P-W

Waddell-Duncan-Murray #1 2-24
Sec. 5-Twp 22S-R 27E

2-24
6

County Cochise

Area

Lease No.

Well Name ~~Waddell- Duncan~~ Murray # 1

Location SE NW Sec 5 Twp 22S Range 27E Footage ~~NS~~ 1980FNL & FWL

Elev 4225 ~~Gr~~ Gl 4238 KB (datum used) Spud Date - Completed -50 Abandon 5-16-52 Total Depth 4210 ? (4240' Book; Time Log to 4400'.) Approx. Cost $

Contractor:

8" Csg @ 1975' - P.I. Card

Casing Size	Depth	Cement
13 3/8" (?)	237' EL. 250' Drlr.	
According to Temp. Survey 300'		
8 5/8"	1970'	
5 1/2"	3098'	

Drilled by Rotary
Cable Tool

Production Horizon

Initial Production D & A

Logged by Schlumberger to 3910' 10-18-50
Temp Survey by Hallibirton 30'-3078' 6-22-51.
Shows top cement at 2265"

REMARKS Have Time Log - Temp Log - Schlum Log - also shows perforations.
Perf. 5 shots (5) 2625-50; 28 shots (4) 2825-45'; 27 shots (3) 2950-2980';
30 shots (1) 2990-3.000' and 30 shots (2) 3016-3026.

P.I.-Card: "2 BWPM in. w. some gas @ 2258-70 in Penna." "Went to Pre Є"

Elec. Logs Temperature Log; Resistivity & negative copy ~~E Log~~
Applic to Plug ___ Plugging Record ___ Completion Report ___ Sample #1638
Sample Log drilling sample test log
Sample Descrip.
Sample Set ~~X 7-13 2 5~~ P-1638
Cores

Water well - accepted by

Bond Co. & No.

Bond Am't $ Cancelled Date Organization Report

Filing Receipt Dated Well Book Plat Book

Loc. Plat Dedication

API # 02-003-05039

PERMIT NUMBER none Date Issued

2-24

COPY COPY COPY

CHUCK ASTON
Consulting
Petroleum Geologist
Suite 302, Booker Bldg.
Artesia, New Mexico

2-24

A GENERAL GEOLOGIC REPORT PERTAINING TO OIL AND GAS POSSIBILITIES
SULPHUR SPRINGS VALLEY, COCHISE COUNTY, ARIZONA

This report is cumulative in that it cobers various and sundry previous reports by this writer and is an attempt to cover and area extending, for purposes of this report, from the United States- Mexico boundary at Douglas, Arizona on the South to the beginning of the Gila River water shed at a point roughly due West of Fort Grant approximately thirty miles north of Willcox, Arizona; bordered on the east, from north to south, by the Pinaleno, Dos Cabezas, Chiricahua and Swisshelm mountains; anden the west, from north to south, bythe Winchester, Little Dragoon, Dragoon and Mule Mountains. An area roughly eighty miles long north to south and averaging about twenty to twenty five miles east to west and characteristic of a typical Rocky Mountain type basin with surrounding mountains ranges.

The valley area consists in the main of gently undulating grassy plains at an elevation of from 4200 feet to 5000 feet above sea level. The surrounding mountains ranges rise from a few hundred feet to 5000 feet abover the vally floor.

The cores of the surrounding mountain ranges generally consist of pre-cambrian schists and granites. With the entire Paleozoic cloumn, as shown in the following stratographic column, overlaying the ##### cores. The Cretaceous formations as shown are evident on the flanks.

The major structural axes trend in a northwest-southeasterly direction with only a slight variations from true north and south. There are some indications of later cross folding along a more nearly east west axis. These structural indications are evident on the surface and are confirmed in subsurface where geophysical surveys have been made.

It is impossible to determine the depth of the valley fill overlaying the Cretaceous formations in the valley proper as no subsurface information is available at the present time.

A number of water wells have been drilled in the valley fill and a large number of these have made # showings of oil and gas in greater or lesser quantities; however, it is the writers considered openion that, because of it's reported high gravity character this oil is nothing more or less than stope oil trapped near the surface but originating at # much grater depths.

The Cretaceous formations are definately the best probabilities for the accumulation of oil and/ or gas in commercial quantities because of their particular types and the complete lack of alteration which is evident in the older Paleozoic formations.

However the Paleozoic formations are of a character where altered on the contact and outcrop near the granite cores of the mountains that if the alterations did not take place at a distance from the mountains, in other words in the valley proper, the possabilities of oil and/ or gas accumulations would not be at all unlikely.

As to local structural conditions necessary for the accumulation of oil and/ or gas in the various formations discussed above, the writer has previously written reports covering four excellant prospects, which do not include all the structural features but only the more evident.

The following is a generalized stratographic section of the Sulphur Springs area:

PRE-CAMBRIAN

Schists and granites composing the crystalline basement.

Pinal Schist: Greenish grey schist.

CAMBRIAN

Bolsa Quartzite. Basal Paleozoic. Unconformably overlying the schist or granite. Total thickness may be from 400 to 500 feet. Hard, fine-grained to pebbly conlomerate. Color of exposed rocks brown.

UPPER CAMBRIAN

Abrigo Limestone: Conformably overlying the Bolsa Quartzite. Total thickness of complete section 700 feet. Laminated, thin bedded, cherty limestone. Bands of metamorphosed shale and limestone. Buff to dark grey. At top of section white quartzite 5 feet thick. Slightly fossiliferous.

DISCONFORMITY

Ordovician, Silurian, and part of the early Devonian missing.

DEVONIAN

Martin Limestone: Unconformably overlying the Abrigo Limestone. Total thickness 200 to 350 feet thick. At base grey limestone with layers of soft grey shale. Upper part hard, compact, dark grey to black limestone with a few thin sandy beds. Casts and corals in upper portion.

CARBONIFEROUS
Mississippian

Escabrosa Limestone: Total thickness approximately 500 feet (may be 700 to 1000 feet locally). Thick, white to dark garnular limestone, some hard, white, crystaline. Coral and crinoid stems. Where greater thickness is exposed upper part consists of limestones, shales, and sand stones, predominately yellow.

PENNSYLVANIAN

Naco Limestone: Divided into four members, all marine.

Basal member: Overlaying Escab rose limestone. 1100 feet thick.
Black and grey limestone. Coral and crinoid stems.
Orange dolomite member: Alternating sandstones, shales, and dolomitic limestones. Predominate color yellow to orange. Thickness 690 feet more or less.
Black limestone member: Massive, dense, black limestone; 630 feet thick.
Fauna similar to the Wewoka of Oklahoma.
Upper member: Dolomitic: Shales, shaly limestones, dolomite and sand stone. Approximately 780 feet thick.

Total thickness of Naco Limestone 3200 feet.

In the Whetstone Mountains Dr. Stoyanow places the total thickness of Naco formation of Pennsylvanian age at 1600 feet. Tentatively classifying the upper 1600 feet of Carboniferous beds as Permain. (Whetstone, Empire and Little Dragoon Mountains.)

UNCONFORMITY

Triassic and Jurassic apparently missing.

MESOZOIC

Comanchean Cretacous: Generalized section: (Bisbee Group??)

Glance Conglomerate : Laid down upon an erosional surface on Naco Limestone; consists of a conglomerate of angular fragments of the older rocks of all sizes filling the hollows of the eroded syrface to a more or less even surface. Thickness from 0 to as much as 500 feet.

Novaculite and blue limestone: 50 to 70 feet thickness of irregular novasulite beds overlain by blue fossiliferous limestone. It is a good formation marker. Overlies glance conglomerate

Morite formation: Lower member: Shales, sandstones, quartzites, some limestone: Estimated approximately 1200 feet thick.
Uppermember predominately limestone and shales. Correlates with Trintity group of Texas.

Mural Limestone: Predominately limestone, approximately 700 feet thick Correlates with Glen Rose of Texas: Upper part may be equivalent of Edwards Limestone.

Cintura Formation: Uppermost Comanchean Cretaceous. Shales, sands, sandstones, impure limestones. Approximately 1800 feet thick Upper part generally eroded. Fredericksburg Group-some may be younger.

Entire thickness of Lower Cretaceous generalized section 3000 to 4000 feet. In the Whetstone Mountains indicated to be 10,000 feet, and in the Empire Range at around 6000 feet.

Cenozoic to recent: Conglomerates and gravels of valley fills of indeterm' thickness.

The above stratigraphic column indicates that a test well of less than 6000 to 7000 feet in depth would in all probability not adiquately test the Cretaceous formations; therefore, it is recommended that any test hole be predicated to at least these depths, unless shallower production is encountered, or deeper if it is desirable to test the Paleozoic possabilities.

From an analyses of the factors set out above and from a number of years of practical field experience, the Sulphur Springs Valley is one of the best prospective future oil provinces in the Southwest today.

Respectfully submitted this 27th day of May, 1948

/s/ CHUCK ASTON
Chuck Aston
Consulting Pet. Geologist

A true copy

#2-24

2-24

DRILLING SAMPLES

FROM

WADDELL-DURGAN CO. #1 MURRAY WELL

LOCATION

CSE¼NW¼ SEC. 5, T 22 S, R 27 E.

COCHISE COUNTY, ARIZONA.

CORRELATED BY

LOREN I. BUCK

2242 East Seneca
Tucson, Arizona

WARDELL-DUNCAN CO. #1 MURRAY

Elev. Est. 4240'
4238 K.B

Location--C36-NW, Sec. 5, 22 S, 27E.
Cochise County, Arizona

0 - 540	Valley Fill - conglomerate.
1610	Mostly red & green shaley conglomerate. Base of Morita.
30	Soft white lime - Top of Naco Lime, 1610'.
40	" " " & some Morita.
50	" " " " "
60	" " " " "
70	" " " " "
80	Missing.
90	Soft white lime & some Morita.
1700	" " " " "
10	" " " " "
20	" " " " " (lime increasing)
30	" " " " " " "
40	Reddish light lime & some Morita. ?
50	" " " " " Top solid, 1745± ?
55	Light lime & some Morita w/some chert and erosional material. Few heavy porous pieces.
60	Good solid white & gray xln. lime. Trace chert Dark.
65	xln. white lime - no porosity.
70	" " " - Trace Dark chert.
75	" " "
80	" grey lime; some Dolomitic buff lime - trace chert. Fusilinids noted in sample when wet with acid.
85	" grey lime; some Dolomitic buff lime - trace chert.
90	Missing - lost circulation - no sample at 1790. Cemented
95	Mostly cave--some grey xln. lime. Cemented after losing circulation at 1795.
1800	Grey medium xln. lime w/little reddish lime slightly fossiliferous.
05	" " " " " " " " " Fusilinids
10	Grey medium " " w/some reddish lime Fossil Fusilinids noted in pink lime.
15	Grey medium xln. lime w/some reddish lime. Fusilinids
20	Grey medium xln. lime w/some reddish lime. Fossil Fusilinids.
25	Grey and red xln. lime.
30	" " " " "
40	Grey and red xln. lime w/thin red shale streaks.
50	Red and Grey xln. lime.
1850-60	Grey xln. lime & streaks of grey shale.
70	Grey and reddish grey xln. lime.
80	Grey xln. limestone.
90	" " " w/maroon & green shales. Trip lost circulation. Cemented off.
1900	Grey limestone, marl & little sdy. conglomerate.
10	Dk. grey xln. limestone w/thin dark grey shale streaks. Fosl.
20	Pinkish grey fossiliferous xln. lime.
30	Finely xln. grey lime.
40	Darker grey med. xln. lime.
50	Med. to dark grey xln. lime.
60	" " " " " " (Few-oil-stained cuttings)
65	Reddish grey xln. lime.
70	Med. to Dark grey xln. lime.
75	Reddish dark grey finely xln. lime.
80	Med. to Dark grey " " "
85	Med. grey finely xln. lime.
90	Med. grey finely xln. lime.
95	" " " " " w/thin streak, Dark shale.
2000	" " dense lime w/traces of chert

05 Medium grey dense lime w/traces of chert.
Trip.
10 Maroon shale & dense lime w/traces of chert.
15 " " " " .
20 Some Maroon shale & dense lime - little green shale.
25 Dark maroon and bright green shales w/grey lime streaks.
30 Medium grey finely xln. lime w/some maroon shale streaks.
40 Reddish grey finely xln. lime w/some maroon shale streaks.
45 Reddish grey and grey finely xln. lime w/some maroon & green shale streaks.
50 Medium grey to reddish xln. lime w/some maroon shale streaks.
fossiliferous trip.
55 Medium grey xln. lime.
60 " " " "
65 Med. grey & reddish xln. lime w/some maroon shale streaks.
70 Med. grey xln. lime.
75 " " " "
80 " " " " w/some dark maroon & some green shale streaks.
85 " " " " " " " " " " "
90 " " " " " " " " " " "
95 Dark maroon & green shale w/grey med. xln. lime streaks.
2100 Med. xln. med. grey lime w/dark maroon & green shale streaks & lime; little dolomitic.
05 Med. xln. med. grey lime w/dark maroon & green shale streaks and a thin band of oolitic lime.
10 Buff med. xln lime w/dark maroon & green shale streaks.
15 Grey med. xln lime w/dark maroon & green shale streaks - trace of chert.
20 Grey med. xln. lime.
25 " " " "
30 Grey to Reddish grey xln. lime w/trace of dense oolitic lime.
35 Grey to reddish grey xln lime w/streaks of maroon & green shale.
40 Med. grey xln. lime.
45 " " " "
Trip 2147.
50 Light grey xln. lime.
Fossiliferous
55 Light grey xln lime (fossiliferous) plus some conglomerate. Dense to coarsely xln
60 Conglomerate. Maroon & green dense lime and shales w/much chert
65 Conglomerate. Maroon & green dense lime and shales w/some chert
70 Conglomerate. Same as above.
75 Some conglomerate, with grey lime and translucent chert increasing.
80 Maroon shales, light grey lime and translucent chert
85 Maroon shales w/some reddish to grey xln lime
90 " " " " " " " and chert
95 Grey and pink xln lime--little translucent chert
2200 Grey & pink xln lime--little translucent chert w/maroon shale streaks
05 Pink to maroon dense lime and maroon shale streaks
10 Fossiliferous. Grey & pink xln lime w/maroon & green shale streaks.
15 Grey & pink xln lime w/oolitic chert & maroon shales
20 Conglomerate. Maroon & grey xln lime x/oolitic chert & maroon shales.
25 grey & maroon xln lime w/some translucent chert & maroon shales.
30 Grey & rose xln lime w/much translucent & rose chert.
35 Missing.
40 Grey & pink med. xln lime w/trace of chert.
45 " " " " " w/much translucent chert & some maroon shale.
50 " " " " " w/chert & dark grey shale streaks.
55 Coarsely xln grey lime w/translucent chert & maroon shale streaks.
60 Xln grey lime w/translucent chert
65 Cherty conglomerate. Reddish xln lime & reddish mineral w/some chert.
70 Cherty conglomerate. Reddish dense lime & maroon shale w/chert.
75 Cherty conglomerate. Reddish & grey xln. lime w/much chert.
80 Cherty conglomerate. Reddish dense lime & maroon shale w/chert.
85 Cherty conglomerate. Reddish & grey xln. lime & chert w/little maroon shale.
90 Cherty red conglomerate w/little grey lime.
95 " " " " " "
2300 " " " " " "

2305 Cherty red conglomerate w/some grey xln lime. Top Miss 2305 ?
10 " " " " " " "
15 " " " w/grey xln lime.
20 " " " " " "
25 " " " " " "
30 Grey xln lime w/little white chert.
35 " " " w/some dolomitic lime.
40 Medium grey finely xln lime.
45 Darker grey finely xln lime.
50 " " " " "
55 Med. grey finely xln lime.
60 " " " " " w/traces white opaque chert.
Trip
65 Med. grey med. xln lime.
70 " " " " "
75 " " " " "
80 " to coarsely xln med. grey lime.
85 " " " " " " "
90 " xln med. grey lime.
95 " " " " "
2400 " " grey lime.
05 " " " " w/white lime streaks.
10 White xln lime, soft.
Notco Test 2413 = 2409'
Corrected
2410 White xln lime, soft.
15 " " " w/grey lime streaks, soft.
20 " " " " " " "
2420-25 Grey and white xln lime.
30 " " " " "
35 Grey medium xln lime.
40 " " " "
45 " " " "
50 " " " "
55 " " " "
60 " " " " darker
65 " " " " "
70 " " " " "
75 " " " " w/trace of light chert.
80 " to buff slightly dolomitic lime w/trace of rose chert.
85 Grey & pink medium xln lime (fossiliferous)
90 Light grey to white med. xln. lime.
95 " " " " " " " (fossiliferous)
2500 " " " " " " " w/trace white chert
05 " " " " " " " (fossiliferous)
10 White xln lime.
15 " " " (fossiliferous)
20 Light grey xln lime "
25 " " " " highly fossiliferous
30 Med. grey coarsely xln lime
30 " " " " w/some pink xln lime
35 " " " " streaks of reddish stained
40 " " " " w/lime & streaks of purple shale
45 " " " " " " " " "
50 Light grey & pinkish xln lime - highly fossiliferous
55 " " xln lime & pink dolomitic lime.
60 " " & pink xln lime.
65 " " " dolomitic & xln lime w/some maroon shales (probably cavings)
70 Soft Lt. grey & pink Dolomitic & xln lime
Circulating 30 min.
70 Soft Lt. pink and grey dolomitic sand.
Circulating 1 hour
70 Soft lt. pink and grey dolomitic sand.
75 Soft dark pink & grey dolomitic sand.
80 Fair porosity. Medium to coarsely xln light red dolomite & dolomitic lime w/trace dark chert.
85 Fair porosity. Medium to coarsely xln light red dolomite & dolomitic lime w/trace dark chert.

