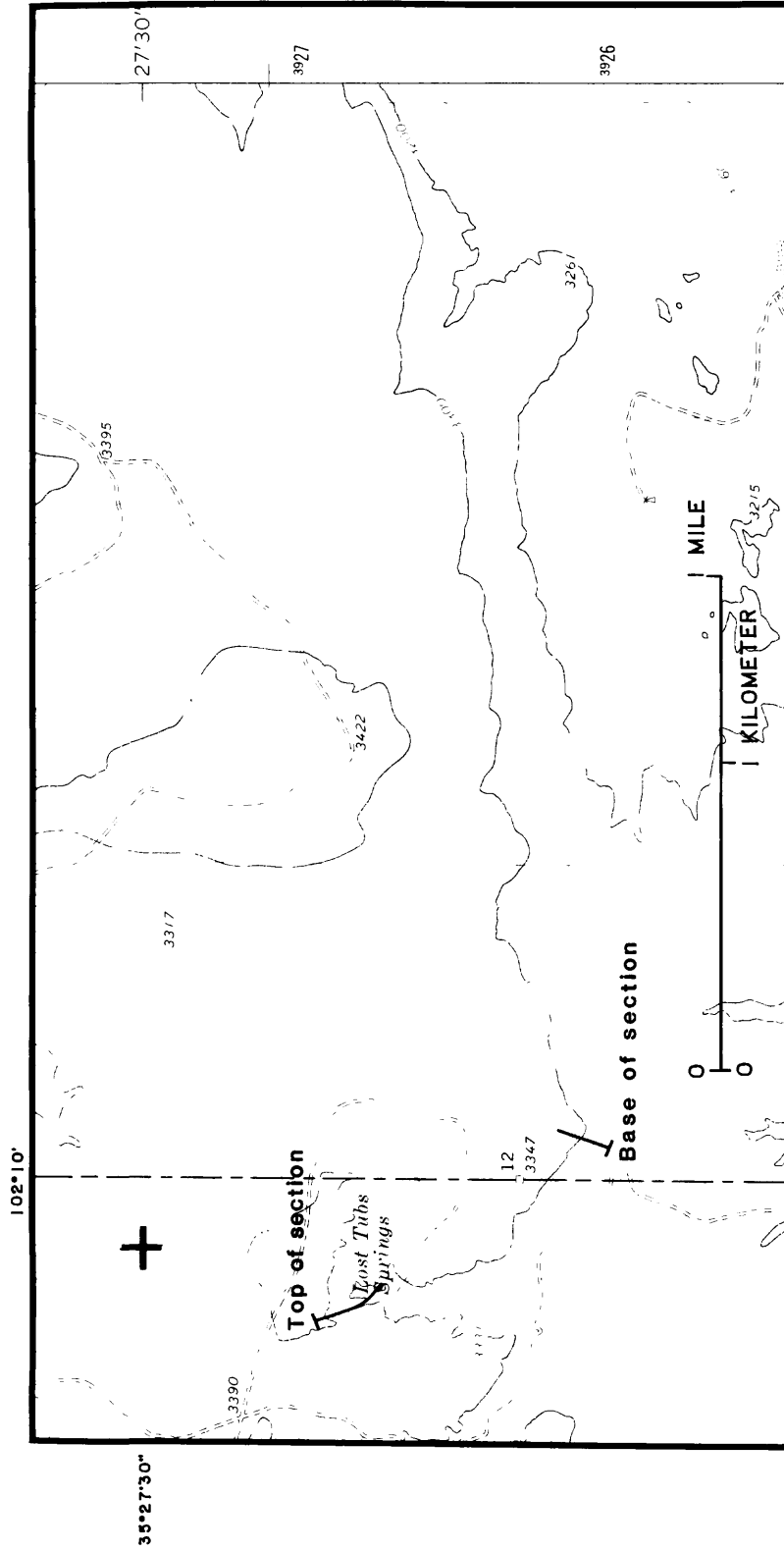


Figure 21.--Location of the line of measurement of the Lost Tubs Springs section (pl. 1, locality 11) within the Ady 7.5-minute topographic quadrangle, Oldham and Potter Counties, Texas

	<u>Feet</u>	<u>Meters</u>
11. Sandstone and limestone-granule conglomeratic sandstone as ledges with about equal amount of interbedded claystone like unit 10; sandstone, greenish-white, very fine grained, well-sorted, clayey and micaceous, ripple-marked, fairly well cemented by calcite; limestone-granule conglomerate, greenish-white, abundant granules mostly 1-3 mm and some as much as 10 mm across, interstitial calcareous mudstone, small-scale low-angle crossbeds.....	17.	5.2
10. Claystone, reddish-brown (10R 4/4), weathers pale reddish brown (10R 5/4), soft, weathers flaky on slope.....	22.	6.7
9. Claystone, reddish-brown (10R 4/4), weathers pale reddish brown (10R 5/4), soft, silty, well-sorted, friable; greenish-white, black, and dark-green mineral grains, abundant ripple marks; some interbedded, very fine-grained sandstone layers.....	4.	1.2
8. Limestone-pebble conglomerate and coarse-grained sandstone, light- greenish-gray (5G 8/1), weathers yellowish brown (10YR 5/2); mostly chips of silty and clayey limestone less than 5 mm across, 10 mm-diameter pebbles common, and numerous 25-50 mm-diameter pebbles in a few beds near base; small- to large-scale, nearly planar low-angle crossbeds.....	19.	5.8
Total of incomplete Trujillo Formation.....	<u>132.</u>	<u>40.2</u>
7. Claystone, reddish-brown (10R 4/4), weathers pale reddish brown (10R 5/4), basal 1 m green and yellowish-orange; weathers flaky; forms steep slope; all but most basal part may be Trujillo.....	18.	5.5

	<u>Feet</u>	<u>Meters</u>
6. Siltstone and claystone interbedded in layers 0.25-0.50 m thick; siltstone, light-brown (5R 6/4), weathers same, fairly well sorted, well-cemented with calcite, internally ripple- laminated, forms flaggy ledges; claystone, like unit 5 below.....	13.	4.0
5. Claystone, reddish-brown (10R 4/4), weathers reddish orange (10R 5/6) into hackly chips.....	7.	2.1
4. Claystone, dark-pink (5R 6/4), weathers pale red (10R 6/2) and into hackly chips, slightly silty.....	10.	3.1
3. Claystone, dark-yellowish-orange (10YR 6/6), weathers grayish orange (10YR 7/4), hard, siliceous(?); hackly, conchoidal fracture; cut by irregular vein-like bleached zones.....	11.	3.3
2. Claystone, moderate-reddish-brown (10R 4/6), weathers moderate reddish orange (10R 6/6), grades upward to overlying yellowish unit through moderate-yellowish-brown (10YR 5/4), which weathers light brown (5YR 6/4), hard, fractures semi-conchoidally; contains tubules in lower part; a few irregular white silty streaks in upper half outline flat bedding; forms steep slope of recemented flaky debris.....	29.	8.8

	<u>Feet</u>	<u>Meters</u>
1. Claystone, pale-reddish-brown (10R 5/4) to moderate-red (5R 5/4), weathers orangish pink; forms slightly frothy surface; mostly uniformly thin beds or low-angle, large-scale crossbeds; streaked with greenish-white, friable, quartzose, well-sorted siltstone; high-angle crossbeds of siltstone dominant in lower 1 m; base not exposed.....	<u>20.</u>	<u>6.1</u>
Total of incomplete Tecovas Formation.....	<u>108.</u>	<u>32.9</u>
Total of incomplete Dockum Group.....	<u>240.</u>	<u>73.1</u>

Potter County

Rotten Hill Fossil Locality Section

Section measured about 0.6 mi (1 km) east of Division Pens Springs at Rotten Hill fossil quarry (Panhandle Geological Society, 1958, remains of stone house mark site) on Ware LS ranch in Ady 7.5-minute quadrangle, Potter county, Texas (fig. 22; pl. 1, locality 12). Altitude of base of section is about 3,220 ft.