2590 Medium to coarsely xln light red dolomite w/fair porosity.
95 Medium to coarsely xln light red dolomite w/trace dark chert.
2600 Medium to coarsely xln. light red dolomite & dolomitic lime.
Trip
05 Medium xln light red and grey lime.
10 Medium xln light red and grey dolomitic lime.
15 Medium xln light red w/some grey dolomitic lime.
20 Light red with little grey dolomitic lime.
25 Light red with some grey dolomitic lime.
30 Light red dolomitic lime.
35 Light red dolomitic lime.
40 Light red w/little grey dolomitic lime.
45 Light red & some pinkish grey limey dolomite.
50 Light red & some pinkish grey dolomitic lime.
55 Red dolomitic--lime.
60 Red dolomitic lime & grey xln lime.
65 Medium grey xln lime w/thin red streaks.
70 Medium " " " " " "
75 " " " "
80 " " and some reddish xln lime.
85 Red dolomitic lime w/little grey xln lime.
Circ. 30"
2688 Red & grey lime & red dolomitic lime w/some dark chert
Circ. 1 in.
2688 Red & grey lime & dolomitic lime w/some dark chert.
90 Soft red lime & dolomitic lime.
95 " " " " "
2700 Red lime and dolomitic lime w/few streaks grey lime.
05 Red & some grey lime and red dolomitic lime.
10 Red lime and red dolomitic lime w/red shale streaks w/dark chert.
15 Red & some grey lime & red dolomitic lime w/red shale streaks.
20 Red & grey lime & dolomitic lime w/shale streaks & brown chert.
25 Dense grey dolomitic lime w/grey shale streaks & some dark grey chert.
30 Finely xln grey dolomite.
35 Finely xln grey dolomite w/dark chert.
40 " " " " " "
45 " " " "
Trip & repairs - 37 hours.
50 Finely xln grey sandy dolomite and dome xln grey & pink lime w/some dark chert streaks.
55 Finely xln grey sandy dolomite w/little light chert streaks.
60 Finely xln pink & grey sandy dolomite w/dark (some) grey chert streaks.
65 Finely xln grey & pink dolomite & lime w/dark grey chert, streaks.
70 Light red and grey finely xln sandy dolomite w/dark grey chert streaks.
75 Light red finely xln sandy dolomite s/little grey chert.
80 Light red and grey dolomitic sand w/little brown chert.
85 Light red dolomitic sand.
90 Light red dolomitic sand w/few streaks of grey sandy dolomite.
95 Light red sandy dolomite w/few streaks of grey sandy dolomite & dark chert.
2800 " " " " " " " " " "
05 Light red dolomitic sand
10 " " " " " " " " ", tr. of oolitic chert.
15 " " & grey sandy dolomite.
20 " " medium dolomitic sand w/few streaks grey dolomite.
25 " " " " " w/few streaks finely xln buff dolomite.
30 " " & grey medium dolomitic sand.
35 Pink & grey dolomitic sand w/some light grey finely xln dolomite.
40 " " " " finer
45 " " " " "
50 Little pink & gray dolomitic sand "
55 " " " " " "
60 " " fine " "
65 " " " " " "
70 Pink & grey fine sandy dolomite.
75 " " " " "
80 Pink, buff & grey sandy dolomite w/few grey micaceous shale streaks.
85 " xln dolomite & dark grey xln lime.
90 " " " " " " "
95 Light red finely xln dolomite w/some dark grey xln lime.

2900 Grey to dark grey xln lime w/few dark gray shale streaks.
05 " " " " " w/some shaley black dolomite.
10 " " " " " " " " "
15 " " " " " " " " "
15 w/trace of translucent oolitic chert.
20 Grey medium xln lime w/streaks of oolitic to fossiliferous translucent chert.
25 Grey med. xln lime & dolomitic lime w/streaks of oolitic to fossiliferous translucent chert.
Trip & repairs
30 Grey med. xln lime & dolomitic lime w/streaks of oolitic to fossiliferous translucent chert.
35 Same
40 Light red & some grey med. xln dolomite, some grey lime & translucent chert.
45 Grey & light red coarsely xln dolomite w/opaque chert.
50 Grey & light red coarsely xln dolomite w/translucent & opaque chert.
55 Grey & light red coarsely xln dolomitic lime & fossiliferous light chert.
60 Grey & light red coarsely xln lime & dolomitic lime & fossiliferous light chert.
65 Grey coarsely xln lime & dolomitic lime & fossiliferous light chert.
70 Grey med. to coarsely xln lime & dolomitic lime & fossiliferous light chert.
75 " " " " " " " " " " " "
80 Grey & light red to coarsely xln dolomitic lime & fossiliferous light chert.
85 Grey med. sandy dolomite & dolomitic lime w/little light chert;
85 few oil-stained piece.
90 Grey med. sandy dolomite (some stained pieces as above)
95 " " coarse sandy lime.
3000 " " " " "
05 " " xln sandy lime.
10 " " " " " w/some chert.
15 Pink & grey med. to coarsely xln sandy lime w/trace of buff chert.
20 " " " " " " " " w/more white chert.
25 " " " " " " " " w/some white chert.
30 Soft pink & grey med. xln dolomitic lime w/some white chert.
35 " " " " " " " " " "
40 " light red fine to med. xln sandy lime.
45 " grey med. xln dolomite & dolomitic xln lime w/some detrital material.
50 " red med. to coarsely xln sandy lime w/detrital material.
Circulate 30" at 3050.
Circulate 1 hr. at 3050.
Soft red coarsely xln red dolomite w/little detrital material; fair porosity.
55 Red med. to coarse xln dolomite w/little grey lime.
60 Grey xln lime & red med. xln dolomite, red & green shale & red siltstone w/little translucent chert.
65 Grey & red dolomite w/porosity w/some detrital material.
70 Pink to grey med. xln dolomite w/trace of chert.
75 " " " " " " " " "
80 " " " " " " " " "
85 Soft pink to grey med. xln dolomite w/trace of chert.
Circulate 30".
85 Soft pink to grey med. xln dolomite w/trace of chert.
Circulate 1 hr.
85 Soft pink to grey med. xln dolomite
90 Soft pink to grey med. xln dolomite.
95 Soft light red & grey fine to med. xln. dolomitic lime.
3100 " " " " " " " " " "
05 " " " " " " " " " "
10 " " " " " " " " " & dolomite.
15 " " " " medium " " " "
20 " " " " " " dolo. & dolomitic lime w/translucent chert
25 " " " " " " " " " "
30 Light red & grey " xln dolo. & dolomitic lime w/traces chert.
35 " " " med. to coarse xln dolo. & " " " "
40 " " " " xln dolomitic lime.
45 " " " " " " " x/some translucent chert.
50 " " " coarsely xln lime.
55 Pink & grey coarsely xln lime.
60 " " " " "
65 " " med. to coarsely xln lime.
70 " " " " " " " w/traces of light chert.
75 " " " xln green flecked(?) sandy dolomite.

3180 Pink & grey med. xln green flecked(?) sandy dolomite.
85 " " " " " " " "
90 " " " to coarse sandy dolomite.
95 " " " " " " "
3200 " " " " " " "
05 " " " " " " "
10 " " fine to med. dolomitic sand & some sandy dolomite.
15 " " " " " " " " " "
20 " " " " " " " " " "
25 " " " " " " " " " "
Circulate 30 min.
3227 Pink & grey dolomitic sand & some sandy dolomite.
Circulate 1 hr.
3227 Red coarse dolomitic sand
30 " " " " and grey sandy dolomite.
35 Pink, red & grey sandy dolomite w/green flecks.
40 Pink and grey sandy dolomite.
45 " " " " "
Correction--Ran S.L.M. 3245 = 3254.
3250-55 Pink & grey sandy dolomite.
60 " " " "
65 " " " " green flecked.
70 " " " " " " with little chert.
75 " " " " " " "
80 " " xln lime.
85 " " " "
90 " " " " slightly green flecked.
95 Green flecked pink & grey sandy dolomite.
3300 " " red & " " "
05 " " pink & " " "
10 " " " " " "
15 Grey and pink sandy dolomite w/some dolomitic sand.
20 " " " " "
25 " green " " & some grey xln lime.
30 " & pink " "
35 " " " " "
40 " " " " " & some grey dolomitic sand.
45 " " " sandy lime " " " "
50 " " " " " green flecked--~~few pieces are oil stained~~.
55 Hard, grey dolomitic sand--more dense.
60 " " " " " "
65 " " " " " " , green flecked.
70 Pink & buff sandy dolomite.
75 Gray sandy dolomite.
80 Pink & grey sandy dolomite.
85 Darker grey sandy dolomite w/streak of pink quartzite.
90 " " " " w/trace of translucent chert.
95 Red lime & few red shale streaks.
3400 " " & sandy lime w/trace chert.
05 Red, grey & green sandy lime to limey sand w/few red shale streaks.
10 Red & grey sandy lime w/few red shale streaks.
15 Grey & some white lime.
20 " med. xln lime w/streaks of grey shale.
Trip
3422 Trip
25 Sample after trip--probably same as above.
30 Grey med xln lime w/streaks of grey shale.
35 Interbedded finely xln dark grey lime & grey calcareous shale.
40 " " " " " " " " "
45 " " " " " " " " "
50 " " " " " " " " "
55 Grey, buff & pink med. xln lime w/few red shale streaks.
60 Grey & reddish med. xln lime w/red shale streaks.
65 " " " " " " " " "
70 Red & grey " " " w/few red shale streaks.
75 Interbedded pink & grey med. xln lime w/red & green shale streaks.
80 " " " " " " " " " "
85 " " " " " " " " " "
90 Grey & pink med. xln lime w/red shale streaks.
95 " " " " " " " "

prob Devonian EAK

Silurian @ 3380' — Hollingsworth

"Silurian" — Holl.

3500 Grey & pink med. xln lime w/few red shale streaks.
05 Red xln lime, dark green dolomitic shale & red shale.
10 " " " " " " " " "
15 " " " " greenish grey dolomitic shale & red shale.
20 Pink & greenish grey calcareous shale.
25 " " " xln lime.
30 Greenish grey med. " "
35 Light green & grey med. xln lime w/few grey calcareous shale streaks.
40 Light greenish grey med. xln lime
45 Light greenish grey dolomitic quartzitic sandstone.
50 " " " " " "
55 " " " limey sandstone w/grey shale streaks.
60 " " " " " " " "
65 " " " " " " " "
70 Light greenish grey sandy lime w/maroon & grey shale streaks.
75 " " " limey sand w/grey shale streaks.
80 Greenish grey finely xln limestone w/grey shale streaks.
85 Pink and grey sandy lime w/red & grey shale streaks.
90 " " " " " w/few grey shale streaks.
95 Buff, pink & grey sandy lime w/grey (few) shale streaks.
3600 Greenish grey sandy lime w/few grey shale streaks.
05 " " " " " " "
10 Pink & greenish grey sandy lime w/few grey shale streaks.
15 Greenish grey sandy lime w/calcareous grey & green shale streaks.
20 " " " " " " " " "
25 Pink & grey sandy lime w/calcareous grey & green shale streaks.
30 Grey sandy lime w/calcareous grey & green shale streaks.
35 " " " " " " " "
40 Grey sandy lime
45 Grey sandy lime " " " " "
50 " " " " " " " "
55 Pink & grey & slightly sandy lime w/calcareous grey & green shale streaks, w/little chert.
60 Dark grey finely xln lime.
65 Dark to light grey finely xln lime.
70 Dark to light grey med. xln lime.
75 Med. grey med. xln lime w/few grey shale streaks.
80 " " " " "
85 " " sandy dolomite.
90 " " " "
95 " " " " w/few grey & green shale streaks.
3700 " " " " " " " " "
05 " " " "
10 Light & dark grey sandy dolomite w/few grey shale streaks.
15 " " " " " " " " "
20 Dark grey sandy dolomite w/traces of chert.
25 Light & dark grey sandy dolomite w/traces of chert.
30 Med. grey sandy dolomite.
35 " " " "
40 " " " "
45 " " " "
50 " " " "
55 " " dolomitic sand.
60 " " " "
65 " " " "
70 " " " "
75 " " " "
80 " " " "
3780 — 85 " " sandy quartzite.
90 " " " "
95 " " " "
3800 After trip. Med. grey sandy quartzite with traces chert.
05 Clear to translucent sandy quartzite to quartzitic sand.
10 " " " " " " "
15 " " " " " " "
20 " " white " " " "

Shale

3825 Clear to white quartzite to quartzitic sand
30 " " " " " " " w/some translucent chert.
35 " " " " " " " " " "
40 Sample missing.
45 Pink to translucent sandy quartzite to quartzitic sand.
50 " " " " " " " "
55 " & greenish quartzite.
60 " " "
65 " to translucent, quartzite.
70 " & greenish "
75 " " " w/some maroon & green dolomitic shale.
80 " " " " " " " "
85 Greenish grey sandy dolomite.
90 Grey dolomitic sand & sandy dolomite.
95 " " " " "
3900 " " " " "
05 " " " " " w/little chert & traces of maroon & grey shale & some translucent quartzite.
10 Pinkish & translucent quartzite w/streaks of dolomitic grey sand & trace of chert.
14 " " "
Shut-down for a week--testing and running casing to 1997'.
20 Pink, white and light green quartzite w/little red dolomitic sand.
25 " " " " " " w/streaks of grey shale & grey dolomitic sand.
30 Pink, white and light green quartzite " " " " " " " sand.
35 White to pink quartzitic sand to quartzite w/few thin streaks of grey shale & maroon & grey dolomitic sand.
40 Same
45 "
50 "
55 White to pink to light green quartzitic sand to quartzite w/few thin streaks of grey shale & maroon & grey dolomitic sand.
60 Same
65 "
70 "
75 White to pink to light green quartzitic sand to quartzite w/few thin streaks of grey shale.
80 Same
85 White to pink to light green quartzitic sand to quartzite w/few thin streaks of grey shale & maroon & grey dolomitic sand.
90 Trace chert. Same as above.

PE-3990 Hollingsworth

95 Increase in red. Same as above.
4000 Deep pink to white to green quartzitic sand to quartzite w/increase in grey shale, some dolomitic sand, traces of dull brown chert & calcopyrite?
05 Red to white to green quartzitic sand to quartzite w/traces of limey & dolomitic sand.
10 " " " " " " " " " " " " " "
15 " " " " " " " " " " " " " " and few grey shale streaks.
20 Same.
25 Increase green. Red to white to green quartzitic sand to quartzite w/streaks of grey dolomitic sand.
30 Pink to white to green quartzitic sand to quartzite w/streaks of grey & red dolomitic sand.
35 Same.
40 Pink to white quartzitic sand.
45 " " " " " to quartzite.
50 " " " " "
55 Lost circulation. Pink to white to green quartzitic sand (finer).
60 Lost circulation. " " " " " " (mixing mud)
65 Pink to white to green quartzitic sand (finer) (mixing mud).
70 " " quartzitic sand.
75 " " " "
80 " " " "
85 " " " " to quartzite.
90 " " " " " "
4093 Trip
95 Pink to white quartzite w/few streaks grey shale.

4100 Pink to white quartzite w/few streaks grey shale.
05 " " " " w/few streaks grey shale & grey dolomite.
10 " " " " " " " " " "
15 " " " " " " " " " "
20 Light red quartzite.
25 " " "
30 Pink to white quartzite.
35 " " " "
40 " " " "
45 " " " " w/thin streaks of grey dolomite.
50 " " " " " " " " "

Trip & cementing 5026.

55 Pink to white quartzite w/thin streaks of grey dolomite.
(60 " " " " " " " " " lime & grey shale.
(65 " " " " " " " " " " " w/1 piece brown/dolo.
issing ? (70 " " " "
(75 " " " "
(80 Pink & white quartzite w/few grey dolomite streaks.
85 " " " " " " "
90 " " " " " " "
95 Light red quartzite w/few green & red shale streaks.
4200 " " " w/thin green, red & grey shale streaks.
05 " " & white quartzite w/thin green, red & grey shale streaks (Pipe-dope ? in samples-resembles oil stains.)
10 Light red & white quartzite w/thin green, red & grey shale streaks (Pipe dope in samples-resembles oil stains.)