[Measured by J. C. Wright, May 15, 1968]

	<u>Feet</u>	<u>Meters</u>
Quaternary.		
10. Gravel, caliche; quartz, chert, and igneous and metamorphic rock pebbles; eolian sand; thickness not measured		
Triassic System.		
Dockum Group:		
Trujillo Formation:		
9. Conglomerate, gray, mostly calcareous clay and limestone chips 4-20 mm across; unit locally thicker, appears to locally cut out and rework units 8 and 7 just below base of Trujillo Formation.....	<u>1.</u>	<u>0.3</u>
Total of incomplete Trujillo Formation.....	<u>1.</u>	<u>0.3</u>

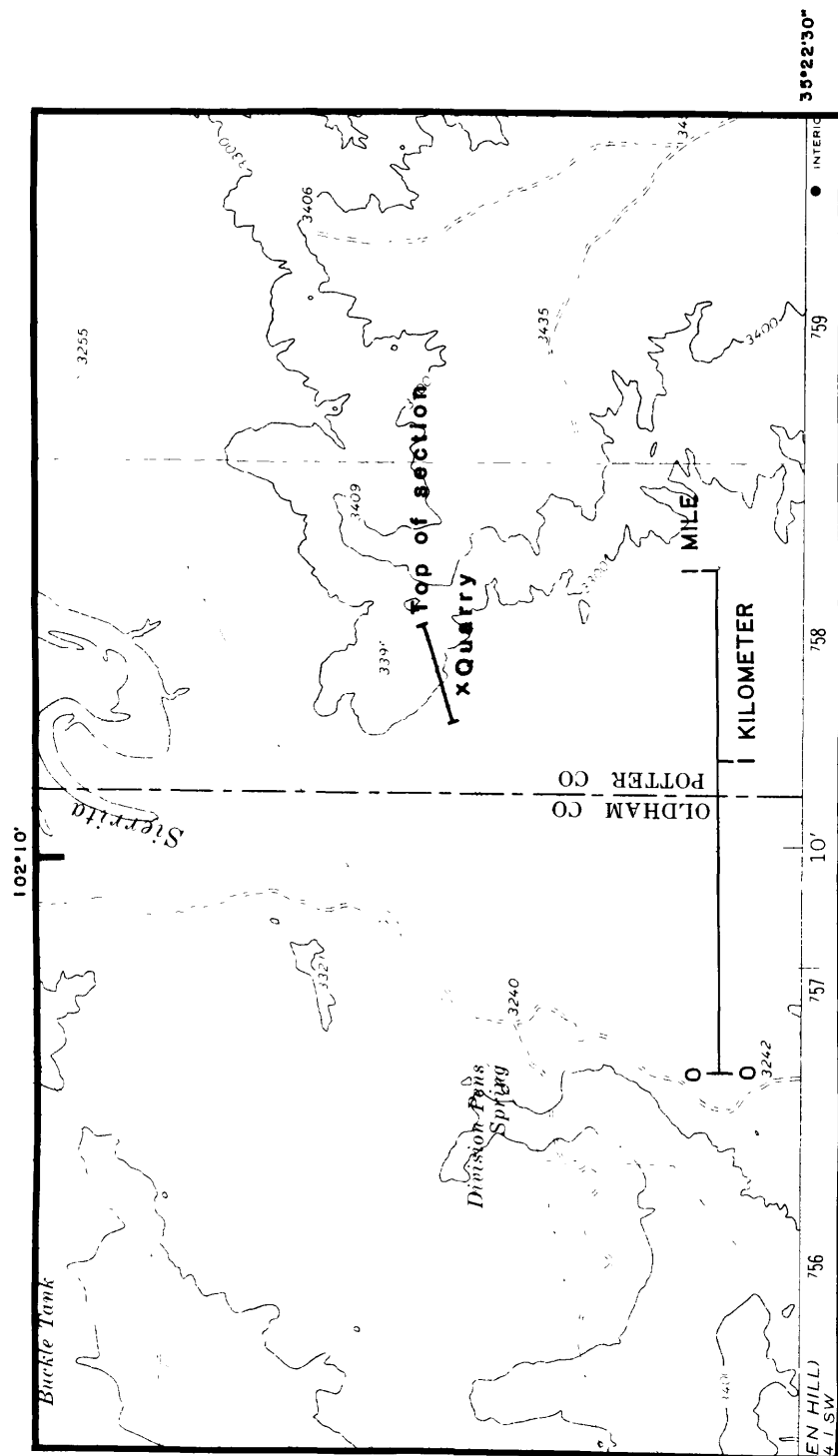


Figure 22.--Location of the line of measurement of the Rotten Hill Fossil Locality section (pl. 1, locality 12) within the Ady 7.5-minute topographic quadrangle, Potter County, Texas

	<u>Feet</u>	<u>Meters</u>
Tecovas Formation:		
8. Siltstone, yellowish-orange (10YR 7/6), weathers white; sandy, poorly sorted; thin flat beds to very low angle, large-scale crossbeds; perhaps beach-or bar-type subaqueous deposit; passes laterally into thicker unit of nearly same lithology but redder in color, pale-reddish-orange (10R 7/6), and with steeper large-scale crossbeds and thin interbeds of limestone-pebble conglomerate; this may be regarded as fluviially reworked Tecovas; the nearly flat bedded, sandy siltstone described here at top of Tecovas may elsewhere form uneroded domes rising notably above general level of Tecovas-Trujillo contact as about 2.5 km west of Rotten Hill at stables of LS Ranch headquarters and at "Rock City" west of stables (see Halfway Creek Quadrangle); these outcrops are 5-10 m thick, have distinctive convex upwards rounded slick-rim outlines (just like Entrada slick-rim facies), and small incipient stonepecker holes; about 3 km west of Rotten Hill the slick-rim facies builds up out of unit 6 to level of units 8 and 7.....	3.	0.9
7. Siltstone, reddish-orange (10R 5/6); irregular hackly fracture marked by irregular light-bleached zones particularly near top; earthy; nearly massive; this unit like unit 8 appears locally to be virtually cut out by Trujillo fluvial reworking; where sandy reworked zone is thickest there is 1-4 ft (0.3-1 m) of white, well-sorted, coarse siltstone with horizontal and low-angle crossbeds at base, also ripple-marked; <u>Unio</u> casts at base.....	17.	5.2
6. Claystone, dark-yellowish-orange (10R 7/6), weathers partly reddish orange; irregular bleached vertical lines about 1-1.5 m below top, hard siliceous(?); weathers to angular, conchoidally fractured hackly chips; makes steep straight slope on cliff; on one outcrop several more resistant beds that just break slope show even, flat bedding.....	30.	9.1

	<u>Feet</u>	<u>Meters</u>
5. Claystone like unit 6 above, but grades in color to moderate-red (5R 5/4); calcareous(?) concretions mark bedding planes of irregular, nubbly 2-12 cm-thick beds; unit in part, at least, fragmental clastic; looks like reworking of unit 4 below with introduction of some new material.....	5.	1.5
4. Claystone, moderate-red (5R 4/4), weathers moderate red (5R 5/4); flaky; upper part contains bleached calcareous(?), veinlike zones 25-50 mm across cutting irregularly down from overlying concretionary zone; some calcareous(?) concretions in upper 1.2 m; lower half water saturated and digging here reveals very abundant fossil worm(?) tubules 1-3 mm in diameter; lower 1.2 m partly yellow orange color, weathering light grayish red and slightly frothy; lower contact grades downward into unit 3.....	19.	5.8
3. Claystone, variably complex unit with large-scale (15 m long) low-angle crossbeds and lateral facies changes within 200 m; varies from moderate-reddish-brown (10R 4/6) claystone to frothy (expanded, hard-dried, mud cracked) dark-grayish-red (5R 3/2) claystone that weathers pale red (5R 6/2), and locally to crossbedded, greenish-white, sandy siltstone like unit below.....	28.	8.5
2. Siltstone, greenish-white (5GY 9/1), weathers white giving the appearance of limestone, pale-red (5R 6/2) streaks outline large-scale (7 m long), high-angle crossbeds oriented in random directions; slightly sandy, well-sorted coarse quartz grains; slightly clayey, contains very friable fossil vertebrate bones.....	23.	7.0

	<u>Feet</u>	<u>Meters</u>
1. Claystone, weathers pale-red (5R 6/2) to dark- pink (5R 6/4), frothy surface, vertebrate fossils abundant about 2 m below top.....	<u>40.</u>	<u>12.2</u>
Total of Tecovas Formation.....	<u>165.</u>	<u>50.2</u>
Total of incomplete Dockum Group.....	<u>166.</u>	<u>50.5</u>

Rosita Creek - Canadian River Section

Measured about 7,500 ft (2300 m) ENE of point where sand of Rosita Creek meets sand of Canadian River in northern part of Chunky 7.5-minute quadrangle, Potter County, Texas (fig. 23; pl. 1, locality 13). Altitude of base of section is about 2,990 ft.

[Measured by W. I. Finch and A. P. Smith, Jr., June 20, 1973]

	<u>Feet</u>	<u>Meters</u>
Quaternary.		
7. Gravel, terrace.....	4.	0.9
Triassic.		
Dockum Group:		
Trujillo Formation (incomplete):		
6. Conglomerate, brown, poorly sorted, coarse grains of quartz and chert, rock fragments as much as 5 in. (13 cm) across, coarse sand matrix; very large-scale (50-150 ft across) festoon beds; unit channels into underlying units with as much as 3 ft (1 m) of relief; forms massive ledge; thickens to 25-ft (7.6 m) ledge 500 ft (150 m) to south.....	<u>7.</u>	<u>2.1</u>
Total measured Trujillo Formation.....	<u>7.</u>	<u>2.1</u>
Tecovas Formation:		
5. Sandstone, like unit 3 but all very fine grained.....	14.	4.3
4. Claystone, varicolored, grayish-red-purple (5RP 4/2), yellowish-gray (RY 8/1), moderate-red (5R 5/4), shaly, forms covered slope.....	12.	3.7

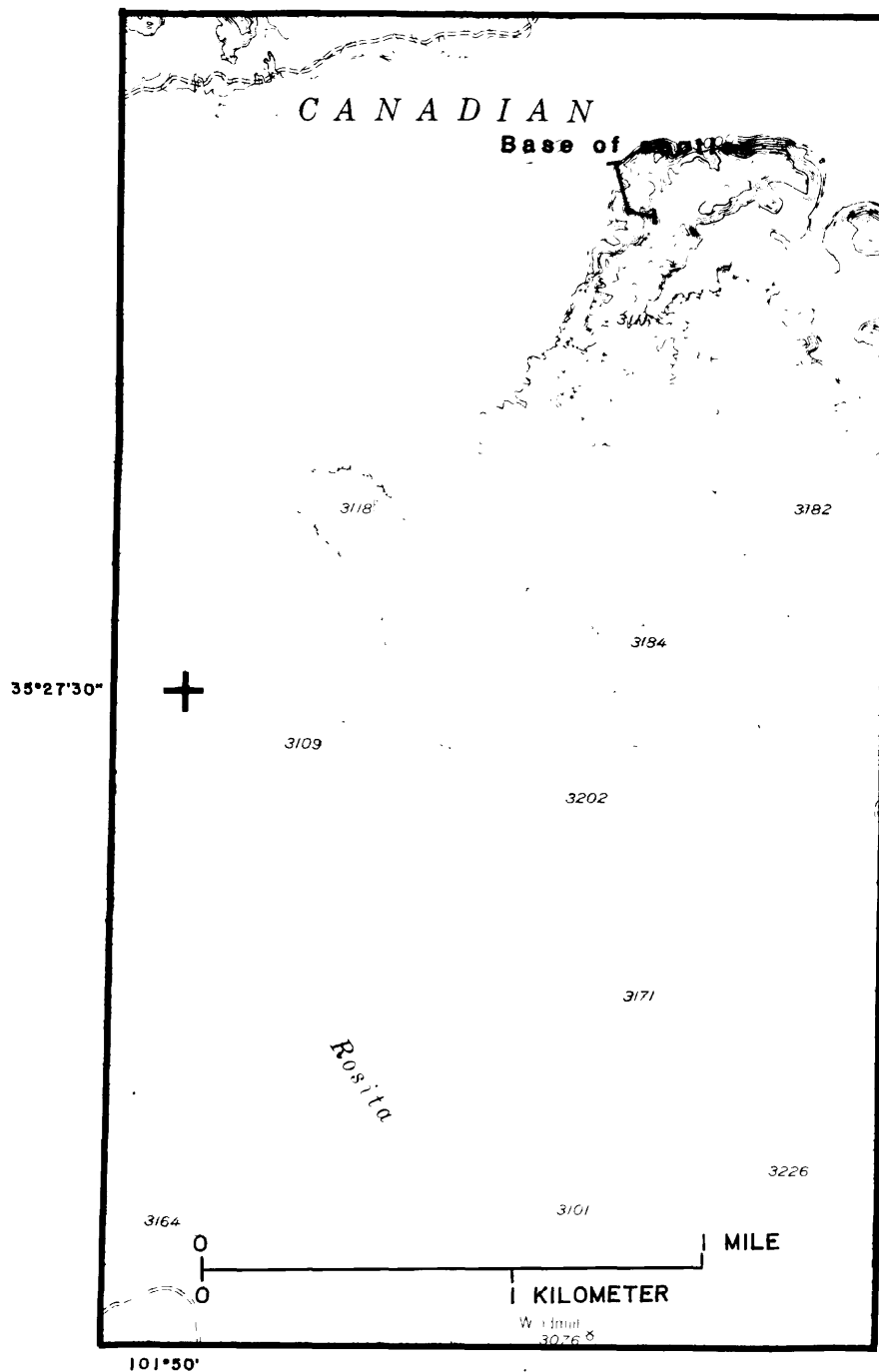


Figure 23.--Location of the line of measurement of the Rosita Creek-Canadian River section (pl. 1, locality 13) within the Chunky 7.5-minute topographic quadrangle, Potter County, Texas

	<u>Feet</u>	<u>Meters</u>
3. Sandstone, pinkish-gray (5YR 6/1), weathers brown, well-sorted very fine to fine quartz and sparse dark grains, very sparse white clay grains; a fining-upward sequence; clean, soft sugary, friable; crossbeds weakly displayed; upper 3 ft (0.9 m) weathers out into balls 1/4-1/2 in. (0.6-1.2 cm) in diameter; highly jointed; forms weak to bold ledge; lies with apparent angular contact on unit 2.....	<u>38.</u>	<u>11.5</u>
Total thickness of Tecovas Formation.....	<u>64.</u>	<u>19.5</u>
Total thickness of Dockum Group.....	<u>71.</u>	<u>21.6</u>

Permian.

Quartermaster Formation (incomplete):

Alibates Dolomite Lentil:

- | | | |
|--|-----|------|
| 2. Siltstone and claystone, intermixed in beds, moderate-reddish-orange (10R 6/6) to moderate-reddish-brown (10R 4/6), locally oxidized to yellowish-gray (5Y 8/1) particularly in upper few cm contact with unit 3, entire unit weathers slightly duller colors; abundant opaque grains; siltstone thinly laminated; claystone shaly; siltstone beds show asymmetrical ripple marks and small-scale crossbeds; forms covered slope..... | 35. | 10.7 |
|--|-----|------|

Alibates Lentil:

- | | | |
|---|------------|-------------|
| 1. Dolomite, white (N9) to pinkish-gray (5YR 8/1), weathers pinkish-gray to very light gray (N8), very fine grained, thinly (1 mm) laminated, locally contorted; typical ledge weathering, unit continuous of fairly uniform thickness in slopes across river; weathered blocks 3-10 ft (1-3 m) across persist downslope for 100 ft (30 m) vertically onto underling red siltstone beds; base not examined; unit as little as 22-ft (6.7 m) thick downstream..... | <u>45.</u> | <u>1.5</u> |
| Total thickness of measured Quartermaster Formation..... | <u>40.</u> | <u>12.2</u> |

Randall County

Goodnight Peak Highway Section

Section measured along Goodnight Peak Highway roadcut into Palo Duro Canyon State Park in Fortress Cliff 7.5-minute quadrangle, Randall county, Texas (fig. 24; pl. 1, locality 14). Section starts below switchback at south end of cut a little west-northwest of riding stable. Approximate altitude of top of section is 3,340 ft.

[Measured by J. C. Wright, August 26, 1967. Description addended by W. I. Finch, 1972]

	<u>Feet</u>	<u>Meters</u>
Pliocene.		
Ogallala Formation:		
Not measured. Contact with Trujillo Formation very poorly exposed.		
Triassic.		
Dockum Group:		
Trujillo Formation:		
22. Siltstone, light-brown (5YR 6/4), clayey, calcareous, micaceous (colorless), carbonaceous(?) films and flecks, compact.....	10.	3.1
21. Sandstone, yellowish-gray; well-rounded, very coarse grains (1-2 mm) of limestone; hard; well-cemented with calcareous mud.....	3.	0.9
20. Claystone, light-greenish-gray (5GY 8/1), calcareous, carbonized plant remains; subordinate greenish-white, crossbedded siltstone; ledges of greenish-gray (5GY 6/1) medium-grained sandstone; granules of Timestone scattered throughout unit	20.	6.1
19. Claystone and sandstone alternating about half and half, yellowish-gray (5Y 7/2), very fine clear quartz grains, micaceous (colorless, black), calcareous; sandstone in channel-fill structures.....	60.	18.3