Circulating

4210 Light Red & White quartzite w/few grey & green shale streaks & trace tan chert
15 " " " " " " " " " & trace quartzite sand.
20 Same.
25 Light red & white quartzite w/few grey & green shale streaks
30 " " " " " " " " " & thin grey lime strk
35 " " " " " " " " "
40 Pink to white quartzite w/few grey & green shale streaks.
45 " " " " " " " " "
50 " " " " " " " " "
55 " " " " " " " " " w/trace red lime.
60 " " " " " " " " " w/trace grey lime.
65 " " " " " " " " "
70 " " " " " " " " "
75 " " " " " " " " "
80 " " " " " " " " " w/trace grey lime.
85 " " " " " " " " " " " "
90 " " " " " " " " " " " "
95 " " " " " " " " " " " "
4300 " " " " " " " " " " " "
05 trace staining--probably from pipe dope.
10 Pink to white quartzite w/few grey & green shale streaks.
15 " " " " " " " " " w/trace buff lime.
20 " " " " " " " " " " grey "
25 " " " " " " " " "
30
35 Pink to white quartzite.
40 " " " " w/little quartzitic sand.
45 " " " " " " "
50 " " " "
55 " " " "
60 " " " " w/trace grey lime.
65 " " " "
70 " " " " w/trace black dolo. & green shale.
75 " " " "
80 " " " " w/trace green shale.
85 " " " " w/trace green & grey shale.
90 " " " " w/trace green & grey shale & gray lime.
95 " " " " " " " " " " "
4400 " " " " " " " " " " "

Loren I. Buck
Geologist

From the desk of
Cochise Co [redacted] NARD A. KOESTER

Wadell-Duncan #1 Co #1 Murrey
5-22s-27E

	EL.	Hollingsworth.	L Buck
Valley fill [redacted] Morita Wag		0-1608.	0- 560 560-1610.
Penn (Atoka)	1610	*1608-2305 Atoka fusulinella @ 1805-40.	Penn Nacolst. 1610- Δ Ceyclom. 2260-
Miss.	2305	2305-3380. X @ 3207.	2305 (poss. bly EAK) 2525-
Silurian (Prob Devonian)	?	3380-	
Cambrian		3520-	
Pe Granite		3990'-4400' X 3995	Pt. 3780 -4400'
T.D 4400'			

OIL Shows

	1950-1960
2980-2990'.	2900-2990.
	3045-50 ¢ - no show.
3340-3370.	3345-3350' few pieces oil-stained.

See Perforations.

Waddell-Duncan #1 Murrey
5-22s-27E

X R.E. Geer

From the desk of:

EDWARD A. KOESTER

Perm # 50.
5-22s-27E.

Wadell-Duncan Oil Co #1 Murray

11-13-70.

Telephone conversation with Loren Buck:

Had stains in Permian.

On nose from the Swissholm mountains.

Ran very high.

WADDELL-DUNCAN CO. #1 MURREY

Elev. Est. 4240'

Location--CSE-NW, Sec. 5, 22 S, 27E.
Cochise County, Arizona

0-560 Valley Fill- conglomerate.
1610 Mostly red & green shaley conglomerate. Base of Morita.
30 Soft white lime-Top of Naco Lime. 1610'.
40 Soft white lime and some Morita.
50 " " " " " "
60 " " " " " "
70 " " " " " "
80 Missing.
90 Soft white lime and some Morita.
1700 " " " " " "
10 " " " " " "
20 " " " " " " (lime increasing)
30 " " " " " " " "
40 Reddish light lime and some Morita.
50 " " " " " " Top solid, 1745
55 Light lime and some Morita w/some chert and erosional material. Few heavy porous pieces.
60 Good solid white & gray xln. lime. Trace chert Dark.
65 xln. white lime-no porosity.
70 " " " -Trace Dark chert.
75 " " "
80 " grey lime; some Dolomitic buff lime- trace chert. Fusilinids noted in sample when wet with acid.
85 xln grey lime; some Dolomitic buff lime- trace chert.
90 Missing- lost circulation-no sample at 1790.
Cemented
95 Mostly cave-some grey xln. lime.
C Cemented after losing circulation at 1795.
1800 Grey medium xln. lime w/little reddish lime slightly fossiliferous.
05 " " " " " " " " " "
Fusilinids
10 Grey medium " " w/some reddish lime,
Fossil Fusilinids noted in pink lime.
15 Grey medium xln. lime w/some reddish lime.
Fusilinids
20 Grey medium xln. lime w/some reddish lime.
Fossil Fusilinids
25 Grey and red xln. lime.
30 " " " " "
40 Grey and red xln. lime w/thin red shale streaks.
50 Red and grey xln. lime.
1850-60 Grey xln. lime & streaks of grey shale.
70 Grey and reddish grey xln. lime.
80 Grey xln. limestone.
90 " " " w/maroon & green shales.
Trip lost circulation. Cemented off.
1900 Grey limestone, marl & little sdy. conglomerate.
10 Dk. grey xln. limestone w/thin dark grey shale streaks.
Fosl.
20 Pinkish grey fossiliferous xln. lime.
30 Finely xln. grey lime.
40 Darker grey med. xln. lime.
50 Med. to dark grey xln. lime.

60 Med. to dark grey xln. lime (Few oil Stained cuttings)
65 Reddish grey xln. lime.
70 Med. to dark grey xln. lime.
75 Reddish dark grey finely xln. lime.
80 Med. to dark grey " " "
85 Med. grey finely xln. lime.
90 " " " " "
95 " " " " " w/thin streak, dark shale
2000 " " dense lime w/traces of chert.

05 Med. grey dense lime w/traces of chert
Trip.
10 Maroon shale & dense lime w/traces of chert.
15 " " " " .
20 Some Maroon shale & dense lime-little green shale.
25 Dark Maroon and bright green shales w/grey lime streaks.
30 M Medium grey finely xln. lime w/some maroon shale streaks.
40 Reddish grey finely xln. lime w/some maroon shale streaks.
45 Reddish grey & grey finely xln. lime w/some maroon &green shale streaks.
50 Medium grey to reddish xln. lime w/some maroon shale streaks.
Fossiliferous trip.
55 Medium grey xln. lime.
60 " " " "
65 Med. grey & reddish xln. lime w/some maroon shale streaks.
70 Med grey xln. lime.
75 " " " "
80 " " " " w/some dark maroon & some green shale streaks.
85 " " " " " " " " " " "
90 " " " " " " " " " " "
95 Dark maroon & green shale w/grey med. xln. lime streaks.
2100 Med. xln. med. grey lime w/dark maroon & green shale streaks and lime; little dolomitic.
05 Med. xln. med. grey lime w/dark maroon & green shale streaks and a thin band of oolitic lime.
10 Buff med. xln lime w/dark maroon & green shale streaks.
15 Grey med. xln. lime w/dark maroon & green shale streaks, trace of chert.
20 Grey med. xln. lime.
25 " " " "
30 Grey to Reddish grey xln lime w/trace of dense oolitic lime.
35 " " " " " " w/streaks of maroon and green shale.
40 Med. grey xln. lime.
45 " " " "
Trip 2147.
50 Light grey xln. lime.
Fossiliferous
55 Light grey xln lime (fossiliferous) plus some conglomerate.
Dense to coarsely xln.
60 Conglomerate. Maroon & green dense lime and shales w/much chert.
65 Conglomerate. " " " " " " " w/some "
70 Conglomerate. Same as above.
75 Some Conglomerate, with grey lime and translucent chert increasing
80 Maroon Shales, light frey lime and translucent chert
85 Maroon shales w/some reddish to grey xln lime

90 Maroon shales w/some reddish to grey xln lime and chert.
95 Grey and pink xln lime-- little translucent chert
2200 " " " " " " " " w/maroon shale streaks
05 Pink to maroon dense lime and maroon shale streaks
10 Fossiliferous. Grey & pink xln lime w/maroon & green shale streaks.
15 Grey & pink xln lime w/oolitic chert & maroon shales
20 Conglomerate. Maroon & grey xln lime w/oolitic chert & maroon shales.
25 Grey & maroon xln lime w/some translucent chert & maroon shales.
30 Grey & rose xln lime w/much translucent & rose chert.
35 Missing.
40 Grey & pink med. xln lime w/trace of chert.
45 " " " " " w/much translucent chert & some maroon shale.
50 Grey & pink med. xln lime w/chert & dark grey shale streaks.
55 Coarsely xln grey lime w/translucent chert & maroon shale streaks.
60 Xln grey lime w/translucent chert.
65 Cherty conglomerate. Reddish xln lime & reddish mineral w/some chert
70 Cherty conglomerate. Reddish dense lime & maroon shale w/chert.
75 Cherty conglomerate. Reddish & grey xln. lime w/much chert.
80 Cherty conglomerate. Reddish dense lime & maroon shale w/chert.
85 Cherty conglomerate. Reddish & grey xln. lime & chert w/little maroon shale.
90 Cherty red conglomerate w/little grey lime.
95 " " " " " " "
2300 " " " " " " " "
05 Cherty red conglomerate w/some grey xln lime.
10 " " " " " " " "
15 " " " w/grey xln lime.
20 " " " " " " "
25 " " " " " " "
30 Grey xln lime w/little white chert.
35 " " " w/some dolomitic lime.
40 Medium grey finely xln lime.
45 Darker grey finely xln lime.
50 " " " " "
55 Med. grey finely xln lime.
60 " " " " " w/traces white opaque chert.
Trip
65 Med. grey med. xln lime.
70 " " " " "
75 " " " " "
80 " to coarsely xln med. grey lime.
85 " " " " " " "
90 " xln med. grey lime.
95 " " " " "
2400 " " grey lime.
05 " " " " w/white lime streaks.
10 White xln lime, soft.
Tetco Test 2413-2409'
Corrected
2410 White xln lime, soft.
15 " " " w/grey lime streaks, soft.
20 " " " " " " "
2420-25 Grey and white xln lime.
30 " " " " "
35 Grey medium xln lime.
40 " " " "
45 " " " "

50 Grey medium xln lime.
55 " " " "
60 " " " " darker.
65 " " " " "
70 " " " " "
75 " " " " w/trace of light chert.
80 Grey to buff slightly dolomitic lime w/trace of rose chert.
85 Grey & pink medium xln lime (fossiliferous)
90 Light grey to white med. xln lime.
95 " " " " " " " (fossiliferous)
2500 " " " " " " " w/trace white chert.
05 " " " " " " " (fossiliferous)
10 White xln lime.
15 " " " (fossiliferous)
20 Light grey xln lime "
25 " " " " highly fossiliferous
30 Med. grey coarsely xln lime
30 " " " " w/some pink xln lime
35 " " " " streaks of reddish stained
40 " " " " w/lime & streaks of purple shale.
45 " " " " " " " " "
50 Light grey & pinkish xln lime-highly fossiliferous
55 " " xln lime & pink dolomitic lime.
60 " " & pink xln lime.
65 " " " dolomitic & xln lime w/some maroon shales, (probably cavings)
70 Soft lt. grey & pink Dolomitic & xln lime
Circulating 30 min.
70 Soft Lt. pink and grey dolomitic sand.
Circulating 1 hour
70 Soft Lt. pink and grey dolomitic sand.
75 Soft dark pink & grey dolomitic sand.
80 Fair porosity. Medium to coarsely xln light red dolomite and dolomitic lime w/trace dark chert.
85 Fair porosity. Medium to coarsely xln light red dolomite and dolomitic lime w/trace dark chert.
2590 Medium to coarsely xln light red dolomite w/fair porosity.
95 " " " " " " " w/trace dark chert.
2600 " " " " " " " & dolomitic lime.
Trip
05 Medium xln light red and grey lime.
10 Medium xln light red and grey dolomitic lime.
15 Medium xln light red w/some grey dolomitic lime.
20 Light red with little grey dolomitic lime.
25 Light red with some grey dolomitic lime.
30 Light red dolomitic lime.
35 " " " "
40 " " w/little grey dolomitic lime.
45 " " & some pinkish grey limey dolomite.
50 " " " " " " dolomitic lime.
55 Red dolomitic-lime.
60 Red dolomitic lime & grey xln lime.
65 Medium grey xln lime w/thin red streaks.
70 " " " " " " "
75 " " " "
80 " " and some reddish xln lime.
85 Red dolomitic lime w/little grey xln lime.
~~XXXXXXXXXXXXXXXXXXXXXXXXXXXX~~
Circ. 30"

2688 Red and grey lime & red dolomitic lime w/some dark chert
Circ. 1 in.
2688 Red & grey lime & dolomitic lime w/some dark chert
90 Soft red lime & dolomitic lime.
95 " " " " "
2700 Red lime and dolomitic lime w/few streaks grey lime.
05 Red & some grey lime and red dolomitic lime.
10 Red lime and red dolomitic lime w/red shale streaks w/dark chert.
15 Red & some grey lime & red dolomitic lime w/red shale streaks.
20 Red & grey lime & dolomitic lime w/shale streaks & brown chert.
25 Dense grey dolomitic lime w/grey shale streaks & some dark grey chert
30 Finely xln grey dolomite.
35 Finely xln grey dolomite w/dark chert.
40 " " " " " "
45 " " " "
Trip & repairs-37hours.
50 Finely xln grey sandy dolomite and some xln grey & pink lime
w/some dark chert streaks.
55 Finely xln grey sandy dolomite w/little light chert streaks.
60 Finely xln pink & grey sandy dolomite w/dark (some) grey chert streaks
65 Finely xln grey & pink dolomite & lime w/dark grey chert streaks
70 Light red and grey finely xln sandy dolomite w/dark grey chert streaks
75 Light red finely xln sandy dolomite w/little grey chert.
80 Light red and grey dolomitic sand w/little brown chert
85 Light red dolomitic sand.
90 Light red dolomitic sand w/few streaks of grey sandy dolomite.
95 " " sandy dolomite w/few streaks of grey sandy dolomite, and
dark chert.
2800 Light red " " " " " " " "
05 Light red dolomitic sand
10 " " " " " " " " " " tr. of
oolitic chert.
15 Light red and grey sandy dolomite
20 " " medium dolomitic sand w/few streaks grey dolomite.
25 " " " " " w/few streaks finely xln buff dolomite
30 " " & grey medium dolomitic sand.
35 Pink and grey dolomitic sand w/some light grey finely xln dolomite
40 " " " " " finer
45 " " " " " "
50 Little pink & grey dolomitic sand "
55 " " " " " " "
60 " " " " fine " "
65 " " " " " " "
70 Pink & grey fine sandy dolomite.
75 " " " " "
80 Pink, buff & grey sandy dolomite w/few grey micaceous shale streaks
85 " xln dolomite & dark grey xln lime.
90 " " " " " " " "
95 Light red finely xln dolomite w/some dark grey xln lime.
2900 Grey to dark grey xln lime w/few dark grey shale streaks.
05 " " " " " w/some shaley black dolomite
10 " " " " " " " " "
15 " " " " " " " " "
15 w/trace of translucent oolitic chert.
20 Grey medium xln lime w/streaks of oolitic to fossiliferous
translucent chert.

2900
25 Grey medium xln lime & dolomitic lime w/streaks of oolitic to fossiliferous translucent chert.
Trip & repairs
30 Grey med. xln lime & dolomitic lime w/streaks of oolitic to fossiliferous translucent chert.
35 Same
40 Light red & some grey med. xln dolomite, some grey lime & translucent chert
45 Grey & light red coarsely xln dolomite w/opaque chert.
50 " " " " " " w/ translucent & opaque chert
55 " " " " " dolomitic lime & fossiliferous light chert.
60 Grey & light red coarsely xln lime & dolomitic lime & fossiliferous light chert.
65 Grey coarsely xln lime & dolomitic Lime & fossiliferous light chert.
70 Grey med. to coarsely xln lime & dolomitic lime & fossiliferous light chert.
75 Grey med. to coarsely xln lime & dolomitic lime & fossiliferous light chert.
80 Grey & light red to coarsely xln dolomitic lime & fossiliferous light chert.
85 Grey med. sandy dolomite & dolomitic lime w/little light chert;
85 few oil stained piece.
90 Grey med. sandy dolomite (some stained pieces as above)
95 " " coarse sandy lime.
3000 " " " " "
05 " " xln sandy lime
10 " " " " " w/some chert.
15 Pink & grey med to coarsely xln sandy lime w/trace of buff chert.
20 " " " " " " " " w/more white chert.
25 " " " " " " " " w/some white chert
30 Soft pink & grey med. xln dolomitic lime w/some white chert.
35 " " " " " " " " "
40 " light red fine to med. xln sandy lime.
45 " grey med. xln dolomite & dolomitic xln lime w/some detrital material.
50 Soft red med. to coarsely xln sandy lime w/detrital material.
Circulate 30" at 3050.
Circulate 1 hr. at 3050.
Soft red coarsely xln red dolomite w/little detrital material; fair porosity.
55 Red med. to coarse xln dolomite w/little grey lime.
60 Grey xln lime & red med. xln dolomite, red & green shale & red siltstone w/little translucent chert.
65 Grey & red dolomite w/porosity w/some detrital material.
70 Pink to grey med. xln dolomite w/trace of chert.
75 " " " " " " " " "
80 " " " " " " " " "
85 Soft pink to grey med. xln dolomite w/trace of chert.
Circulate 30".
85 Soft pink to grey med. xln dolomite w/ trace of chert.
Circulate 1 hr.
85 Soft pink to grey med. xln dolomite.
90 " " " " " " "
95 Soft light red & grey fine to med. xln dolomitic lime.
3100 " " " " " " " " "
05 " " " " " " " " "
10 " " " " " " " " " & dolomite.