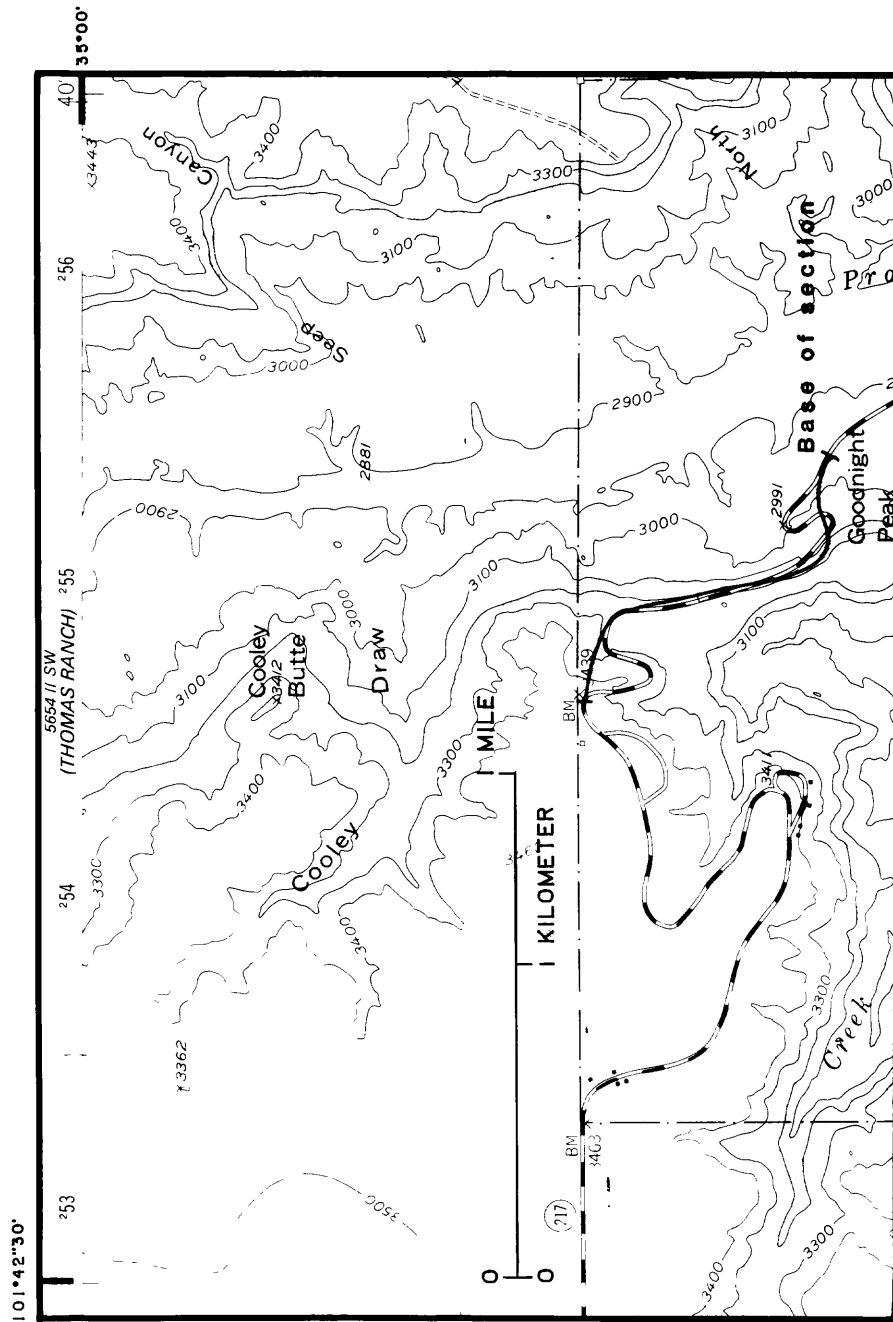


Figure 24.--Location of the line of measurement of the Goodnight Peak Highway section (pl. 1, locality 14) within the Fortress Cliff 7.5-minute topographic quadrangle, Randall County, Texas

	<u>Feet</u>	<u>Meters</u>
18. Sandstone, pale- to dark-yellowish-orange (10YR 7/6) speckled white; fine to very fine clear and yellowish-white quartz and dark-grains, very sparse muscovite, abundant white clay grains, calcareous; local small massive channel filling.....	9.	2.7
17. Irregularly interbedded pale-reddish-brown (10R 5/4) claystone, greenish-white siltstone, and greenish-white very fine grained sandstone; calcareous.....	11.	3.3
16. Claystone.....	12.	3.7
15. Claystone, reddish-brown (10R 4/4), very silty, interbedded with sandstone beds.....	10.	3.1
14. Sandstone, very pale orange (10YR 8/2), stained grayish red by wash from overlying claystone, very fine to fine-grained clear quartz and sparse dark minerals, scattered white clay grains; very clean, noncalcareous, friable; numerous limestone-pebble streaks, particularly in lower part, few larger than 32 mm; the road cut exposes the left half of a channel fill; two sandstone ledges, each about 1.5 ft (0.5 m) thick and separated by about 4 ft (1.2 m) of claystone outside the channel, thicken and fill in a channel about 28 ft (8 m) deep; all of a succession of sandstone ledges have thick channel axes at this point, including all ledges to top of ridge through which the highway is cut.....	28.	8.5
13. Claystone, light-brown (5YR 5/6) to moderate-red (10R 4/4); silty, sandy (fine quartz grains), noncalcareous; along outcrop this unit is as much as 30 ft (9 m) thick but at highway cut is scoured out beneath channel axis of overlying unit.....	10.	3.1

	<u>Feet</u>	<u>Meters</u>
12. Sandstone, lithologically like underlying unit, but large-scale wedge sets of low-angle crossbeds and cut and fill; some partings of reddish-brown, silty claystone; nearly all scours are uniform in direction suggesting present day eroded cliff is parallel to old axis of inferred troughs that dip S. 25° E.; uneven top of unit formed by uppermost beds in wedge sets.....	25.	7.6
11. Sandstone, yellowish-gray (5Y 8/1); very fine grained clear quartz, few dark grains; very clean, friable, noncalcareous; massive breaking beds 2-4 ft (0.6-1.2 m) thick with very large scale, low-angle cross laminae; minor scouring along base.....	27.	8.2
10. Claystone, pale-reddish-brown (10R 5/4), silty, noncalcareous.....	4.	1.2
9. Sandstone, pinkish-gray (5YR 8/1) to moderate-orange-pink (5YR 8/4), well-sorted; very fine clear quartz and sparse dark grains; noncalcareous; sparse flecks of plant matter along some bedding planes; very clean, friable; in upper part several 1 ft (0.3 m) thick beds of reddish-brown silty claystone, thin even beds with a few sets of cross laminae, poorly exposed except in highway cut.....	12.	3.7
Total of Trujillo Formation.....	<u>241.</u>	<u>73.5</u>
Tecovas Formation:		
8. Claystone, mostly yellowish orange (10YR 7/6), covered on line of section, described from adjacent poorly exposed slopes.....	45.	13.7
7. Claystone, mostly yellowish orange (10YR 7/6), some moderate-red (5R 4/4) near base, a little reddish-brown (10R 4/4) near top; silty, calcareous; weathers into crumbly hackly chips; top not exposed locally.....	11.	3.4

	<u>Feet</u>	<u>Meters</u>
6. Sandstone, pale-red (10R 6/2) to light-brownish-gray (5Y 6/1), well-sorted medium-grained clear quartz, very well-indurated with calcareous cement; contains dense aphanitic yellowish-white clay chips and grains; radial fibrous quartz(?) rose 20 mm in diameter noted at base; forms ledge.....	1.	0.3
5. Sandstone, light-greenish-gray (5GY 8/1); silty, poorly sorted very fine grained quartz; medium- to coarse-well-rounded grains of clear, gray, and pale-orange-stained quartz and black chert concentrated in basal 2-8 cm of unit at point 100 m southwest of line of section; upper half contains interbeds of silty, pale-reddish-purple claystone; exposure poor, but some crossbeds visible; contact with underlying Permian concordant locally;.....	<u>9.</u>	<u>2.7</u>
Total of Tecovas Formation.....	<u>66.</u>	<u>20.1</u>
Total of Dockum Group.....	<u>307.</u>	<u>93.6</u>

	<u>Feet</u>	<u>Meters</u>
Permian.		
Quartermaster Formation:		
4. Claystone, reddish-orange (10R 5/6), very silty, no gypsum, evenly bedded; similar to unit 2; interbeds of greenish-white sandy siltstone 30- 45 cm thick, 8 m, 11 m, and 15 m abovebase.....	53.	16.2
3. Claystone, pale-reddish-brown (10R 5/4), thin interbeds of ripple-marked light-greenish-gray (5GY 8/1) siltstone, evenly laminated.....	7.	2.1
2. Claystone, reddish-orange (10R 5/6), very silty, evenly bedded, no gypsum.....	21.	6.4
1. Claystone, reddish-orange (10R 5/6), slightly silty, contains gypsum, laminated.....	<u>3.</u>	<u>0.9</u>
Total of incomplete Quartermaster Formation.....	<u>84.</u>	<u>25.6</u>

Mesquite Park Section

Section measured along well-worn trail up prominent spur to Mesquite Park on south wall of Palo Duro Canyon in Fortress Cliff 7.5 minute quadrangle, Randall County, Texas (fig. 25; pl. 1, locality 15). Section starts across from circle-terminous campgrounds of paved road down canyon. Approximate altitude of base of section is 2,780 ft.

[Measured by J. C. Wright, August 25-26, 1967]

	<u>Feet</u>	<u>Meters</u>
Pliocene.		
Ogallala Formation: Not measured.		
Triassic.		
Dockum Group:		
Trujillo Formation:		
31. Sandstone, channel structures.....	~40.	~12.
30. Claystone, reddish-brown, silty, poorly exposed.....	~75.	~23.
29. Sandstone, greenish-gray, fine-grained; few clayey siltstone interbeds 0.3-1.2 m thick; troughs at base; contains many subangular to subrounded 1-20 mm-long limestone chips; basal 0.3 m is a pebbly, very coarse grained sandstone, pebbles of dominantly greenish gray limestone; other pebbly stringers higher up; prominent crossbeds dip NNE. to NNW.; poorly exposed between slumped blocks along traverse on spur; top covered under talus; unit appears to thicken westward.....	~10.	~3.0
28. Pebbly mudstone, greenish-gray (5GY 6/1); pebbles mostly limestone and some chert; matrix dominantly calcareous clay like underlying bed.....	3.	0.9
27. Claystone, greenish-gray (5GY 6/1), slightly silty; thin siltstone interbeds in top 1.5 m; small pockets of carbonaceous plant trash, some stained yellow; poorly exposed.....	9.	2.7

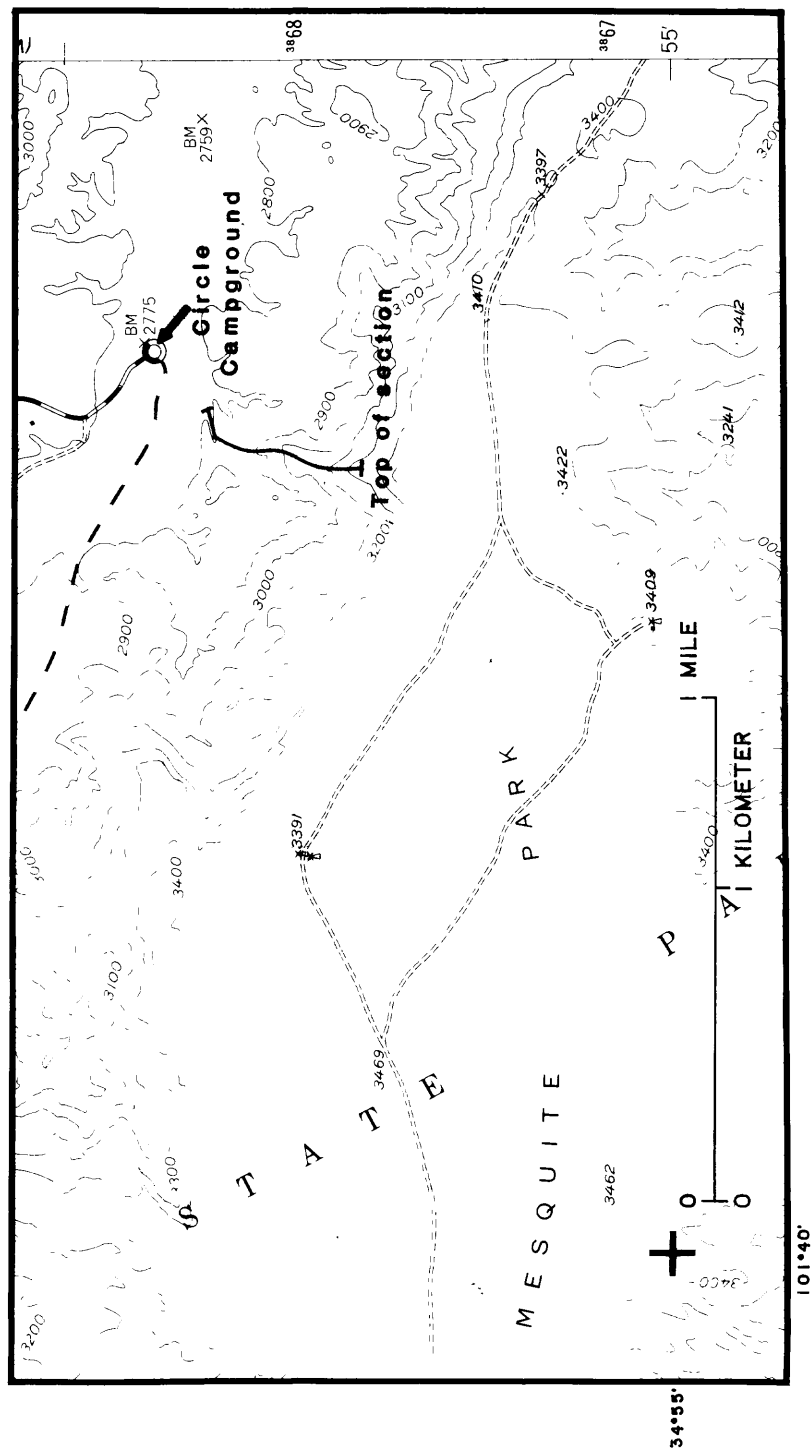


Figure 25.--Location of the line of measurement of the Mesquite Park section (pl. 1, locality 15) within the Fortress Cliff 7.5-minute topographic quadrangle, Randall County, Texas

	<u>Feet</u>	<u>Meters</u>
26. Claystone, reddish-brown (10R 4/4), silty; many thin interbeds of greenish-white siltstone in upper 2 m; poorly exposed beneath talus on most points; forms protected cliffs in some areas.....	24.	7.3
25. Siltstone, light-greenish-gray (5GY 8/1), sandy, mostly thin evenly laminated.....	2.	0.6
24. Claystone, reddish-brown (10R 4/4), silty, internal structure mostly obscured, uppermost 15 cm contains planar cross laminae dipping N. 80° E.....	4.	1.27
23. Sandstone, greenish-gray (5GY 6/1), very fine grained quartz, silty; no pebbles except granules of limestone in bottom 7.5 cm; minor splits of reddish-brown (10R 4/4), silty claystone; one broad shallow channel fill of claystone 0.15-0.60 m thick; low-angle (50-100) crossbeds; steepest crossbeds dip N. 57° E., S. 62° E., N. 30° W., N. 40° E., N. 30° E.; lowest of prominent ledges of Trujillo Sandstone; unit appears to thicken westward along canyon wall.....	13.	4.0
22. Claystone, reddish-brown (10R 4/4); weathered surface not frothy; contains a few silty sandstone beds about 0.15 thick like underlying unit; forms either a slope or protected recess....	12.	3.7
21. Sandstone, light-greenish-gray (5GY 8/1), very fine grained, wedge sets about 7-60 cm thick of planar cross laminae dip about 10° to N. 60° E. (a few due N.); basal 0.6 m contains many chips as much as 10 mm across of underlying claystone; forms inconspicuous ledge.....	<u>11.</u>	<u>3.4</u>
Total of Trujillo Formation.....	<u>~203.</u>	<u>~62.</u>

	<u>Feet</u>	<u>Meters</u>
Tecovas Formation:		
20. Claystone, grayish-red (10R 4/2), silty, frothy weathering.....	18.	5.5
19. Same as unit 18 below, but better exposed.....	19.	5.8
18. Siltstone, greenish-white, poorly sorted; subordinate light-grayish-red (5R 5/2) claystone beds; bedding slightly irregular and minor low-angle crossbeds; poorly exposed; unit slumped on spurs.....	36.	11.0
17. Claystone, light-grayish-red (5R 5/2) (possible Tecovas-Trujillo contact).....	10.	3.1
16. Claystone, yellowish-orange (10YR 7/6).....	27.	8.2
15. Claystone, light-grayish-red (5R 5/2).....	4.	1.2
14. Claystone, yellowish-orange (10YR 7/6), contains 1-3 in. (2.5-7.5 cm) limestone concretions.....	20.	6.1
13. Claystone, light-grayish-red (5R 5/2); limestone-filled tubules in upper half; very frothy but hard-cemented slope.....	16.	4.9
12. Claystone, dusky-red (5R 3/4); subordinate 10-30 cm-thick ledges of fine- to medium-grained, poorly sorted, very well cemented sandstone; silica-cemented sandstone ledge capping unit contains abundant granules of probable Triassic or Permian siltstone; whole unit exhibits large-scale crossbeds dipping about 15° N. 67° E.; 2-m-thick claystone bed just below top sandstone ledge contains irregular, vertical, limestone-filled tubules 5-15 cm across and 15-45 cm high, and some peculiar knobby, dense limestone etched to show tubules about 5 mm across on surface.....	27.	8.2

	<u>Feet</u>	<u>Meters</u>
11. Claystone, moderate-red (5R 4/4), some medium-gray (N6) near top; swelling and frothy weathering; probably crossbedded like above units and below but obscured by frothy surface; forms purple-stained steep slope.....	14.	4.3
10. Claystone, reddish-brown, silty; interbedded with greenish-white silty fine-grained sandstone; crossbedded; top surface is a gently dipping crossbed.....	7.	2.1
9. Pebbly sandstone like unit 7.....	0.5	0.15
8. Conglomerate, subangular to subrounded 5-15 cm diameter cobbles of underlying Permian siltstone in a sparse pebbly sandstone matrix.....	0.5	0.15
7. Pebbly sandstone, greenish-white (5G 9/1); coarse-grained, poorly sorted; subordinate cross laminae of reddish-brown (10R 4/4) silty claystone; granules and pebbles mostly white, pink, and gray quartz and white, gray, black, red, and yellow chert, subrounded to subangular, mostly 2-6 mm across but some as much as 30 mm; this unit with two above form one crude set of irregular large-scale crossbeds dipping 100-150 N. 500 E.....	3.	0.9
6. Claystone, reddish-brown (10R 4/4), very silty, clay swelled on weathered surface.....	<u>1.</u>	<u>0.3</u>
Total of Tecovas formation.....	<u>203.</u>	<u>61.9</u>
Total of Dockum Group.....	<u>~406.</u>	<u>~124.</u>