3115 Soft light red & grey medium xln. dolomitic lime & dolomite
20 " " " " " dolo. & dolomitic lime w/translucent chert.
25 Soft light red & grey medium xln dolo. & dolomitic lime w/translucent chert.
30 Light red & grey medium xln dolo. & dolomitic lime w/traces chert.
35 " " " med. to coarse xln dolo. & dolomitic lime w/traces chert.
40 Light red & grey med. xln dolomitic lime.
45 " " " " " " " w/some translucent chert.
50 " " " coarsely xln lime.
55 Pink & grey coarsely xln lime.
60 " " " " "
65 " " med. to coarsely xln lime.
70 " " " " " " " w/traces light chert.
75 " " " xln green flecked (?) sandy dolomite.
80 Pink & grey med. xln green flecked (?) sandy dolomite
85 " " " " " " " "
90 " " " to coarsely sandy dolomite.
95 " " " " " " "
3200 " " " " " " "
05 " " " " " " "
10 " " fine to med. dolomitic sand & some sandy dolomite.
15 " " " " " " " " " "
20 " " " " " " " " " "
25 " " " " " " " " " "
Circulate 30min.
3227 Pink & grey dolonitic sand & some sandy dolomite.
Circulate 1 hr.
3227 Red coarse dolomitic sand
30 " " " " and grey sandy dolomite.
35 Pink, red & grey sandy dolomite w/green flecks.
40 Pink & grey sandy dolomite.
45 " " " "
Correction-Ran S.L.M. 3245 - 3254
3250-55 Pink & grey sandy dolomite.
60 " " " "
65 " " " " green flecked.
70 " " " " " " with little chert.
75 " " " " " " "
80 Pink & grey xln lime.
85 " " " "
90 " " " " slightly green flecked.
95 Green flecked pink & grey sandy dolomite.
3300 " " red & " " "
05 " " pink & " " "
10 " " " " " "
15 Grey & pink sandy dolomite w/some dolomitic sand.
20 " " " "
25 " green " " & some grey xln lime.
30 " & pink " "
35 " " " "
40 " " " " & some grey dolomitic sand.
45 " " sandy lime " " " "
50 " " " " green flecked-few pieces are oil stained.
55 Hard, grey dolomitic sand--more dense.
60 " " " " " "
65 " " " " " " , green flecked.
70 Pink & buff sandy dolomite.
75 Grey sandy dolomite.

3380 Pink & grey sandy dolomite.
85 Darker grey sandy dolomite w/streak of pink quartzite.
90 " " " " w/trace of translucent chert.
95 Red lime & few red shale streaks.
3400 " " & sandy lime w/trace chert.
05 Red, grey & green sandy lime to limey sand w/few red shale streaks.
10 Red & grey sandy lime w/few red shale streaks.
15 Grey & some white lime.
20 " med.xln lime w/streaks of grey shale.
Trip
3422 Trip
25 Sample after trip--probably same as above.
30 Grey med xln lime w/streaks of grey shale.
35 Interbedded finely xln dark grey lime & grey calcareous shale.
40 " " " " " " " " "
45 " " " " " " " " "
50 " " " " " " " " "
55 Grey, buff & pink med xln lime w/few red shale streaks.
60 Grey & reddish med. xln lime w/red shale streaks.
65 " " " " " " " "
70 Red & grey " " " w/few red shale streaks.
75 Interbedded pink & grey med. xln lime w/red & green shale streaks.
80 " " " " " " " " " "
85 " " " " " " " " " "
90 Grey & pink med. xln lime w/red shale streaks.
95 " " " " " " " "
3500 Grey & pink med. xln lime w/few red shale streaks.
05 Red xln lime, dark green dolomitic shale & red shale.
10 " " " " " " " "
15 " " " " greenish grey dolomitic shale & red shale.
20 Pink & greenish grey calcareous shale.
25 " " " xln Lime.
30 Greenish grey med. " "
35 Light green & grey med. xln lime w/few grey calcareous shale streaks
40 Light greenish grey med. xln lime.
45 Light greenish grey dolomitic quartsitic sandstone.
50 " " " " " "
55 " " " Limey sandstone w/grey shale streaks.
60 " " " " " " " "
65 " " " " " " " "
70 Light greenish grey sandy lime w/maroon & grey shale streaks.
75 " " " limey sand w/grey shale streaks.
80 Greenish grey finely xln limestone w/grey shale streaks.
85 Pink & grey sandy lime w/red & grey shale streaks.
90 " " " " w/few grey shale streaks.
95 Buff, pink & grey sandy lime w/grey (few) shale streaks.
3600 Greenish grey sandy lime w/few grey shale streaks.
05 " " " " " " " "
10 Pink & greenish grey sandy Lime w/few grey shale streaks.
15 Greenish grey sandy lime w/calcareous grey & green shale streaks.
20 " " " " " " " " "
25 Pink & grey sandy lime w/calcareous grey & green shale streaks.
30 Grey sandy lime w/calcareous grey & green shale streaks.
35 " " " " " " " "
40 Grey sandy lime.
45 Grey sandy lime " " " " "
50 " " " " " " " "
55 Pink & grey & slightly sandy lime w/calcareous grey & green shale streaks. W/little chert.
60 Dark grey finely xln lime.

3665 Dark to light grey finely xln lime.
70 Dark to light grey med. xln lime.
75 Med. grey med. xln lime w/few grey shale streaks.
80 " " " " "
85 " " sandy dolomite.
90 " " " "
95 " " " " w/few grey & green shale streaks.
3700 " " " " " " " " "
05 " " " "
10 Light & dark grey sandy dolomite w/few grey shale streaks.
15 " " " " " " " " " "
20 Dark grey sandy dolomite w/traces of chert.
25 Light & dark grey sandy dolomite w/traces of chert.
30 Med. grey sandy dolomite.
35 " " " "
40 " " " "
45 " " " "
50 " " " "
55 " " dolomitic sand.
60 " " " "
65 " " " "
70 " " " "
75 " " " "
80 " " " "
85 " " sandy quartzite.
90 " " " "
95 " " " "
3800 After trip. Med. grey sandy quartzite w/traces chert.
05 Clear to translucent sandy quartzite to quartzitic sand.
10 " " " " " " "
15 " " " " " " "
20 " " white " " " "
25 Clear to white quartzite to quartzitic sand.
30 " " " " " " " w/some translucent chert.
35 " " " " " " " " " "
40 Sample missing
45 Pink to translucent sandy quartzite to quartzitic sand.
50 " " " " " " " "
55 " & gree nish quartzite.
60 " " "
65 " to translucent quartzite.
70 " & greenish "
75 " " " w/some maroon & green dolomitic shale.
80 " " " " " " " "
85 Greenish grey sandy dolomite.
90 Grey dolomitic sand & sandy dolomite.
95 " " " " "
3900 " " " " "
05 " " " " " w/little chert & traces of maroon & grey shale & some translucent quartzite.
10 Pinkish & translucent quartzite w/streaks of dolomitic grey sand and trace of chert.
14 Pinkish translucent quartzite.
Shut down for a week--testing and running casing to 1997'
20 Pink, white and light green quartzite w/little red dolomitic sand.
25 " " " " " " w/streaks of grey shale and grey dolomitic sand.
30 Pink, white, & light green quartzite " " " " " grey dolomitic sand.

3935 White to pink quartzitic sand to quartzite w/few thin streaks of grey shale & maroon & grey dolomitic sand.
40 Same.
45 "
50 "
55 White to pink to light green quartzitic sand to quartzite w/few thin streaks of grey shale & maroon & grey dolomitic sand.
60 Same
65 "
70 "
75 White to pink to light green quartzitic sand to quartzite w/few thin streaks of grey shale.
80 Same.
85 White to pink to light green quartzitic sand to quartzite w/few thin streaks of grey shale & maroon & grey dolomitic sand.
90 Trace chert. Same as above.
95 Increase in red. Same as above.
4000 Deep pink to white to green quartzitic sand to quartzite w/increase in grey shale, some dolomitic sand, traces of dull brown chert and calcopyrite?
05 Red to white to green quartzitic sand to cuartzite w/ traces of limey and dolomitic sand.
10 Red to white to green quartzitic sand to quartzite w/traces of limey & dolomitic, sand.
15 Red to white to green quartzitic sand to quartzite w/traces of limey and dolomitic sand and few grey shale streaks.
20 Same.
25 Increase green. Red to white to green quartzitic sand to cuartzite w/streaks of grey dolomitic sand.
30 Pink to white to green quartzitic sand to quartzite w/streaks of grey & red dolomitic sand
35 Same.
40 Pink to white quartzitic sand.
45 " " " " " to quartzite.
50 " " " " "
55 Lost circulation. Pink to white to green quartzitic sand (finer)
60 " " " " " " " " " " (mixing mud
65 Pink to white to green quartzitic sand (finer) (mixing mud)
70 " " quartzitic sand.
75 " " " "
80 " " " "
85 " " " " to quartzite.
90 " " " " " "
4093 Trip
95 Pink to white quartzite w/few streaks grey shale.
4100 Pink to white quartzite w/few streaks grey shale.
05 " " " " " " " " & grey dolomite
10 " " " " " " " " " "
15 " " " " " " " " " "
20 Light red quartzite.
25 " " "
30 Pink to white quartzite.
35 " " " "
40 " " " "
45 " " " " w/thin streaks of grey dolomite.
50 " " " " " " " " "
Trip & cementing 5026
55 Pink to white quartzite w/ thin streaks of grey dolomite.
60 " " " " " " " " "
Missing 65 " " " " " " " " lime & grey shale

Missing

4170 Pink to white quartzite w/thin streaks of grey lime & grey shale w/1piece brown dolo.
75 Pink to white quartzite
80 Pink & white quartzite w/few grey dolomite streaks.
85 " " " " " " "
90 " " " " " " "
95 Light red quartzite w/few green & red shale streaks.
4200 " " " w/thin green, red & grey shale streaks.
05 " " & white quartzite w/thin green, red & grey shale streaks (Pipe dope in samples resembles oil stains.)
10 Light red & white quartzite w/thin green, red & grey shale streaks (Pipe dope in samples resembles oil stains.)

Circulating
4210 Light red & white quartzite w/few grey & green shale streaks & trace tan chert.
15 Light red & white quartzite w/few grey & green shale streaks and trace quartzite sand.
20 Same.
25 Light red & white quartzite w/few grey & green shale streaks.
30 " " " " " " " " " & thin grey line streak
35 Light red & white quartzite w/few grey & green shale streaks.
40 Pink to white quartzite w/few grey & green shale streaks.
45 " " " " " " " " "
50 " " " " " " " " "
55 " " " " " " " " "
60 " " " " " " " " " w/trace red lime
65 Pink to white quartzite w/few grey & green shale streaks w/trace grey lime.
70 Pink to white quartzite w/few grey & green shale streaks
75 " " " " " " " " "
80 " " " " " " " " "
85 " " " " " " " " " w/trace grey lime.
90 Pink to white quartzite w/few grey & green shale streaks w/trace grey lime.
95 Pink to white " " " " " " " grey lime.
4300 Pink to white " " " " " " " grey lime.
05 Pink to white " " " " " " " grey lime.
trace staining--probably from pipe dope.
10 Pink to white quartzite w/few grey & green shale streaks.
15 " " " " " " " " "
20 " " " " " " " " " w/trace buff lime.
25 Pink to white " " " " " " w/trace grey lime.
30 Pink to white " " " " " "
35 Pink to white quartzite.
40 " " " "
45 " " " " w/little quartzitic sand.
50 " " " " " " "
55 " " " "
60 " " " " w/trace grey lime.
65 " " " "
70 " " " " w/trace black dolo. & green shale
75 " " " "
80 " " " " w/trace green shale.

4385	Pink	to	white	quartzite	w/trace	green	&	grey	shale.			
90	"	"	"	"	"	"	"	"	"	&	grey	lime.
95	"	"	"	"	"	"	"	"	"	"	"	"
4400	"	"	"	"	"	"	"	"	"	"	"	"

COCHISE COUNTY, ARIZONA No Per. No. 3720

Waddell-Duncan Co. (Willcox, Ariz.)

Murrey (Cowan) No. 1

Sec. 5, T 22 S, R 27 E

SPECIAL: Waddell-Duncan Co./Chuck Aston-12/22/50

1-12-51: LR to Waddell-Duncan Co.

10-4-51: LR to J. W.Alexander w/Cities Service

July 7,1951

REPORT

1608: Top Pennsylvanian system, by lithology

1608: Top Atoka series, by lithology

1810-1840: Atoka fusulines

By lithology only:

2305: Top "Mississippian"limestone

3380: Top Silurian system

3520: Top Cambrian system

3990: Top pre-Cambrian granite

Samples examined from 0 to 4400 feet. 7/7/51

[illegible] Petroleum Company
[illegible] Hollingsworth
[illegible] Phone [illegible]
[illegible], Texas

January 13, 1951

Harold L. Williams
Boylan S. Baker, Jr.
Eugene F. Lancaster

[illegible] Keering,
Consultant
[illegible], Oklahoma

Radiell-Vacan Company
Willcox, Arizona

Dear Sirs:

We report, as follows, on a special project.

INTERNATIONAL DRILL

by R.V. Hollingsworth

Cochise County, Arizona

Radiell-Vacan Company
Murrey No. 1
Sec. 5 T 22 S.R. 27E
0-1603 "Willcox Filler"

0-90 Sand, white to red fine grained, with streaks of pale red clay.

90-100 Sand fine grained.

100-550 Sand white coarse grained to fine gravelstone sized, subangular to subround, with light brown to pale red cobble limestone pebbles included.

550-1270 Sand white coarse grained to fine gravelstone, subangular to subround, with 50% or more weathered igneous rock, subround to round, dominantly red in color included.

1270-1400 Sand, white coarse grained to fine gravelstone, subangular to subround with 50% or more weathered igneous rock, subround to dominantly green in color included.

1400-1603 Sand white fine to coarse grained subround to round, with weathered igneous rock subrounded to round varigated in color.

(1603-2305) Pennsylvanian System, Atoka ("Bond") Series.

1603-1613 Limestone, white medium to coarse paurograined.

1613-1625 Granite wash, reddish brown with streaks of red shale.

1625-1635 Limestone, white medium to coarse paurograined.

1635-1740 Granite wash, reddish brown with streaks red shale.

1740-1750 Granite wash with pale red cobble limestone and quartz pebbles included.

1755-1775 Limestone, light brown fine paurograined.
1775-1785 Granite wash.

1785-1795 Limestone, light brown fine paurograined.
1795-1805 Granite wash. (Cemented cave after lost circulation – L. Buck)

Cochise County
Waddell-Duncan Co.
Murray Co. 1

(1600-2305) Pennsylvanian System, Atoka ("Bend") or (Derry) Series (Continued)

1305-1315 Limestone, pale red fine panograined.
Fusulinella- Atoka in age.

1315-1350 Granite wash, ? with intervals of light gray to pale red fine panograined limestone in 1325-1335 and 1345-1350.
Fusulinella Atoka in age 1330-1340/.

1350-1375 Granite wash. ?
1375-1385 Limestone, light gray micrograined.
1385-1390 Granite wash. Trip 1390'-lost circulation-cemented off

1390-2000 Limestone, pale reddish brown very fine panograined, with pseudoolites in 1950-1960 and large crinoidal fragments in 1990-2000.

2000-2030 Limestone, pale reddish brown micrograined, with streaks of red shale and large crinoidal fragments included. Trace white opaque vitreous chert in 2010-2020. Smooth nondescript ostracodes with slight Mississippian aspect in 2020-2030

2030-2100 Limestone, white to pale brown very fine panograined with streaks red shale and crinoidal fragments included. Limestone, as above, with oolites and pseudoolites in 2070-2100.

2100-2105 Granite wash.
2105-2160 Limestone; white to light gray medium mesograined, slightly oolitic and pseudoolites, with crinoidal fragments included.

2160-2200 Limestone, white to pale fine panograined, slightly streaked with red shale, with some light bluish gray vitreous chert included. Limestone slightly dolomitic in 2170-2200.

2200-2205 Granite wash.
2205-2260 Limestone, pale yellowish brown medium mesograined, with pseudoolites and some light gray, brown spotted, vitreous chert included. Limestone slightly dolomitic in 2170-2200.

2260-2305 Chert, red to pale yellowish gray, with streaks of red shale, white crystal calcite and cobble limestone pebbles included, with streaks of pale yellowish brown medium mesograined limestone in 2270-2305.

(2305-3300) Mississippian system.
2305-2320 Limestone, white to dark yellowish brown very fine to coarse panograined.

2320-2330 Limestone, dark yellowish brown very fine panograined.

2330-2370 Dolomitic limestone, dark yellowish brown fine panograined with calcite veinlets and scattered crinoidal fragments. Trace of bluish white brown-spotted chert in 2340-2350.