	<u>Feet</u>	<u>Meters</u>
Permian.		
Quartermaster Formation:		
5. Claystone and siltstone, interbedded, siltstone like underlying unit in beds 7-90 cm thick; claystone, pale-reddish-brown (10R 5/4), beds 0.3-1 m thick, thinly laminated; contains thin light-greenish-gray beds; lower half of unit contains about 10 percent of well-cemented, crossbedded, moderate-reddish-orange siltstone beds 5-20 cm thick that form small ledges and have flat tops but irregular channeled bottoms....	20.	6.1
4. Siltstone, moderate-reddish-orange (10R 6/6), slightly clayey, massive, bedding obscure; forms vertical cliff where not concealed under talus.....	13.	4.0
3. Sandstone, silty, very fine grained, poorly sorted; contains not only abundant fine-grained fraction but also a secondary coarser-grained mode of clear smoky and pale-orange frosted well-rounded medium to coarse quartz grains; crossbedded in truncated broad trough sets of planar to gently arcuate beds, sets 10-60 cm thick, crossbeds dip N. 47° E., N. 64° E., N. 80° E., and S. 73° W. (last one at very low angle); forms prominent white band visible for several miles along north wall of canyon.....	3.	0.9
2. Claystone, reddish-orange (10R 5/6), very silty; thinly evenly laminated, contains ripple-marked, well-indurated siltstone, both light-greenish-gray (5GY 8/1) and moderate-reddish-orange (10R 6/6); generally like underlying unit but contains very little gypsum; forms steep slopes where not covered by talus of Triassic rocks.....	30.	9.1

	<u>Feet</u>	<u>Meters</u>
1. Claystone, moderate-reddish-brown (10R 4/6) to reddish-orange (10R 5/6), very silty; thinly and evenly laminated, contains inconspicuous but numerous beds of gypsum 2.5-7.5 cm thick; contains in a shaly interval some satin-spar seams nearly parallel to bedding towards base; a few light-greenish-gray (5GY 8/1) ripple-marked well-cemented siltstone beds near top; weathers to silty and flaky soil; supports grass and brush cover; erodes into badlands and very steep slopes.....	<u>65.</u>	<u>19.8</u>
Total of measured Quartermaster Formation...	<u>131.</u>	<u>39.9</u>

Scurry County

Flat Top Mountain Section

Section measured on southwest side of Flat Top Mountain in the north-central part of the Flat Top Mountain 7.5-minute quadrangle, Scurry County, Texas (fig. 26; pl. 1, locality 24). Altitude of base of section is about 2,425 ft.

[Measured by W. I. Finch, April 14, 1971]

	<u>Feet</u>	<u>Meters</u>
Cretaceous.		
Not measured		
Triassic.		
Dockum Group:		
Trujillo Formation:		
5. Claystone, moderate-reddish-orange (10R 6/6), silty, sandy, slightly micaceous, shaly, most forms covered slope.....	15.	4.6
4. Sandstone and claystone, yellowish-gray (5Y 7/2), mottled and streaked dark-yellowish-orange (10YR 6/6), limonitic, micaceous (muscovite and biotite), shaly; mostly covered slope; grades into unit 5.....	7.	2.1
3. Conglomerate, light-gray with various yellow and green shades, mostly 1/8 to 1/4 in (0.3-0.4 cm) quartz (white, gray, yellow), crossbedded, intergrades with unit 2.....	5.	1.5
2. Sandstone, white to very light gray, weathers medium gray; medium to coarse, clear to pale-gray to orange quartz grains; sparse mica, white clay interstitial; clean, porous, friable; crossbedded; lower 15+ ft (4.6 m) forms slope in lower part and ledge in upper part; all forms ledge in canyon to the north.....	<u>28.</u>	<u>8.5</u>
Total measured Trujillo Formation.....	<u>55.</u>	<u>16.7</u>

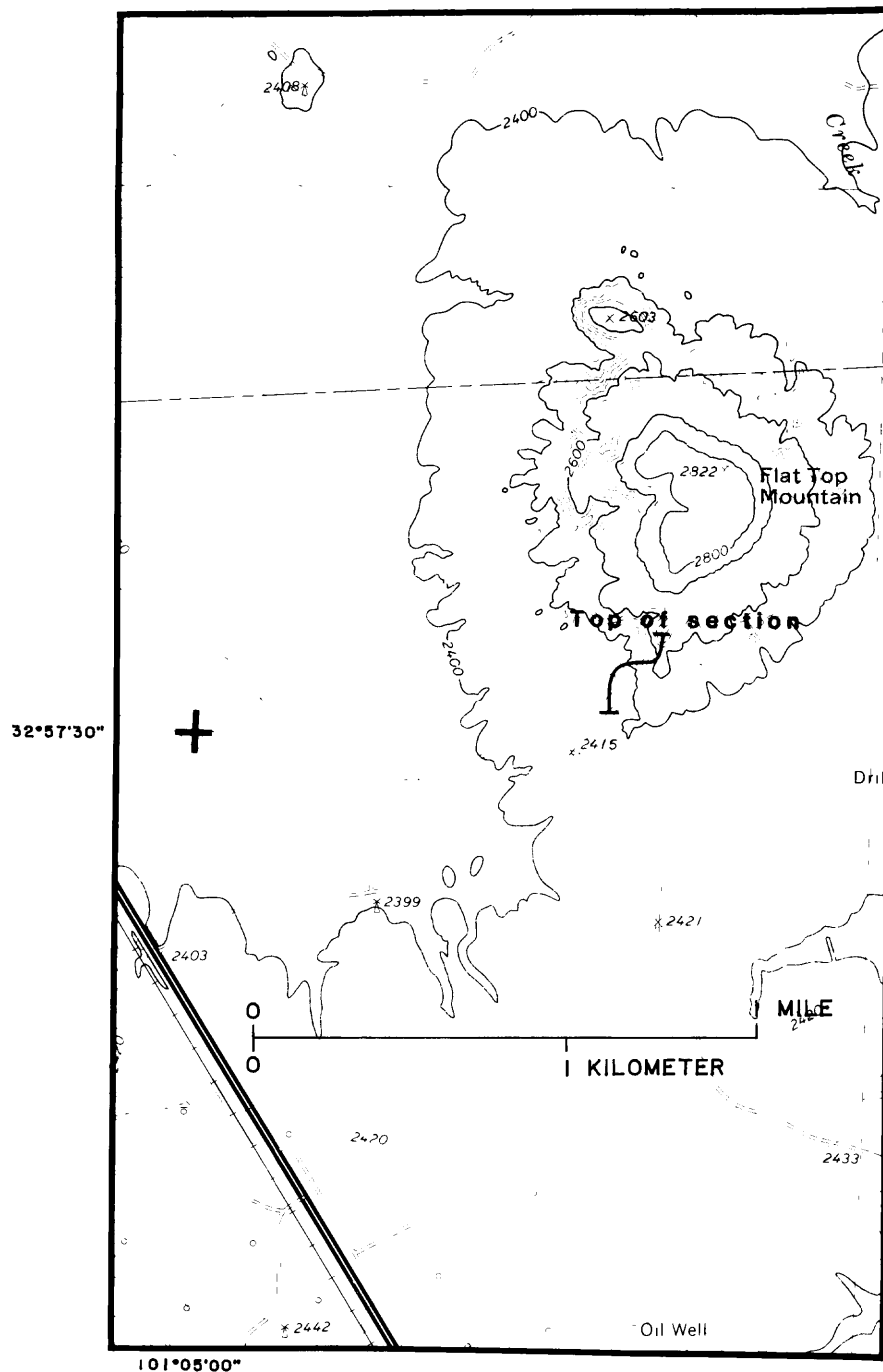


Figure 26.--Location of the line of measurement of the Flat Top Mountain section (pl. 1, locality 24) within the Flat Top Mountain 7.5-minute topographic quadrangle, Scurry County, Texas

	<u>Feet</u>	<u>Meters</u>
Tecovas Formation (incomplete):		
1. Claystone, dark-reddish-brown (10R 3/4), patches of mottled grayish-yellowish-green (5 GY 7/2), coarse-grained quartz blebs and irregular patches; mostly shaly; some crusty surfaces; covered for most part.....	<u>120+.</u>	<u>36.6</u>
Total exposed Tecovas Formation.....	<u>120+.</u>	<u>36.6+</u>
Total measured Dockum Group.....	<u>175+.</u>	<u>53.3+</u>

Stonewall County

West Double Mountain Section

Section measured on the southwest side of the east conical subpeak of the western Double Mountain in the Double Mountains 7.5-minute quadrangle, Stonewall County, Texas (fig. 27; pl. 1, locality 23). Description is very general and thicknesses are approximate. Altitude of top of Triassic estimated at about 2,320 ft.

[Measured by J. C. Wright, September 16, 1967]

	<u>Feet</u>	<u>Meters</u>
Cretaceous.		
5. Claystone and nodular fossiliferous limestone; claystone forms lower part and is weathered orangish yellow.....	20.	6.1
Cretaceous(?).		
4. Claystone, light-greenish-gray to lavender.....	15.	4.5
3. Siltstone, white, sandy, granules and pebbles of chert at base.....	<u>10.</u>	<u>3.1</u>
Total measured Cretaceous beds (actually much greater).....	<u>45.</u>	<u>13.7</u>
Triassic.		
Dockum Group:		
2. Claystone, purple, frothy weathered surface.....	15.	4.5
1. Conglomerate, 1 to 2 in. (2.5-5 cm) subrounded to well-rounded black, red, and yellow chert and white quartz pebbles in white matrix, fines upward.....	<u>25.</u>	<u>7.6</u>
Total measured Dockum Group.....	<u>40.</u>	<u>12.1</u>
Permian.		
Not measured		

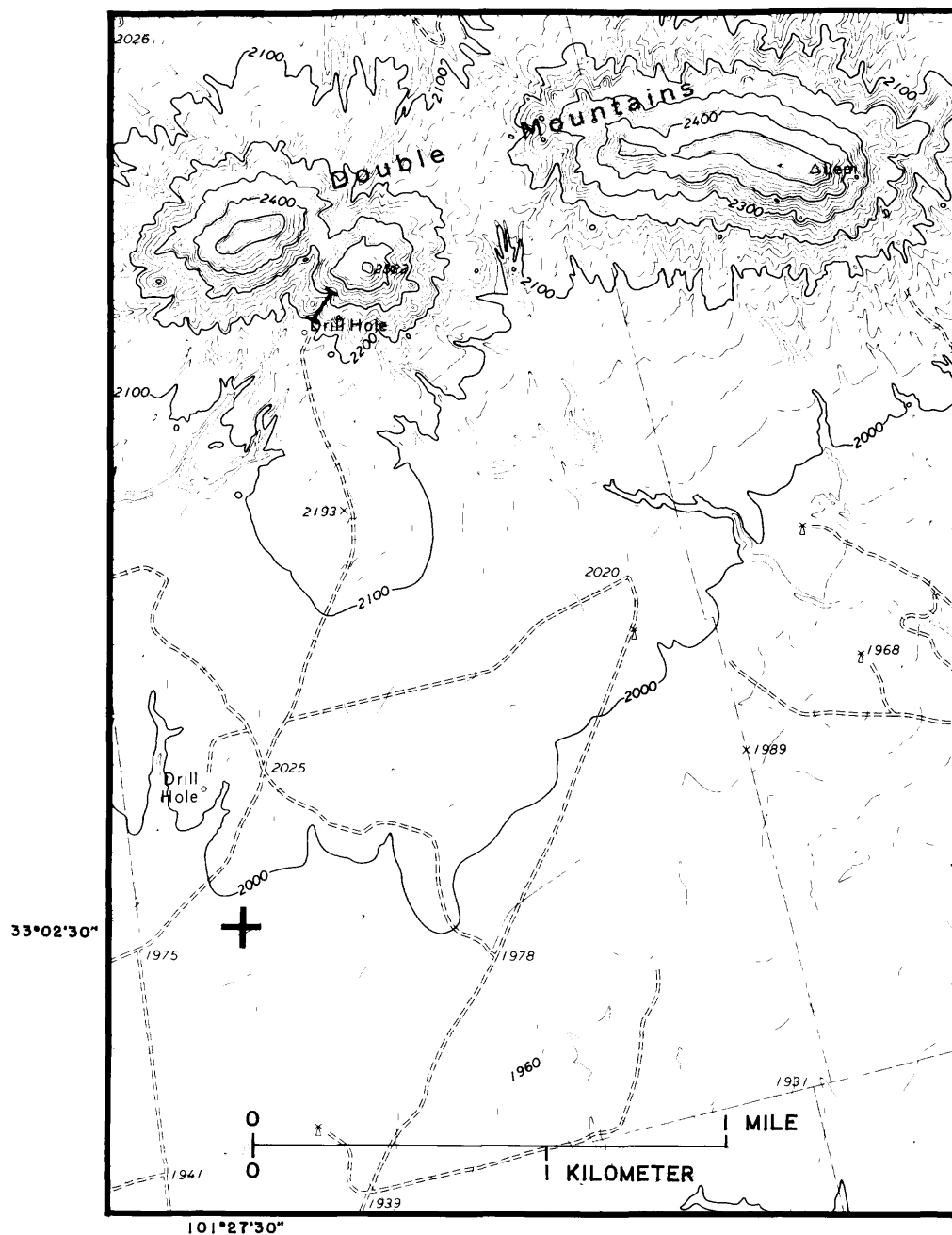


Figure 27.--Inferred location of the line of measurement of the West Double Mountain section (pl. 1, locality 23) within the Double Mountains 7.5-minute topographic quadrangle, Stonewall County, Texas

OKLAHOMA

Cimarron County

West Fork, South Picket House Draw Section

Section measured along east bank of a west fork of South Picket House Draw (name in quadrangle on the north) in sec. 36, T. 5N., R. 5 E., in the Keys SW quadrangle, Cimarron County, Oklahoma (fig. 28; pl. 1, locality 28). Altitude of base is about 4,000 ft. Photograph of section is in paper by Stovall (1943, pl. V, section "26" in caption is an error).

[Section measured by W. I. Finch, May 21, 1971]

	<u>Feet</u>	<u>Meters</u>
Jurassic.		
Morrison Formation:		
7. Siltstone, brown, calcareous, flat-even bedded, shaly; few indurated layers 1-2 in (2.5-5 cm) thick cut by iron-oxide veinlets; unit forms mostly covered slope; base fairly flat but locally with slight erosional unconformity; Cretaceous Dakota contact probably a foot or so above.....	13+.	4.0+
Entrada Sandstone:		
6. Sandstone, very light gray, fine- to medium-quartz grains, sparse very coarse (as much as one-quarter in. (0.6 cm) across) to small red and black chert grains, more abundant near base; white interstitial material, calcareous; bedding not apparent; forms hard ledge; erosional and slightly angular unconformity at base.....	1.5-2	0.5
Triassic.		
Dockum Group:		
5. Claystone and siltstone, reddish-brown, grayish-green lower and upper 1 ft (0.3 m), sandy in part, calcareous.....	4.	1.2

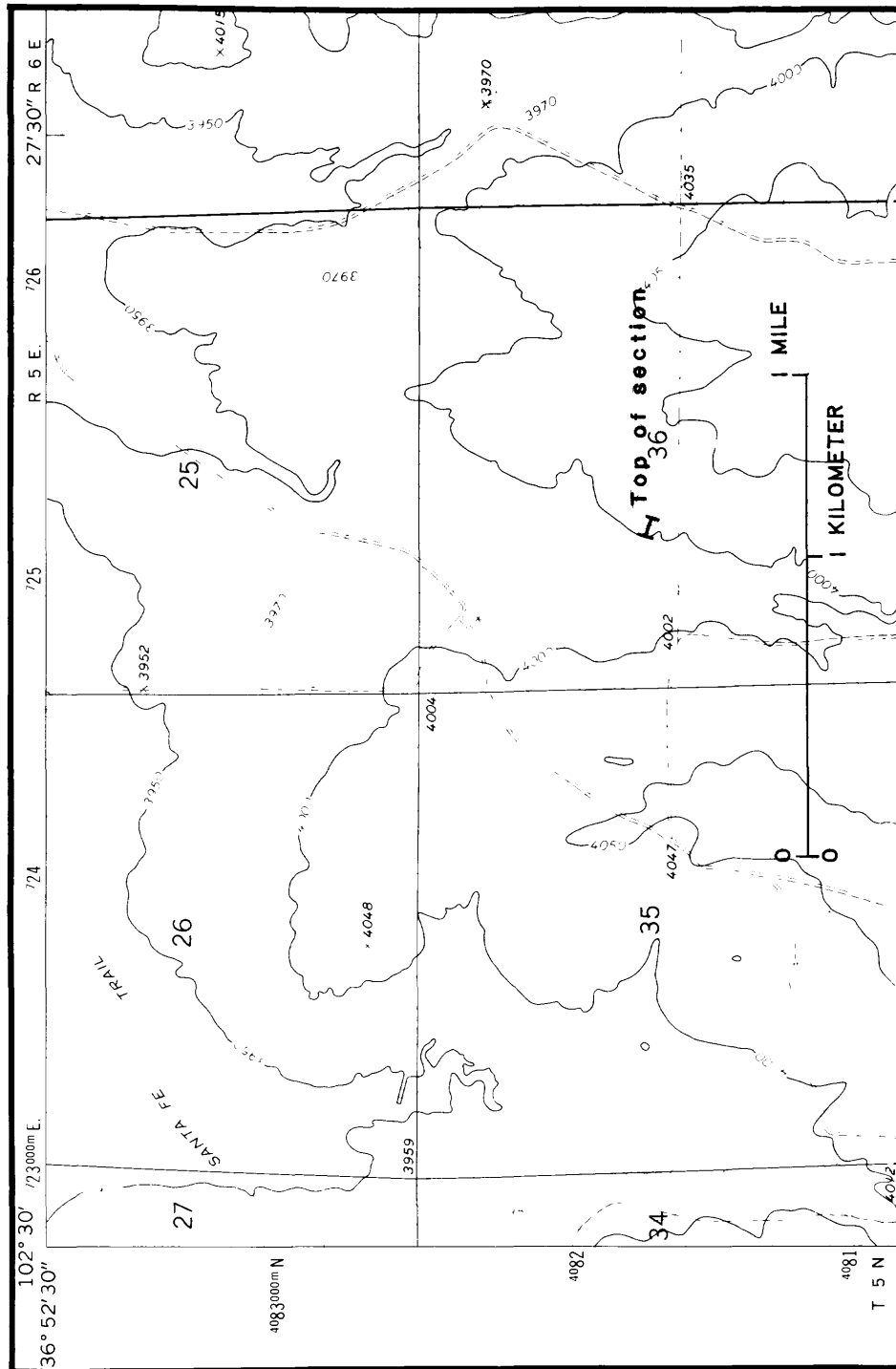


Figure 28.--Location of the line of measurement of the West Fork, South Picket House Draw section (pl. 1, locality 28) within the Keys SW 7.5-minute topographic quadrangle, Cimarron County, Oklahoma