2370-2400 Limestone, white medium to coarse mesograined, with pseudoolites and crinoidal fragments included. Limestone dolomitic at 2370-2400.

2400-2418 Limestone, white medium to coarse mesograined, slightly oolitic, with many pseudoolites included.

2305-3300 Mississippian system

2418-2460 Limestone, white to pale brown medium mesograined with crinoidal fragments, pseudoolites and calcite veinlets included

Cochise County
Waddell-[illegible] Co.
Murray [illegible] 1.

2460-2[illegible] [illegible] very coarse-[illegible] [illegible] parts pebbles in [illegible].

2465-2[illegible] [illegible] white coarse [illegible] [illegible] blue[illegible] [illegible] limestone, [illegible] [illegible] pebbles [illegible].

2565-2[illegible] Cherty [illegible] with interbeds of dark yellowish [illegible] limestone in 2[illegible]-2610 with [illegible] of red medium [illegible] dolomitic limestone in 2[illegible]-2[illegible].

2655-2[illegible] Dolomitic limestone, dark yellowish brown fine [illegible] medium mesograined.

2680-27[illegible] Dolomite, pale [illegible] mesograined, interbedded with pale red dolomitic limestone. Streaks of reddish shale, [illegible] calcite and [illegible] brown dull chert included in 2[illegible]-2700.

2700-27[illegible] Siliceous dolomite, light gray to brownish [illegible] fine pauvrograined with streaks of [illegible] pale brown dolomite [illegible] and red chert included with [illegible] pale brown vitreous [illegible] 2[illegible]0-2730. [illegible] chert in 27[illegible]0-[illegible].

2730-27[illegible] Dolomite, pink to white to red medium mesograined with little pale [illegible] vitreous chert included. Dolomite slightly [illegible] is in 2800-10.

2810-28[illegible] Siliceous dolomite, pink to red medium [illegible], with some bluish white round vitreous chert pebbles included.

2860-2870 Siliceous dolomite, pink to red medium [illegible].
2870-2910 Siliceous dolomite, olive gray to pale red [illegible] mesograined with little bluish white vitreous chert included [illegible] above chert slightly [illegible] medium round [illegible] grains included [illegible].

2955-30[illegible] Dolomite, white [illegible] coarse [illegible] bluish white [illegible] vitreous chert [illegible]. [illegible] 2[illegible]0. [redacted]

3000-3030 Dolomite, white to pink coarse mesograined, [illegible] slightly glauconitic, with little white to bluish white opaque vitreous chert.

3030-3070 Arenaceous dolomite, white to red medium to coarse mesograined, very glauconitic, with little light blue vitreous chert, white, fine to medium grained subround to round sand grains. Dolomite at 3[illegible]-3070.

3070-3150 Dolomite, white to red coarse mesograined, slightly glauconitic, with little bluish white vitreous chert included, white fine to medium subround sand grains in 3140-3150.

3150-3300 Arenaceous dolomite, white to red coarse mesograined, very glauconitic, with medium to very coarse subangular to [illegible] sand grains included.

3300-3380 Dolomitic sandstone, white, fine to very coarse-grained, subround to round, extremely glauconitic, with interbeds of light gray, medium mesograined arenaceous dolomite included. [redacted]

3[illegible]0- [redacted]

[redacted] Probably Devonian EAK

3380-3425 Limestone, white to light gray very fine pauvrograined, with streaks of reddish brown medium pauvrograined limestone and red shale included. With streaks of olive gray shale in 3[illegible]00-3425.

Goulina County
Waddell Duncan Co.
Survey No. 1

3435-3450 Limestone, [illegible] light greenish gray very fine pauvograined to [illegible]-spotted and slightly dolomitic, with streaks and [illegible] of light greenish [illegible] gray, brown-spotted shale [illegible].

3450-3520 Limestone, [illegible] pale red [illegible] pauvograined, slightly glauconitic, with shell [illegible] and streaks of pale [illegible] included.

3520-3[illegible] Very siliceous [illegible], dark green and red [illegible] pauvograined, [redacted]ton.

3520-3590 Arenaceous limestone, white to olive gray coarse pauvograined, very glauconitic and slightly dolomitic, with streaks and interbeds of light olive gray shale included.

3590-3630 Calcareous sandstone, light greenish gray very fine to fine-grained, subangular, [illegible] and glauconitic in part, with streaks of light brownish gray [illegible]-grained limestone and [illegible] green to olive gray shale included. [illegible] in 3590-3630 is somewhat [illegible] like.

3630-3670 Dolomitic arenaceous limestone, brownish gray very fine pauvograined, slightly glauconitic and brown-spotted, with streaks of light green [illegible] olive gray shale included. [illegible] of light greenish gray very fine to fine-grained sand, slightly calcareous in 3630 - 70.

3670-3690 Dolomitic sandstone, light gray to light [illegible] gray very fine to fine-grained, subangular slightly glauconitic, with streaks and interbeds of light olive gray, medium [illegible], arenaceous dolomite included. Thin streaks of bright [illegible] shale in 3690-3780, with little [illegible] vitreous chert [illegible].

3780-3845 Sandstone, [illegible] gray medium, [illegible] grained sub-round to [illegible] grains with white, [illegible] subangular quartz doble[illegible], slightly glauconitic [illegible] 3835, with yellowish gray [illegible] quartz cobble[illegible] [illegible]ly glauconitic in 3835-[illegible].

3845-3[illegible] Arkosic sandstone [illegible] to very coarse gr[illegible] cobblestone-sized angular to sub[illegible], with fine crystalline [illegible] spar. [illegible]

3[illegible]-3900 Sandstone, light olive gray to grayish green very fine to fine-grained, subangular, slightly dolomitic in part.

[illegible]-3990 Arkosic sandstone as at 3845-3880.

3990-4400 Pre-Cambrian granite.

3990-4400 Acid igneous rock, granitoid texture, white quartz, with large phenocrystals of feldspar, orthoclase variety, pinkish in color with ferro-magnesian minerals, biotite, hornblende, and [illegible] olivine.

Respectfully submitted,

PALEONTOLOGICAL LABORATORY

R. V. Collingsworth

Geologic Section

Compiling the various geo[illegible] sections exposed in the [illegible] we find the following ages represented:

CRETACEOUS TO RECENT — Valley fill.

CRETACEOUS — Coarse conglomerates, sandstone (up to [illegible] thick) shales and limestone.

PERMIAN — Basal [illegible], sandstone, inter[illegible] shale [illegible] and limestone.

PENNSYLVANIAN — Limestone and shale.

MISSISSIPPIAN (LOWER) — Massive granular limestone.

DEVONIAN (UPPER) — Lime and sandy limestone.

UPPER CAMBRIAN — Limestone, granular and sometimes [illegible]aceous.

MIDDLE CAMBRIAN — Dolomitic limes to sandy shales. Also Bolsa Quartzite.

PRE-CAMBRIAN — Final schists and granites.

Methods of Locating Subsurface Folding in the Valley

Since the writer has observed no capable outcrops throughout the greater part of the valley some other means of locating geologic structures, the valley fill will continue to a great depth, both core drilling and [illegible]graph methods are probably eliminated. It is the writer's opinion that magnetometer work would be the most reliable in locating buried folds.

Possible Petroleum Horizons

The writer, after observing the various outcrops in the [illegible] adjacent to Sulphur Springs Valley, is of the opinion that the following rocks GOOD RESERVOIRS for oil and gas may be encountered by [illegible] drilled on structure within the valley:

Cretaceous
Permian
Pennsylvanian
Upper Mississippian
And Perhaps in some of the older beds.

Recent Magnetometer Survey

The writer has studied the extensive magnetometer map recently completed of Sulphur Springs Valley for Waddell-Duncan Co., of Wilcox, Arizona. The map appears to be rather complete and thoroughly done since good control was available in most of the area. Upon this map were several first class [illegible] number of these appear to be first class locations for test wells. The writer would recommend that careful study be made of the map and the best appearing structure be tested.

Plans for testing

The test should be started after plans had been made to drill to a depth of at least 10,000 feet. This decision was partly arrived at after the writer had observed the rotary well samples from a test located immediately North west of the town of Wilcox, in SW-SE 1/4 of Sec. 23 Twp 13 South Range 24 East. This test is currently below 6800'. The samples indicate that the test has been drilling Cretaceous for several hundred feet. Casing was cemented to a depth of 6,512 feet. Numerous shows of oil and gas have been reported in the section behind the casing and plans are to test them in the future.

Loren I. Buck
Consulting Geologist
2212 East Seneca
Tucson, Arizona

December 3, 1949

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Stoyanow, A.A.

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G.S.A. Memoir, 38, 1949

Ulrich, N.W.

A Review of Arizona Geology
U.S.G.S. and Arizona Bureau of Mines
Bull. 7JIJ Geological Series 3.

CHUCK ASTON'S
GEOLOGIC REPORT.....

NOTES AND RECOMMENDATIONS [illegible] GEOLOGY AND [illegible] POSSIBLE OIL AND GAS IN THE SECTION [illegible] SULPHUR SPRINGS, TEXAS.

Concluding Geologic [illegible]

Since July of 1946, the [illegible] made detailed and [illegible] study of the subject area, and [illegible] areas, and has [illegible] from a geologic standpoint, that the [illegible] is definitely [illegible] the occurrence of crude petroleum [illegible] in commercial quantities.

These studies were [illegible] the intervals and [illegible] detailed checking of the stratigraphic sections and reconnaissance of [illegible] structural features which, as has been [illegible], are all of [illegible] sufficient to warrant commercial accumulations.

The stratigraphy as evidenced in the mountain areas [illegible] the subject area is made up of the following geologic sections:

Cretaceous Recent	Valley fill Cretaceous [illegible] sandstone (up to [illegible]) [illegible] shale and limestone.
Permian	[illegible] conglomerate, [illegible] interbedded [illegible] shale and limestone.
Pennsylvanian	[illegible] limestone and shales.
Mississippian	[illegible] massive granular [illegible]
Devonian(upper)	[illegible] and sandy limestone.
Upper Ordovician	[illegible] limestone, [illegible] Cretaceous.
Middle Ordovician	[illegible] limestone and sandy [illegible]. Also Bulge [illegible]
Pre-Cambrian	[illegible] schists and [illegible]

The thickness of the [illegible] in the subject [illegible] of a minor magnitude of approximately [illegible]. The surface [illegible] present knowledge is the controlling oil and/or gas reservoir possibility [illegible] of a maximum thickness of approximately [illegible] consisting of organic [illegible] limestone and sandstone. The possibilities of crude oil accumulation in the Cretaceous beds are somewhat limited in that [illegible] surface is definitely [illegible] on the outcrops.

The surface expressions of possible geologic structures in the subject area are limited to arching of the valley fill, which is [illegible] indicative. However, in the past 13 months numerous and detailed magnetic surveys were made by R.H. Andrews Geophysical Service, of Dallas, Texas, which confirmed, in the main, these so called surface expressions.

As this work were than 20 first class prospective oil structures were determined. Subsequent to this magnetic work, detailed gravity surveys were made by R.H. Andrews Geophysical Service and J.L.Copsilaid of Dallas, Texas which with some slight variance in interpretation have again confirmed the structural anomalies, resulting in a location for a test well of adequate depth, estimated at 7300', to be made in the SE ¼ of NW ¼, Sec. 8, T-22-S.R-27-E.

It is the writers considered opinion that the Cretaceous (Austin?) Marl limestone, probably equivalent of the producing limestone horizon in the Tarrant field of Texas, will be encountered somewhere by 2500' and have a probable thickness of 300'. In the proposed location with approximately 1800' of stratified limestone and shales between the Marl(?) and a four or 5 hundred foot sandstone, possible Woodbine Marl equivalent. In other words this ideal reservoir sand should be encountered by 4500'.

Because of additional possible reservoir formations the subject test should be holed-in for minimum of 7300'. It is the recommendation of the writer that this test should be made at the earliest practical date to the depth of not less than 7500' for commercial production.

Respectfully submitted this 15th day of June 1950 CHUCK ASTON
Consulting Petroleum Geologist

[illegible] Underwriter
R. Hollingsworth
[illegible] Phone [illegible]
Hilari, Texas

January 13, 1951

[illegible] Williams
[illegible] Baker, Jr.
Eugene F. Lancaster

[illegible] Operator,
[illegible] Texas
[illegible], Oklahoma

Waddell-Carson Company
Willcox, Arizona

Dear Sirs:

We report, as follows, on a special project.

INTERNATIONAL REPORT

by R.V. Hollingsworth

Machine Ranch, Inland

Waddell-Carson Company
Survey No. 1
Sec. 5 T 22 S.R. 27E
D-1671 "Willcox Field"

0-50 Sand, white to red fine grained, with streaks of pale red clay.

50-100 Sand fine grained.

100-550 Sand white coarse grained to fine gravelstone tined, subangular to subround, with light brown to pale red cobble limestone pebbles included.

550-1270 Sand white coarse grained to fine gravelstone, subangular to subround, with 50% or more weathered igneous rock, subround to round, dominantly red in color included.

1270-1400 Sand, white coarse grained to fine gravelstone, subangular to subround with 50% or more weathered igneous rock, subround to dominantly green in color included.

1400-1608 Sand white fine to coarse grained subround to round, with weathered igneous rock subangular to round variegated in color.

(1608-2305) Pennsylvanian system, Atoka ("Bend") series.

1608-1613 Limestone, white medium to coarse pauragrained.

1613-1625 Granite wash, reddish brown with streaks of red shale.

1625-1635 Limestone, white medium to coarse pauragrained.

1635-1740 Granite wash, reddish brown with streaks red shale.

1740-1750 Granite wash with pale red cobble limestone and quartz pebbles included.

1750-1775 Limestone, light brown fine pauragrained.
1775-1785 Granite wash.

1785-1795 Limestone, light brown fine pauragrained.
1795-1805 Granite wash. (cemented cave after lost circulation – L. Buck)

Carlise "Bond"
Waddell-Duncan Co.
Tracy No. 1

(1605-2305) Pennsylvanian System, Atoka ("Bond") or (Perry) Series (Continued)

1605-1815 Limestone, pale red fine paurograined.
Fusulinella- Atoka in age.

1815-1875 Granite wash, with incerbels of light gray to pale red fine paurograined limestone in 1825-1835 and 1865-1890.
Fusulinella Atoka in age 1830-1840/.

1875-1875 Granite wash. ?
1875-1835 Limestone, light gray micrograined.
1835-1890 Granite wash. Trip 1890'-lost circulation-cemented off

1890-2000 Limestone, pale reddish brown very fine paurograined, with pseudoolites in 1950-1960 and large crinoidal fragments in 1990-2000.

2000-2020 Limestone, pale red to brown micrograined, with streaks of red shale and large crinoidal fragments included. Trace white opaque vitreous chert in 2010-2020. Smooth nondescript ostracodes with slight Mississippian aspect in 2020-2030

2030-2100 Limestone, white to pale brown very fine paurograined with streaks red shale and crinoidal fragments included. Limestone, as above, with oolites and pseudoolites in 2070-2100.

2100-2105 Granite wash.
2105-2160 Limestone; white to light gray medium mesograined, slightly oolitic and pseudoolites, with crinoidal fragments included.

2160-2200 Limestone, white to pink fine paurograined, slightly streaked with red shale, with some light bluish gray vitreous chert included. Limestone slightly glauconitic in 2170-2200.

2200-2205 Granite wash.
2205-2260 Limestone, pale yellowish brown medium mesograined, with pseudoolites and some light gray, brown spotted, vitreous chert included. Limestone slightly glauconitic in 2170-2200.

2260-2305 Chert, red to pale yellowish gray, with streaks of red shale, white crystal calcite and cobble limestone pebbles included, with streaks of pale yellowish brown medium mesograined limestone in 2270-2305.

2305-3380) Mississippian system.
2305-2320 Limestone, white to dark yellowish brown very fine to coarse paurograined.

2320-2330 Limestone, dark yellowish brown very fine paurograined.

2330-2370 Dolomitic limestone, dark yellowish brown fine paurograined with calcite veinlets and scattered crinoidal fragments. Trace of bluish white brown-spotted chert in 2340-2350.

2370-2400 Limestone, with medium to coarse mesograined, with pseudoolites and crinoidal fragments included. Limestone dolomitic at 2370-2400.

2400-2415 Limestone, white medium to coarse mesograined, slightly oolitic, with many pseudoolites included.

2305-3380 Mississippian system

2415-2460 Limestone, white to pale brown medium mesograined with crinoidal fragments, pseudoolites and calcite veinlets included

[illegible]

[illegible] Dolomite, [illegible] medium [illegible]

3[illegible]-3[illegible] [illegible], pale [illegible] medium-grained, interb[illegible] with pale [illegible] dolomitic limestone. [illegible] of reddish-brown [illegible] and [illegible] chert included in [illegible].

3[illegible]-3[illegible] Siliceous dolomite, light gray to [illegible] with [illegible] of [illegible] pale [illegible] [illegible] [illegible]

3520-3990 Cambrian system.

3520-3590 [illegible] limestone, [illegible] very glauconitic and [illegible] with [illegible] [illegible] light [illegible] [illegible]

[illegible] 3630 70.

[illegible] 3690-3780.

[illegible]-3815 [illegible]

[illegible]-3900 [illegible] to [illegible] [illegible]

[illegible] 3990 [illegible]

3990-4400 Pre-Cambrian granite.

3990-4400 [illegible] orthoclase [illegible] [illegible]

Respectfully submitted,

PALEONTOLOGICAL LABORATORY

W. V. Bollingsworth

Geologic Section.

Considering the various geologic [illegible] reported in the [illegible] as follows [illegible]:

[illegible] Alluvial fill.

[illegible] [illegible] conglomerates, sandstones [illegible] shales and limestones.

[illegible] [illegible] and limestones.

[illegible] Limestone and shale.

[illegible] (Ma CP) Massive granular limestone.

[illegible] (Mbbb) Lime and sandy limestone.

[illegible] Limestone, granular and sometimes [illegible].

[illegible] Dolomitic limes to sandy shales. [illegible] carbonate.

[illegible] Black [illegible] and graptolites.

Possible and probable Hydrocarbon Traps in the Valley

Since the writer has observed no [illegible] structures [illegible] the greater part of the valley some other [illegible] structures, the valley fill will continue to a great depth, and here drilling and [illegible] methods are probably eliminated. It is the writer's opinion that [illegible] work would be the most reliable in locating [illegible] folds.

Possible Structures Exist.

[illegible] structure within the valley:

Cretaceous
Jurassic
Pennsylvanian
Upper Mississippian
And Perhaps in some of the older beds.

Recent Magnetometer Survey

The writer has studied the extensive magnetometer map recently completed of Sulphur Springs Valley for Waddell-Parker Co., of Wilcox, Arizona. The map appears to be rather complete and thoroughly done since [illegible] was available in most of the area. Upon this map were several first class [illegible] structures to be first class locations for test wells. The writer would recommend that careful study be made of the map and the best appearing structures be tested.

Plans for testing

The test should be started after plans had been made to drill to a depth of at least 10,000 feet. This decision was partly arrived at after the writer had observed the rotary well samples from a test located immediately North west of the town of Wilcox, in SW-SE 1/4 of Sec. 23, Twp 13 South Range 24 East. This test is currently below 6,000'. The samples indicate that the test has been drilling Cretaceous for several hundred feet. Casing was cemented to a depth of 6,512 feet. Numerous shows of oil and gas have been reported in the section below the casing, and plans are to test them in the future.

Loren E. Bush
Consulting Geologist
2313 East Seneca
Tucson, Arizona

November 3 1949

[illegible]

[illegible]

[illegible] of the [illegible] Mt. [illegible] Basin, University of [illegible], 1[illegible].

[illegible]

Geology [illegible] of the [illegible] Prof. Paper [illegible], 1[illegible].

[illegible]

[illegible] Stratigraphy Southern Arizona. [illegible], p. 1[illegible]

[illegible]

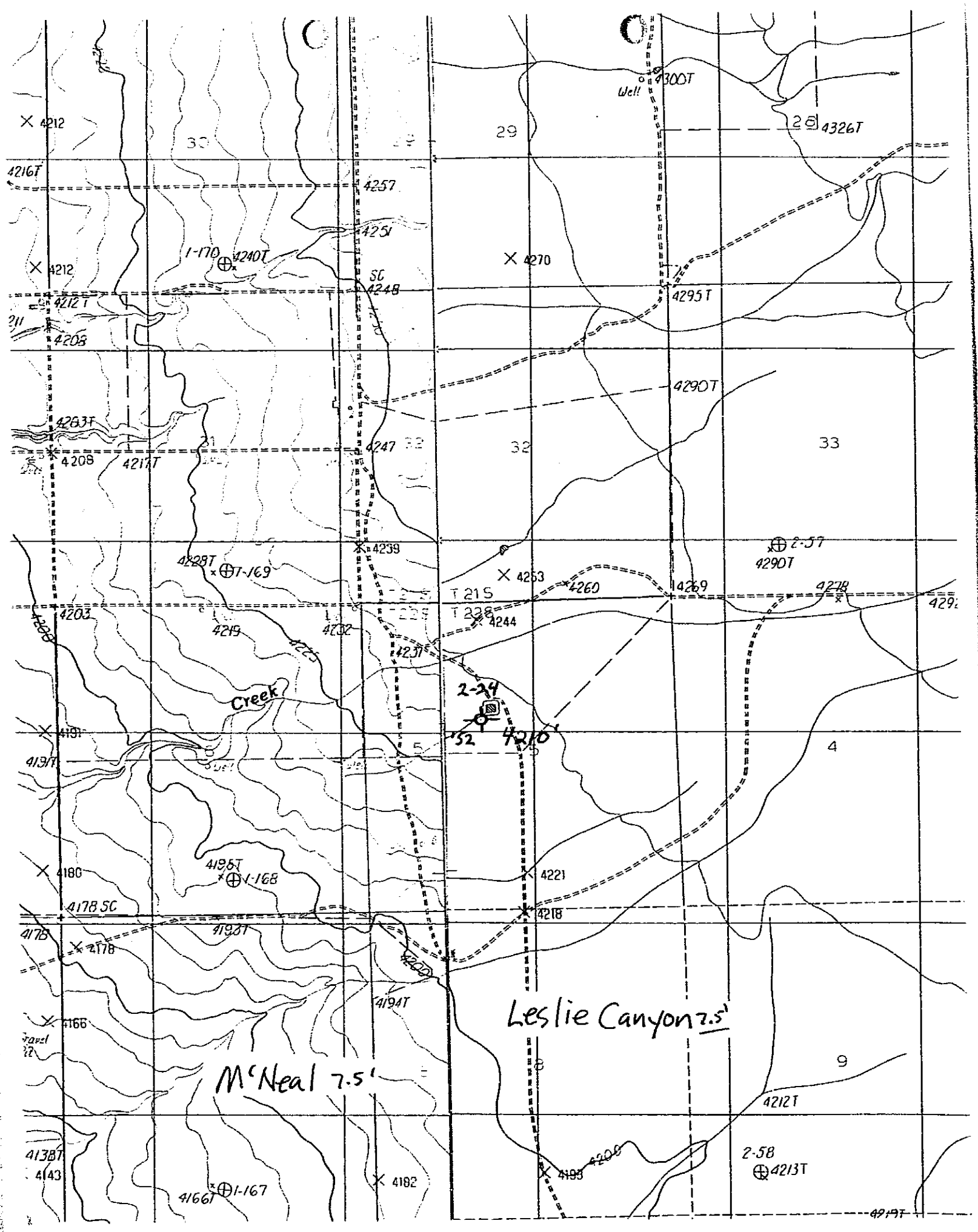
[illegible] of Arizona Geology [illegible] Arizona [illegible] [illegible] Bulletin [illegible].

TUCSON, ARIZONA

[illegible]

[illegible]

[illegible]


Well
4300T
4326T
29
28
4212
30
4216T
4257
4251
1-170
4240T
4212
SC
4248
4270
4295T
4212T
4205
4290T
4203T
4208
4217T
4247
32
33
4239
4228T
T-169
4253
4260
4269
2-57
4290T
T 21S
T 22S
4244
4203
4219
4232
4231
Creek
2-24
4210
4191
4193T
4180
4198T
1-168
4221
4178 SC
4218
4178
4193T
4178
4194T
4166
Leslie Canyon 7.5'
M'Neal 7.5'
9
4212T
4138T
4143
4166T
1-167
4182
4193
2-58
4213T
4217T

GEO-STRAT, INC.

GEOCHEMICAL EVALUATION OF THE WADDELL-DUNCAN
NO. 1 MURREY WELL, SEC. 5, T 22 S, R 27 E,
COCHISE COUNTY, ARIZONA

GEOCHEMICAL EVALUATION OF THE WADDELL-DUNCAN NO. 1 MURREY WELL, SEC. 5, T 22 S, R 27 E, COCHISE COUNTY, ARIZONA

Prepared

for

Karl W. Schwab
GEO-STRAT, INC.
Houston, Texas

March 1980

Date:

LEGAL NOTICE

The report, GEOCHEMICAL EVALUATION OF THE WADDELL-DUNCAN NO. 1 MURREY WELL, SEC. 5, T 22 S, R 27 E, COCHISE COUNTY, ARIZONA, was prepared by Geo-Strat, Inc., Houston, Texas. Neither Geo-Strat, Inc., nor any person(s) acting on its behalf

a. makes any warranty or representation, express or implied, with respect to the accurracy, completeness, or usefullness of the information contained in this report, or

b. assumes any liability with respect to the use of, or for damages resulting from the use of, any geological information disclosed herein.

SUMMARY

- Palynological, total organic carbon, visual kerogen, and vitrinite reflectance analyses, allow the Waddell-Duncan No. 1 Murrey well to be divided into eight (8) fairly distinct geochemical zones. While these don't exactly conform to the Formational boundaries as picked on lithology and/or on the IES Log, they are none-the-less considered to have some time-stratigraphic significance.

- Reworked Cretaceous and Paleozoic palynomorphs are common in Quaternary bolson-type deposits.

- Tertiary sediments contain a great deal of mineral debris (?volcanics). Pollen of the Compositae and the Chenopodiaceae type are common.

- The average total organic carbon content of the entire section is extremely low, less then 0.030 %.

- The stratigraphic section ranges from Immature, 0 to 1,640 feet, to Severely Altered, 2,550 feet to T.D.

- There is a significant "jump" in the level of maturation at the Tertiary-Carboniferous boundary (between 1,640 and 1,650 feet). This is also reflected by a noticeable deterioration in the overall kerogen preservation.

- The Carboniferous (Penn.-?U. Miss. Undiff.) - Mississippian contact, between 2,140 and 2,150 feet, is marked by a sudden decrease in the kerogen particle size. In addition, the quality of the extractable organic matter improves significantly.

- Lower to Middle Ordovician age sediments are inferred by the abundant and diversified occurrences of acritarchs and by the observed occurrence of some chain-like organisms, possibly related to the Chitinozoan Desmochitina sp., and scolecodonts.

SAMPLE MATERIAL

Geo-Strat, Inc. is deeply indebted to Dr. H. Wesley Peirce of the Arizona Bureau of Geology and Mineral Technology, University of Arizona, Tucson, Arizona, for making well cuttings samples of the Waddell-Duncan No. 1 Murrey well available for study.

Forty-one (41) well cuttings samples, representing the stratigraphic interval between 50 and 4,250 feet, were composited into 90 foot sample cuts (Text-Figure 3). Samples prepared for visual kerogen and vitrinite reflectance analyses were processed using standard palynological techniques with the oxidation step omitted. All organic carbon analyses were conducted using a LECO DC-12 Organic Carbon Analyzer and Determinator.

Each sample examined in this study is identified by the Geo-Strat Job Number 219- and by a sequential suffix number -001 through 041. The stratigraphic interval represented by each number can be found in Table 2.

GENERAL INFORMATION

Two (2) copies of this report, complete with all available IES Logs, have been supplied to each participant. In addition, each report contains a transparency of the IES Log which has been reduced for use with the total organic carbon well profile (Text-Figure 8). All visual kerogen slides and vitrinite plugs will be retained by Geo-Strat, Inc. This work is subject to copyright. The reprinting or copying of this report, its Text-Figures, Tables, and Plates, is prohibited.

INTRODUCTION

As petroleum exploration along the Overthrust Belt intensifies, increased attention has been focused on the extension of this structural feature into the Basin and Range Province of southern Arizona (Heylmun, 1978; McCaslin, 1978; and Tippee, 1980). Although over forty (40) petroleum-exploration wells have been reportedly drilled in southeastern Arizona, only about one-forth have penetrated rocks of Paleozoic age (Text-Figure 1). Of these, six (6) were reported to have had questionable oil and/or gas shows (Table 1).

Many geologists feel that deep traps and reservoir quality sediments probably exist within the Paleozoic sediments of the Pedragosa Basin. This being true, the next question the geologist must ask himself is, "are source rocks present?" At present, no organic geochemical data is available on any of the wells drilled in southeastern Arizona. In order to gain a better understanding of the geology-geochemistry relationship, Geo-Strat, Inc. has undertaken a detailed study of the stratigraphic section penetrated by the

Waddell-Duncan No. 1 Murrey well. The results and interpretations made by this writer will be based primarily on Geo-Strat's Palynological, Total Organic Carbon, Visual Kerogen, and Vitrinite Reflectance analyses. From these studies we will attempt to:

1. Accurately define the state of thermal maturity attained by each time-stratigraphic unit encountered in the Waddell-Duncan No. 1 Murrey well.
2. Describe the character, type and quality of the extracted organic matter.
3. Gain a fairly good understanding as to the hydrocarbon source potential of the entire stratigraphic section.

RESULTS AND INTERPRETATIONS

I. GENERAL GEOLOGY

The Pedragosa Basin covers a vast area of southeastern Arizona, southwestern New Mexico, and northern Mexico (Text-Figure 1). In southeastern Arizona it occupies the eastern two-thirds of Cochise County, an area of approximately 1,000 sq. km. Structurally, the area is characterized by subparallel north-northwest trending mountain ranges, 5 to 30 km. wide, separated by alluvial filled basins. They are the result of Laramide and Cascadian tectonism in association with periodic activity along the Deming Axis. The Cenozoic, Mesozoic, and to a limited degree the Paleozoic, is characterized by rocks which exhibit complex folding and thrust faulting coupled with localized areas of volcanic intrusives and mineralization. (NOTE: For a more detailed synopsis concerning the geologic history of the region, please see Turner, 1962).

II. PALYNOLOGICAL OBSERVATIONS

Palynological investigations of the stratigraphic section penetrated by the Waddell-Duncan No. 1 Murrey well turned out to be of limited value. The sparsity of well cuttings sample material, the degree to which the samples had been picked over since they were initially collected, and the fact that this well is open hole from the casing shoe, estimated at 250 feet on the enclosed IES Log, to T.D., all contribute to a very disappointing zonation attempt. Never-the-less, what few palynomorphs were present did prove to be of some value. Palynologically we can show that:

1. Large scale erosion and recycling of Cretaceous and Paleozoic sediments were actively taking place during deposition of the Quaternary bolson-type valley fills (Plates 1-3).

2. The Gila portion of the stratigraphic section contains very few palynomorphs. The most common are those belonging to the Compositae and the Chenopodiaceae. Some gymnosperm pollen, probably reworked from older sediments, were also noted (Plates 2-3).

3. Cretaceous sediments, if encountered in the general area of the Waddell-Duncan No. 1 Murrey well, will tend to be Immature. (NOTE: This is based on the color of the reworked palynomorphs observed in the Tertiary-Quaternary portions of the well).

4. Carboniferous (Pennsylvanian--U. Mississippian) sediments have reached a maturation level ranging from Mature to Very Mature. (NOTE: This again is based on the color of what is considered to be an Upper Pennsylvanian (?L. Permian) bisaccate observed in sample 219-022 (Plate 3, Figure 9).

5. Sediments interpreted as Devonian in age, show a marked change in the organic matter type and degree of thermal alteration. Here we also observe the first occurrence of ?Chitinozoan fragments coupled with a sudden influx of marine algal cysts, i.e., acritarchs (Plates 4-5).

6. Lower to Middle Ordovician age sediments are inferred by the abundant and diversified occurrences of marine algal cysts, i.e., Baltisphaeridium sp., Micrhystridium sp., and Leiospheres. Also present are some chain-like organisms, possibly related to the Chitinozoan Desmochitina sp., and scolecodonts (Plates 4-6).

III. GEOCHEMICAL METHODS

In determining the hydrocarbon potential of a particular rock unit, the geologist-geochemist has a variety of methods upon which he or she can rely. The method which one chooses depends, in part, on the type, amount, condition, and manner in which the samples were collected. Whichever method one chooses to use will naturally have specific limitations. No single analysis will provide the geologist with all the geochemical parameters needed to make an intelligent interpretation. It must be understood that the degree of reliability for a particular analysis will vary from poor to excellent. Therefore, prior to undertaking a geochemical study, one should have a clear picture in his or her mind what it is that they are trying to determine and the options available. A summary of the principal methods used in the characterization of source rocks and their degree of reliability is given by Tissot and Welte, 1978, p. 465. An updated version of their chart is reproduced in Table 3.

Because of the nature of the well cuttings which were made available on the Waddell-Duncan No. 1 Murrey well, i.e., scarcity and quality, Geo-Strat, Inc. had to limit the scope of its geochemical investigation. In this study, we will be discussing three (3) of the most important geochemical parameters: Total Organic Carbon, Visual Kerogen Assessment, and Vitrinite Reflectance analyses. A brief explanation of these methods is given below.

A. TOTAL ORGANIC CARBON

The total organic carbon content of any given sediment is a measure of its organic richness. This procedure involves five (5) basic steps:

1. Drying the rock sample.
2. Grinding the sample to a very fine powder.
3. Weighing about a 0.30 gram sample into a ceramic crucible.
4. Acidizing the sample, in the crucible, with hot and cold hydrochloric acid in order to remove the carbonate carbon.
5. Determining the total organic carbon content in an apparatus utilizing an induction furnace and a thermal conductivity cell to measure the evolved CO_2.