	<u>Feet</u>	<u>Meters</u>
4. Sandstone like unit 2, folds of less amplitude.....	2.	0.6
3. Claystone and siltstone, reddish-orange and grayish-green, calcareous, shaly.....	1.5	0.5
2. Sandstone, pale-reddish-orange, very fine quartz grains, some red and black grains; calcareous, hard; bed is folded with relief about 2-3 ft (0.3-0.6 m) and wave length 50-75 ft (15-23 m).....	2.	0.6
1. Clayey siltstone, reddish-orange, micaceous, shaly, calcareous, base near Permian contact.....	<u>1.</u>	<u>0.3</u>
Total measured thickness of Dockum Group....	<u>10.5</u>	<u>3.2</u>

Labrier Butte Section

Section measured in and along cuts of black-top road on the southeast side of Labrier Butte in the NE1/4 of sec. 29, T. 6 N., R. 1 E. in the Kenton 7.5 minute quadrangle, Cimarron county, Oklahoma (fig. 29; pl. 1, locality 29). Altitude of base of section is 4,300 ft.

[Measured by W. I. Finch, May 19, 1971]

	<u>Feet</u>	<u>Meters</u>
Jurassic.		
Morrison Formation:		
Exposed on slopes of butte to north, forms covered slope, not examined.		
Entrada (Exerter) Sandstone:		
4. Sandstone, very pale orange (10YR 8/2), fine quartz grains, white interstitial clay; lower part is limonitic and brown; lower few inches well-indurated and contains scattered very coarse quartz spheres and 1/8-1/4 in. (0.3-0.6 cm) angular white chert; typical large-scale eolian crossbeds; forms slick rim.....	23.	7.0
Triassic.		
Dockum Group:		
Sheep Pen Sandstone:		
3. Sandstone, dark-yellowish-orange (10YR 6/6) to moderate-yellowish-brown (10YR 5/4), very fine quartz grains, silty, calcareous; beds mostly 1-2 in. (1.2 cm) thick; a stylitic-like caliche layer 1/16-1/4 in. (0.2-0.8 cm) thick forms base of each bed; green claystone lens (1 ft (0.3 m) thick at thickest point) in lower part; forms ledge in places; unconformable with underlying unit.....	10.	3.1

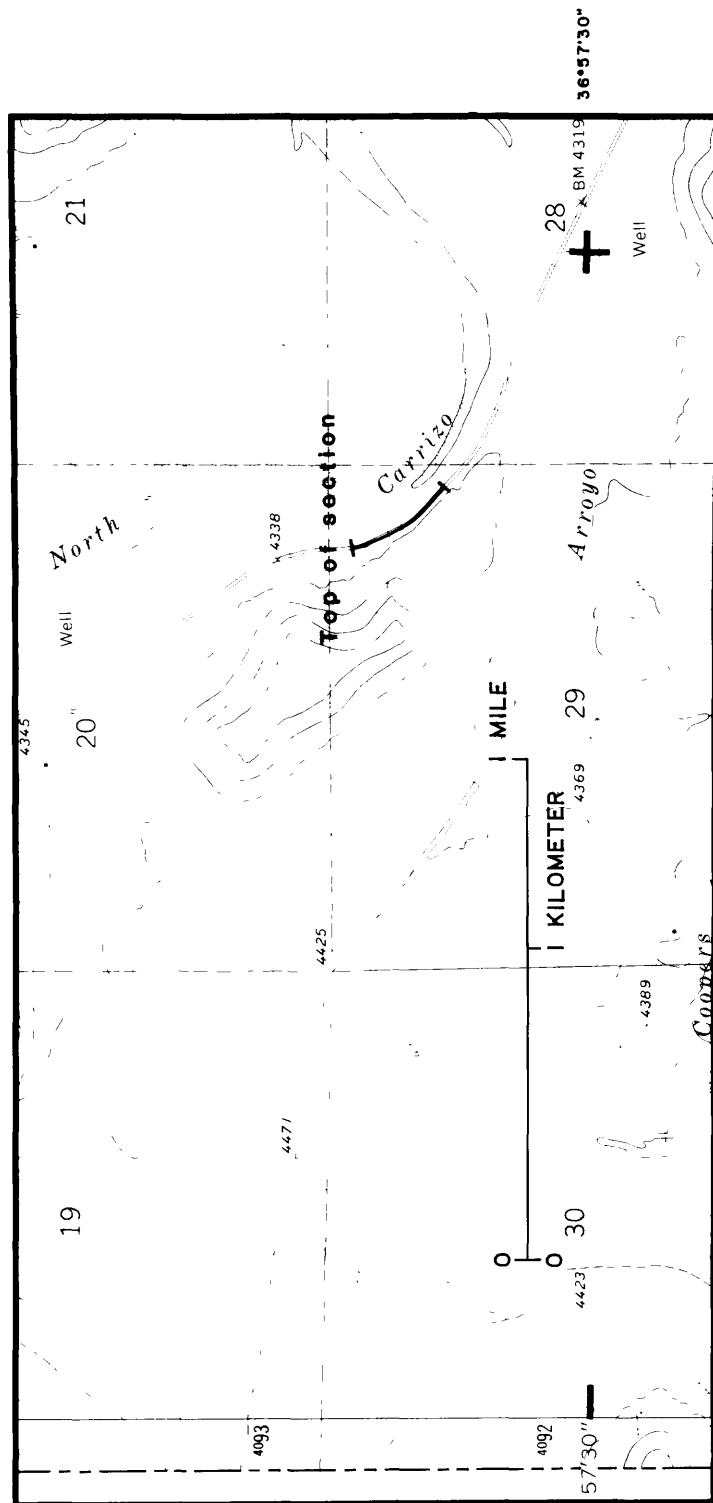


Figure 29.--Location of the line of measurement of the Labrier Butte section (pl. 1, locality 29) within the Kenton 7.5-minute topographic quadrangle, Cimarron County, Oklahoma

	<u>Feet</u>	<u>Meters</u>
Sloan Canyon Formation:		
2. Siltstone and minor very fine grained sandstone, very pale to pale-green in lower part, moderate-yellow and brown (10YR 5/4) to grayish-orange (10RY 7/4) in upper part; indurated; siltstone noncalcareous, sandstone calcareous; thin green claystone lenses in lower part; fairly even bedding, beds 1/2-1 ft (0.15-0.30 m) thick; symmetrical ripple marks; forms ledge in places.....	17.	5.2
1. Claystone and siltstone, pale-green (5G 7/2) to very pale green (10G 8/2), pale- (10R 5/4) to dark- (10R 3/4) reddish-brown, sparse medium-gray (N5), green shades veined red along fractures; noncalcareous; fairly even flat bedding, shaly; intergrades with overlying unit; forms covered slope.....	<u>28+.</u>	<u>8.5+</u>
Total measured thickness of Sloan Canyon Formation.....	<u>45+.</u>	<u>13.7</u>
Total measured thickness of Dockum Group....	<u>55+.</u>	<u>16.7+</u>

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PLATE 1 OF 1



1. Santa Rosa railroad-cut
2. Sunshine Mesa-State Route 156 road-cut
3. Dripping Triangulation Station
4. Henry Pittman Ranch
5. Rana Arroyo
6. Revuelto Creek-U.S. Route 66
7. Trujillo Camp
8. Spring-Las Archas Creek
9. Rincon-Ranch Creek
10. U.S. Route 385-Saddleback
11. Lost Tuba Springs
12. Rottan Hill fossil locality
13. Roalte Creek-Canadian River
14. Goodnight Peak Highway
15. Mesquite Park
16. State Route 284-Pleasant Creek
17. The Narrows-Tule Creek
18. Mexican Creek Hill-State Route 256
19. Lingo Falls
20. Negro Hills-Sand Creek
21. John Guita, Jr., Ranch
22. Red Mud Creek
23. West Double Mountain
24. Flat Top Mountain
25. Muchakooago Peak
26. Pecos River-Texas 1053
27. Castle Mountain West
28. West Fork-South Picket House Draw
29. Labrier Butte

PLATE 1.--INDEX MAP OF EASTERN NEW MEXICO, WEST TEXAS, AND THE OKLAHOMA PANHANDLE
SHOWING THE LOCATION OF MEASURED SECTIONS.