Based on the work of Ronov (1958) and Gehman (1962), it is generally accepted that one needs a minimum of at least 0.50 % T.O.C. in a clastic sediment for it to be considered as having fair source rock capabilities and at least twice that, 1.00 %, to be considered as good. Only about half of this, 0.25 % and 0.50 % respectively, is required for those rock units which are carbonates (Text-Figure 5). Please be aware that these minimal values should be considered only as a rough guideline rather than as an absolute indication for determining a rock's source capabilities. Other criteria which must also be considered include the type of organic matter present and its state of thermal maturation.

B. VISUAL KEROGEN

Kerogen, as originally defined, is the solid bituminous mineraloid substance in oil shales which yeilds oil upon destructive distillation (Crum-Brown, 1912). The term has since been broadened to include all insoluble organic matter, primarily of a plant nature, recovered from shales and other clastic sediments after they have been treated with hydrochloric and hydrofluoric acids (Burgess, 1974). This includes spores, pollen, plant epiderm, woody plant tissue (vitrinite), coaly debris (inerts) and algal cysts (fresh water and marine), as well as a host of unidentifiable organic matter types of uncertain biological affinities.

The thermal history of a sediment, oftened referred to as organic metamorphism or eometamorphism, is manifested in the color of the extractable organic matter. Gutjahr (1966), Correia (1967) and Staplin (1969), were among the first to demonstrate that the color of the kerogen, as viewed in transmitted illumination with the aid of a microscope, acts as a type of paleo-thermometer. The five (5) most important factors which influence the color changes of organic matter are: 1. heat, 2. pressure, 3. chemical associations, 4. weathering, and 5. geologic age. Other factors which may contribute to the degree of color change, especially in palynomorphs (spores, pollen, etc.), include cell-wall composition and morphologic structures (Wilson, 1971).

During increasing thermal maturation, palynomorph carbonization progresses through a series of color stages. Immature sediments are characterized by palynomorphs having a colorless to pale yellow color. Mature sediments contain spores, pollen, and plant tissue which vary from orange-brown to brown in color. Very mature sediments, or those which are nearly metamorphosed, yeild palynomorphs which are dark brown to black in color. It is during these various stages of transformation that hydrocarbons are generated. The relationship between the degree of thermal alteration (T.A.I.), coal rank, and the occurrence of oil and gas, is illustrated in Text-Figure 4.

Palynomorphs are generally destroyed during low-grade metamorphism. Thin-walled dinoflagellates (algal cysts), spores and pollen grains with delicate ornamentation and some forms of membraneous plant tissues, are usually among the first to disappear. Woody tissues however, become darker colored early during diagenesis and retain their delicate wall structures, i.e., pit diaphrams, until most spores and pollen have disappeared. (NOTE: Some woody plant tissues become lignified and thus are dark colored while the plant is still living).

Why use Kerogen?

The visual kerogen analysis is an important technique used to determine the geothermal history of a sedimentary basin. The thermal alteration (T.A.I.) curve and knowledge of the particular type of kerogen incorporated into a sediment (O.M.I.), allows the geologist to predict a particular geographical areas source rock potential (hydrocarbon generation and type). For this reason it is necessary that the dispersed kerogen debris be categorized. Microscopically, using transmitted illumination, GEO-STRAT, INC., recognizes four (4) basic kerogen types. These are ranked according to their importance in the generation of hydrocarbons and are therefore based upon their "lipid" content. (NOTE: Lipids, hydrogen-rich constituents which are considered by many to be the precursors of liquid hydrocarbons, represent a variety of chemically unrelated substances such as fats, hydrocarbons, inorganic sulfur, etc.).

Those considered to be the two most important kerogen types, rich in lipids, are designated as Lp and Ls. Lp stands for liptinites of primary importance (amorphous sapropelic kerogen and associated algal debris), while those designated as Ls, liptinites of secondary importance, include such things as spores, pollen, and plant tissues (epiderm). The third category is comprised of woody plant tissue (vitrinite) and is designated simply as V. This group is lean in its lipid content. The least important kerogen type(s) involved in the generation of liquid hydrocarbons, group four, are the inerts. These are finely disseminated particles of coaly debris mixed with pieces of mineral charcoal. While some of the coaly debris has a dry gas (thermally derived methane) potential, it adds very little to the overall formation and generation of oil and/or gas condensate. Thus in properly assessing the hydrocarbon potential of any sedimentary basin, and in particular the Pedragosa Basin of southeastern Arizona, it is essential that the geologist have a firm knowledge not only about the thermal maturity of the stratigraphic section, but also in the type(s) of organic matter (kerogen) contained within each time-stratigraphic rock unit.

In addition to being an excellent indicator of geothermal diagenesis, the degree of preservation and size range of the individual kerogen particles are also of importance. The degree of preservation (P.I.), is indicative not only of the environment in the area of deposition, i.e., Eh and pH, but it can also provide the explorationist with important clues pertaining to the stratigraphic section, i.e., secondary mineralization (dolomite and pyrite) and possibly tectonic events (unconformities, faulting, etc.). Particle size measurements (P.S.I.) can also yeild significant results providing the samples are prepared in a consistent manner, i.e., grinding, acidization, slide preparation, etc. The overall particle size has been helpful in determining the proximity of the depositional site to shoreline and in ascertaining the direction of transport.

How are the Kerogen parameters derived?

The method used by Geo-Strat, Inc., to determine the individual kerogen parameters is simple and straight forward. Our technique involves the derivation of a numerical value, index, based on the number of squares which are colored-in on the KEROGEN SUMMARY CHART (Text-Figures 7,9). Values are calculated for each of the four (4) basic parameters, i.e., Organic Matter Type, Thermal Alteration, Degree of Preservation, and Kerogen Particle Size. In the derivation of the Organic Matter Index only the botanical entities, represented by the first six (6) rows, are calculated. These include Algae, Amorphous debris, Spores-Pollen, Cuticle-Membraneous debris, Vitrinite or Woody structured debris, and Coaly debris or Inerts. Like the system itself, the kerogen values are subjective. Once derived, the indicies may be used individually of summed in a collective fashion so as to represent a single value for a particular Formation and/or Biostratigraphic Zone (Table 6).

Our primary goal in using this method is to be able to generate a series of contour maps which when combined with additional geological information, will provide the geologist with an added vantage in determining where the most promising locations are for more detailed oil and gas exploration. (NOTE: In order to determine relative abundance for each of the kerogen types in a given sample, one must divided the total number of squares which have been colored-in under the heading TYPE OF ORGANIC MATTER on the KEROGEN SUMMARY CHART, into 100. This in effect will produce a normalized percentage value for each square. When computed, simply multiply this value times the total number of squares colored-in for each of the six (6) categories. The resulting figure will be a rough estimate as to the percentage of that particular kerogen type which was observed on the kerogen slide. An example of this is given below).

TOTAL SQUARES COLORED-IN: (From KEROGEN SUMMARY CHART)

½	Algal debris
3	Amorphous debris
1½	Spores-Pollen
3	Cuticle-Membraneous debris
1	Woody structured debris (Vitrinite)
1	Coaly debris (Inerts)
Total 10	

$$\text{VALUE OF EACH SQUARE} = \frac{100\%}{10} = 10\%$$

NORMALIZED PERCENTAGE OF EACH ORGANIC MATTER TYPE PRESENT

5%	Algal debris
30%	Amorphous debris
15%	Spores-Pollen
30%	Cuticle-Membraneous debris
10%	Woody structured debris (Vitrinite)
10%	Coaly debris (Inerts)
Total 100%	

C. VITRINITE REFLECTANCE

Vitrinite, one of the many petrographic constituents of coal, has been used by the coal mining industry for many years as a means of determining coal rank (Text-Figure 6). In petroleum exploration the technique, although slightly modified, is used as a means of determining a sediment's state of thermal maturity (Text-Figures 4,13; Tables 4-6).

In the vitrinite reflectance analysis, vitrinite particles and associated kerogen types are extracted from the sediment using a series of acids (hydrochloric and hydrofluoric). The process is essentially the same as that used in palynology except that the oxidation step has been omitted. (NOTE: Some geologists prefer to use the raw crushed rock sample without any acidization whatsoever. This technique is used by many petroleum companies and produces just as accurate values as those obtained in the acidization method. The advantage in using a sample which has been macerated is that one can usually obtain a greater concentration of the vitrinite particles. This is especially important when dealing with a carbonate sequence or when evaluating sediments lean in vitrinite). Extractable organic matter, kerogenaceous debris and vitrinite, is air dried in a vacuum chamber and then embedded into a bioplastic or epoxy plug. After being finely polished, a high resolution microscope, calibrated with a known optical standard, is used to measure the reflectivity of the vitrinte particles.

Vitrinite reflectance measurements, expressed as % Ro, are taken in oil and then summarized on individual histograms (Text-Figures 14-16). In samples having a history of low paleotemperatures, less than 175° F, 40 to 50 observations are usually adequate. Sediments which have undergone complex structural deformations and/or which have been subjected to high paleo-temperatures, greater than 250° - 300° F, may require as many as 100 to 150 observations. This is also true for sedimentary units which contain a great deal of recycled kerogen debris. The latter usually contains vitrinite particles which have a wide scatter in their reflectance values and sub-sequently results in histograms having multiple vitrinite reflectance, %Ro, populations. Without the aid of the visual kerogen data and/or other geochemical parameters, samples having multiple vitrinite reflectance , %Ro, populations, are very difficult, sometimes impossible, to interpret.

IV. APPLIED GEOCHEMISTRY

Using the results of Geo-Strat's Total Organic Carbon, Visual Kerogen, and Vitrinite Reflectance analyses, the stratigraphic section encountered by the Waddell-Duncan No. 1 Murrey well can be sub-divided into eight (8) fairly distinct geochemical zones (Text-Figures 3,9-12). While these zones don't exactly conform to the Formational boundaries as picked on lithology and/or on the IES Log, Table 1, they are none-the-less considered to have some time-stratigraphic significance.

Organic geochemical parameters and their respective interpretations will be discussed according to individual Formation and/or Biostratigraphic Zones. A tentative summary of this data can be found in Text-Figure 2, Table 6.

ZONE I

Quaternary Undifferentiated

(0-440')

Zone I, 0 to 440 feet, is characterized by bolson type deposits which are composed of plant cutilce and membraneous debris mixed with equal amounts of woody structured material and inerts. The overall quality of the extractable organic matter, in-so-far as its potential for hydrocarbon generation is concerned, would be considered as only Fair (Text-Figures 9-10A; Table 6). The Fair quality of the organic matter, coupled with the very low levels of thermal maturity and low total organic carbon content, i.e., an average T.A.I. of 1.80 and an average T.O.C. of 0.027 %, indicates that this zone would be considered as having Very Poor source rock capabilities (Text-Figures 8-9,12,14-16; Tables 2,5-6). (NOTE: No vitrinite reflectance measurements were obtained for Zone I due to the lean recovery of kerogen residue).

The kerogen particle size, P.S.I., ranges from Finely Disseminated to Fine. Kerogen preservation is generally Very Good, probably due, at least in part, to the very low levels of oxidation and low paleotemperatures. The average P.S.I. value recorded for this interval is 2.08 while the average P.I. value is 2.67 (Text-Figures 9,10B-11; Table 6).

ZONE II

Tertiary Undifferentiated

(450'-1,640')

Zone II, 450 to 1,640 feet, can be recognized by an increase in the level of thermal maturity, poorer palynomorph preservation, an increase in kerogen particle size, and by a noticable influx of mineral debris (Text-Figures 9,10B-11; Table 6). Average values for maturation, preservation, and particle size, are 3.00, 4.00, and 2.28 respectively. As was noted in Zone I, no vitrinite reflectance measurements were possible for Zone II due to an insufficent amount of kerogen residue. However, based on spore coloration, coupled with vitrinite particles which are considered to represent up-hole cave, the vitrinite reflectance value is estimated to be near 0.51 %Ro (Text-Figures 4,9,13-16; Table 5-6).

The dominant kerogen type in Zone II is plant cuticle and membraneous debris associated with minor amounts of spore-pollen, structured woody material and inerts (coaly debris). While there is a general overall improvement in the quality of the organic matter as compared to that of Zone I, average O.M.I. of 4.65 versus an O.M.I. of 5.00, the average total organic carbon content diminishes. Zone II has an average T.O.C. of 0.017 % while Zone I has an average T.O.C. of 0.027 % (Text-Figures 8-10A; Tables 2,6). (NOTE: Although the overall T.O.C. value diminishes in Zone II, there is a noticeable increase in its percentage between 500 and 940 feet. What the significance of this "jump" means is unclear at this writing. It appears to coencide with an increase in the resistivity between 500 and 800 feet as seen on the enclosed IES Log).

Geochemically, Zone II would be considered as a Very Poor source for the generation of liquid hydrocarbons. Though unlikely, it is possible that minor amounts of biogenic methane could be generated in sediments which represent this portion of the stratigraphic section.

ZONE III

Carboniferous (Penn.-?U. Miss.) Undifferentiated

(1,650'-2,140')

The section designated as Zone III, 1,650 to 2,140 feet, is marked by a pronounced change in its geochemical parameters. Examination of the extractable organic matter shows an increase in the percentage of structured woody material and inert debris along with minor but persistent occurrences of amorphous kerogen. The average organic matter index, O,M.I., for Zone III is 4.80 (Text-Figures 9-10A; Table 6). (NOTE: In general the occurrence of amorphous kerogen would enhance the quality, i.e., hydrocarbon potential, of

a sediment. Similarily, an increase in structured woody debris and inert particulate matter, would tend to downgrade a sediments O.M.I. value and thus its source potential. In this instance the increase in structured woody material and inert debris has caused the average organic matter index, O.M.I., to be moderately higher, therefore less favorable, than that attained in Zone II).

In addition to the increased abundance of the amorphous, structured woody, and inert kerogen types, there is a noticeable increase in the amount of kerogen debris exhibiting high thermal alteration effects. It is this writers opinion that the lower T.A.I. values recorded for this portion of the stratigraphic section, i.e., 1.00 to 2.33, represents up-hole contamination and that the secondary maturation population, T.A.I. values of from 5.00 to 5.50, are in situ (Text-Figures 9,12; Table 6). Because of a lack in the amount of kerogen residue recovered from the acid treatment of the rock, vitrinite reflectance measurements were not obtained for any of the cuttings samples taken through this interval. (NOTE: An average %Ro value estimated at 0.78, as shown in Table 6, is considered to representative for a portion of the sediments representing this particular time period. Please understand however, that this is just an approximate vale based on what I have interpreted as possible being up-hole cave. The %Ro value for Zone III could be considerably higher).

The incrediable "jump" in maturation between Zones II and III, based on visual kerogen, suggests that one of the most dramatic moments in tectonic activity for this area of southeastern Arizona occurred between the Carboniferous (?Permian) and Cretaceous Periods. Depending on what values one uses to represent the paleo-thermal gradient, depth of burial for sediments of Zone III could vary anywhere from approximately 6,250 feet to as much as 20,833 feet (Table 7). The pronounced "jump" in maturation is also reflected by a deterioration in palynomorph and/or kerogen preservation (compare the palynomorphs illustrated in Plates 1-3 with those of 4-6). Though not nearly as dramatic, the average preservation index declines from a P.I. value of 4.00 in Zone II to a P.I. value of 4.50 in Zone III (Text-Figures 9,11; Table 6).

Among other geochemical parameters showing marked changes include the total organic carbon content and kerogen particle size. As can be seen in the Total Organic Carbon well profile, T.O.C. values range from a minimum of 0.014 % at 2,140 feet to a maximum of 0.040 % at 1,840 feet. The average T.O.C. value is 0.027 % (Text-Figure 8; Table 2,6). Here once again the sudden increase in the T.O.C. content roughly coencides with a "jump" in the resistivity (see enclosed IES Log). While the particle size of the kerogen debris in the Quaternary and Tertiary sections appears to fluctuate a great deal, the Carboniferous marks the beginning of a trend towards a finer particle size (Text-Figures 9, 10B; Table 6). This is an indication that deposition is either taking place further out into the basin (farther from shoreline) and/or that we are seeing a major change in lithology type.

Geochemically, sediments assigned to Zone III contain organic matter of Fair quality which have reached a Mature state of alteration. Low organic carbon values obtained from sediments in this portion of the section forces one to regard Zone III as having Poor source rock capabilities. If one can determine in which direction the T.O.C. content increases, lets say to about 1.00 %, without changing the other parameters significantly, the Carboniferous could become a potential source for oil and associated gas.

ZONE IV

?Mississippian

(2,250'-2,540')

In comparison with the overlying unit, Zone III, one can't help but notice that the sediments of Zone IV show a slight improvement in the overall quality of its kerogen content, higher maturation values, finer particle size, and a deterioration in palynomorph preservation. These parameters, reflected by an O.M.I. of 4.36, a T.A.I. of 5.75, a P.S.I. of 1.54, and a P.I. of 5.50, are not easily discernable on the KEROGEN SUMMARY CHART, but show up fairly well on the ORGANIC MATTER, DEGREE OF ALTERATION, PARTICLE SIZE, AND DEGREE OF PRESERVATION well profiles (Text-Figures 9-12). Due to an insufficent amount of kerogen residue, a detailed vitrinite reflectance analyses of this portion of the stratigraphic section was not possible. However, based on the results obtained in our visual kerogen analyses, coupled with measurements which were made on vitrinite particles considered here to represent up-hole contamination, Geo-Strat, Inc., has postulated a vitrinite reflectance, %Ro, value of 1.16 for Mississippian age sediments (Text-Figures 13-16; Tables 5-6). Geologic interpretations made by this writer for this portion of the stratigraphic section are based exclusively on visual kerogen and total organic carbon data. As a result of the differences in these parameters, Geo-Strat, Inc., has interpreted the interval from 2,250 to 2,540 feet as most likely representing Mississippian age deposits. Again, depending upon one's interpretation of the data, sediments assigned to this portion of the geologic column could have been buried anywhere from 10,000 to 33,000 feet (Table 7).

Based on the organic matter content, the Mississippian would be considered as having slightly better source rock qualities than the overlying Carboniferous. However, the Low total organic carbon content, average T.O.C. of 0.029 %, forces one to regard this interval as having Very Poor source rock capabilities (Text-Figures 5,8; Tables 2,6). If one can determine in which direction the T.O.C. content increases, i.e., to about 1.00 % or more, the Mississippian could become an important source rock for the generation of oil, gas condensate, or thermally derived methane.

ZONE V

Devonian

(2,550'-3,340')

The Mississippian-Devonian contact, the most noticeable boundary in the Waddell-Duncan No. 1 Murrey well, is exemplified by a dramatic change in kerogen type. Extractable organic matter is principally of the amorphous-algal type associated with secondary amounts of cuticular and membraneous plant tissue. Minor amounts of structured woody debris and inert materials are also present (Text-Figures 9-10A).

In addition to the pronounced change in the organic matter type, the extractable kerogenaceous debris shows a moderate "jump" in its level of thermal alteration. While overlying Mississippian sediments have an average T.A.I. of 5.75 and are considered to be Very Mature, Devonian rocks have an average T.A.I. of 6.00 and are interpreted as being Severely Altered. This high degree of alteration is also reflected by an average vitrinite reflectance value of 1.63 %Ro. At these temperatures, the maximum depth of burial for Devonian age sediments is calculated to be between 13,000 and 45,000 feet (Text-Figures 9,12-16; Tables 4-7). The organic matter also shows a noticeable deterioration in its state of preservation, probably due to the high level of alteration. The P.I. index, Degree of Preservation, increases from an average of 5.50 in Zone IV to an average of 6.00 for Zone V (Text-Figures 9,11; Table 6).

The kerogen particle size has an average value of 1.34 and continues to show a decrease in overall size. This, along with the sudden influx of amorphous-algal type kerogen, indicates that the Devonian section penetrated by the Waddell-Duncan No. 1 Murrey well was deposited in either fairly deep water and/or at some goodly distance from shoreline (Text-Figures 9-10B; Table 6).

Total organic carbon values continue to be on the Low side. Values range from a minimum of 0.016 % at 3,340 feet to a maximum of 0.044 % at 3,040 feet. The average T.O.C. content was 0.027 % (Text-Figures 5,8; Tables 2,6). Like the Carboniferous and Mississippian portions of the stratigraphic section, the Devonian, as represented in the Waddell-Duncan No. 1 Murrey well, appears to have Very Poor source rock capabilities. Beacuse of its extremely high level of maturation, any hydrocarbons which might be found in association with this portion of the geologic column will undoubtly be of the thermally derived methane (dry gas) type.

ZONE VI

Lower to Middle Ordovician

(3,350'-3,740')

Sediments encountered between 3,350 and 3,740 feet in the Waddell-Duncan No. 1 Murrey well are interpreted as being of Lower to Middle Ordovician in age. Present is an abundant but diversified group of algal cysts, i.e., Baltisphaeridium sp., Micrhystridium sp., ?Acanthodiacrodium sp., and Leiospheres, coupled with some chain-like organisms, possibly related to the Chitinozoan Desmochitina sp., and a single scolecodont (Plates 4-6).

Extractable organic matter recovered from Zone VI is characterized by kerogenaceous debris which is primarily of an amorphous-algal nature. When compared with that observed in Zone V, one can readily see that there is a distinct absence in woody structured debris (vitrinite) and an increase in the percentages of inert material. The progressive trend towards a better quality of organic matter, beginning in the Carboniferous and continuing through the Devonian, is suddenly reversed (Text-Figures 9-10A; Table 6). In addition, there is a noticeable shift in the kerogen particle size. This abrupt change, towards a more coarse size fraction, may coencide with tectonic events, i.e., epeirogenic upwarping and subsequent erosion which may have taken place during late Ordovician and/or early Devonian time (Text-Figures 9-10B; Table 6).

The transition from Devonian to Lower or Middle Ordovician is also characterized by a dramatic decrease in the total organic carbon content. While sediments of Zones III, IV, and V, consistently yeild average T.O.C. values of about 0.027 %, rocks assigned to Zone VI only have an average T.O.C. of 0.014 % (Text-Figure 8, Tables 2,6).

In-so-far as thermal maturity and kerogen preservation is concerned, Zones V and VI are very much alike. Both contain rocks in which the extractable organic matter has been Severely Altered. The average thermal alteration index, T.A.I., is 6.33. Vitrinite reflectance measurements of the same kerogen fraction had an average %Ro of 1.95. This would tend to indicate slightly higher paleotemperatures than what was calculated by the visual kerogen method. Kerogen preservation would be considered, at best, as only Fair. The average Preservation Index, P.I., is 6.00 (Text-Figures 5,9, 11-16; Tables 2,5-6).

Geochemically, Lower to Middle Ordovician sediments could become possible source rocks for thermally derived methane (dry gas) providing one can find an area in which the average T.O.C. content is greatly improved, i.e., about 1.00 %. As it now stands, Lower to Middle Ordovician rocks within the immediate area of the Waddell-Duncan No. 1 Murrey well are considered to have Extremely Poor source rock capabilities.

ZONE VII

?Cambrian Undifferentiated

(3,750'-4,040')

The boundary between the ?Cambrian and the Lower to Middle Ordovician in the Waddell-Duncan No. 1 Murrey well is placed at or near the point where there is a marked decrease in the abundance of the palynomorphs Baltisphaeridium sp., Micrhystridium sp., and ?Acanthodiacrodium sp. cf. A. spinum (Rasul, 1979). This contact is also recognized by a noticeable decrease in the overall quality and preservation of the organic matter, i.e., an average O.M.I. of 3.75 and and average P.I. of 7.40 (Table 6). The Very Poor quality of the extractable organic matter can be attributed to the overall decrease in the percentages of cuticular and membraneous plant tissues coupled by an increase in the amount of inert debris (Text-Figures 9-11; Table 6). In addition, there is an abrupt change in the kerogen particle size and a dramatic shift in the total organic carbon content. While the kerogen particle size decreases from an average of 1.58 in Zone VI to an average of 1.28 in Zone VII, the total organic carbon content "jumps" from an average of 0.014 % in Zone VI to an average of 0.021 % in Zone VII (Text-Figures 8,9-10B; Table 2,6). I believe it would be wise to keep in mind however, that the reversal and trend towards higher T.O.C. values should be considered as highly questionable, at least until other stratigraphic sections of the same general age in nearby wells have been analyzed.

In-so-far as thermal maturity is concerned, the extractable kerogenaceous debris is at about the same level of maturity as that of Zone VI. Both have an average T.A.I. of 6.33 and an average vitrinite reflectance %Ro value of 1.95. The organic matter is considered to be Severely Altered (Text-Figures 9,12-16; Tables 2,6). Depending on the geothermal gradient one uses, Ordovician and ?Cambrian sediments could have been buried anywhere from 14,500 to 48,333 feet (Table 7).

Geochemically, the ?Cambrian section in the Waddell-Duncan No. 1 Murrey well must be considered as having Very Poor source rock capabilities. However, if ?Cambrian age rocks can be found having substantially higher total organic carbon percentages, i.e., 1.00 % or more, then this portion of the stratigraphic section could possibly produce significant quantities of dry gas.

ZONE VIII

?Precambrian

(4,050'-4,250')

In reality it is impossible to pick the ?Cambrian-Precambrian boundary on a change in organic matter type. This is especially true when one understands that the basement complex in this immediate area of the Pedragosa Basin is generally considered to be of an igneous and/or metamorphic nature. At this particular horizon we must revert to negative criteria, i.e., a rapid decrease in the overall abundance of plant tissue, an increase in the variety of organic matter types due to uphole cave, and an increase in the amount of mineral debris in the maceral and/or on the kerogen slide. Using this approach, Geo-Strat, Inc., has placed the ?Cambrian-Precambrian boundary at about 4,050 feet. (NOTE: After taking another hard look at the kerogen data, it would appear that an equally good location for this contact would be between samples 219-038 and 219-039). This is based on four (4) observations: 1. a shift in the Organic Matter Index, 2. a change in the Kerogen Particle Size, 3. an abrupt "jump" in the Total Organic Carbon content, and 4. a noticeable increase in the amount of mineral debris present in the kerogen macerals (Text-Figure 8-10; Table 6). Although I have recorded a number of geochemical parameters for this particular zone, Table 6, these are best interpreted as representing up-hole contamination. They should be viewed with caution and skepticism in-so-far as their geochemical significance is concerned.

CONCLUSIONS

Based on the results of this study, we have concluded that the principal reason why the Waddell-Duncan No. 1 Murrey well resulted in being a dry hole was due to an overall lack of good source rocks. This is directly attributed to an insufficent amount of organic carbon in each of the individual rock units, i.e., the overall average T.O.C. content was less then 0.030 % for each of the time-stratigraphic units (Tables 2,6). It is imperative therefore, that we try and locate and/or outline areas in which the total organic carbon content averages between 0.75 % and 1.00 %. Providing that the kerogen type and degree of maturation remains essentially the same, we feel that the Carboniferous, and possibly the Mississippian, offer the best chances for generating oil and/or gas condensate. The Devonian, Ordovician, and possibly the Cambrian, are more apt to be a source for dry gas (thermally derived methane).

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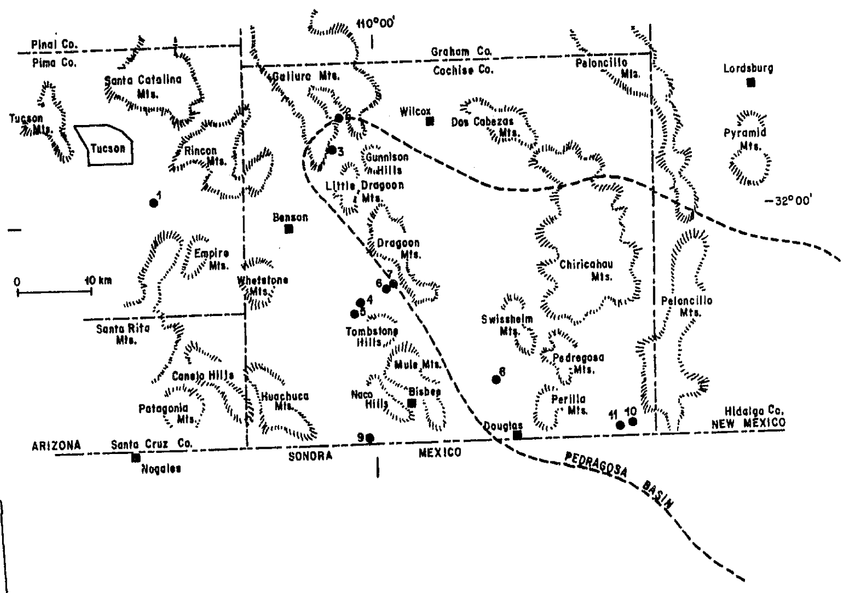
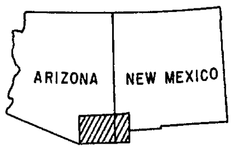
TEXT-FIGURES





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Text-Figure 1. Location map showing key exploration wells which have penetrated Paleozoic (or Precambrian) rocks in southeastern Arizona (Pima and Cochise counties). Please see Table 1 for specific well data.

STRATIGRAPHIC NOMENCLATURE

(Pedregosa basin and adjoining areas)

Chronostratigraphic Units	Lithostratigraphic Units: Pedregosa basin: Ariz.-Sonora	Pedregosa basin: New Mex.-Chih.	Burro and related uplifts	Orogrande basin (southern part)	Main Rock Type		General Depositional Environment
Quaternary	bolson and other deposits				sand		nonmarine
Quat.-Tertiary	Gila			Santa Fe	conglomerate		
Tertiary to Cretaceous	volcanic (and intrusive) rocks				igneous		
	Ft. Crittenden	Ringbone	Lobo	Love Ranch	conglomerate		
Upper to Lower(?) Cretaceous	(not recognized)		Colorado	Mancos	dark mudstone		shallow mar.
			Beartooth	Dakota	sandstone		shallow mar. to nonmarine
			Sarten		sandstone		
					sandstone		
Lower Cretaceous	Bisbee: Cintura	Mojado	(absent)	(present in Chihuahua trough.) (absent)	limestone		shallow mar.
	Bisbee: Mural	U-Bar			redmudstone		nonmarine
	Bisbee: Morita	Hell-to-Finish			conglomerate		
	Bisbee: Glance						
Jurassic	intrusive rocks	(absent)		(absent)	ign.	ls., ss.	shallow mar.
Triassic	volcanic rocks	(absent)			igneous		nonmarine
Permian: Guadalupian	(not recog.)	Santa Rita	(absent)	(absent)	sandstone		shallow marine
	Rainvalley	(absent)		San Andres	limestone, dolostone		
Permian: Leonardian	Concha			Glorieta	sandstone		
	Scherrer			Yeso	dolostone		
	Epitaph				limestone		
	Colina						
Permian: Wolfcampian	? Earp	Earp	Abo-Hueco		red mudst., ls.		non., shall. mar.
Pennsylvanian: Virgilian		Horquilla	(absent)	Bursum	limest. dolost. mudst.	limest. sandst. limest.	shallow to deep marine	shallow marine
Pennsylvanian: Missourian				Panther Seep			
Pennsylvanian: Desmoinesian	Horquilla			Bishops Cap			
Pennsylvanian: Atokan				Berino	limestone, sandstone		shallow marine
Pennsylvanian: Morrowan	Black Prince			La Tuna			
Mississippian	Paradise			Helms	limest., mudst.		
	Escabrosa		Lake Valley—Rancheria		limest., chert		
Devonian	Percha				dark mudstone		
	Martin		(absent)	Canutillo	dolost.	dol., cht.	
Silurian	(not recognized)		Fusselman		dolostone		
Ordovician	?	? Montoya			dolostone		
		El Paso			limest., dolo.		
Cambrian	Coronado	Bliss			sandstone		shall. mar. to non.
	Abrigo	(absent)			limest., dolo.		shallow marine
	Bolsa				sandstone		shall. mar. to non.
Precambrian	basement rocks				ign., metamorphic		——

Magdalena

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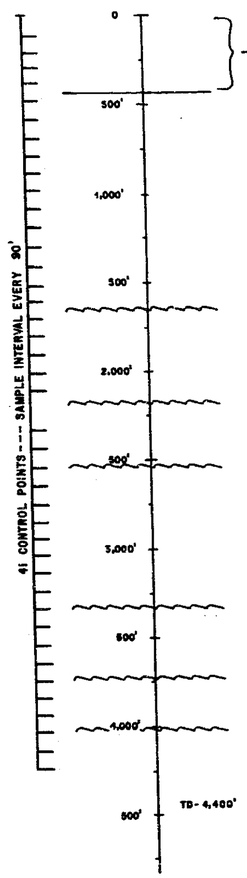
Text-Figure 2

Text-Figure 3

WADDELL-DUNCAN NO.4 MURREY
COCHISE CO., ARIZONA
SEC. 5, T22S, R27E.



Quaternary bolson deposits with reworked U. Cretaceous and Paleozoic polynomorphs.

450' Tertiary-Gila conglomerate and volcanics.
Reworked Mesozoic also present, but not as abundant as in the Quaternary. Specimens of pollen belonging to the Compositae and Chenopodiaceae are very common. Mineral debris is abundant on the kerogen slides which represent this portion of the stratigraphic section.

1,640' Major floral change noted. Probable top of Carboniferous. No striate bisaccates observed, possibly all Pennsylvanian. Diagnostic palynomorphs very rare or absent.

2,140' Top of ?Mississippian. No diagnostic palynomorphs observed.

2,540' Top of Devonian. Acritarchs, i.e., Baltisphaeridium sp., common. First occurrence of ?Chitinozoan fragments at 2,940'.

3,340' Middle to Lower Ordovician. Acritarchs common to abundant.

3,740' Top of Cambrian, marked by a distinct change in preservation. Acritarchs becoming scarce.

4,040' Top of ?Precambrian. Deepest sample, 4,250'.

NOTE: This well is badly contaminated by Tertiary debris due to up-hole caving.

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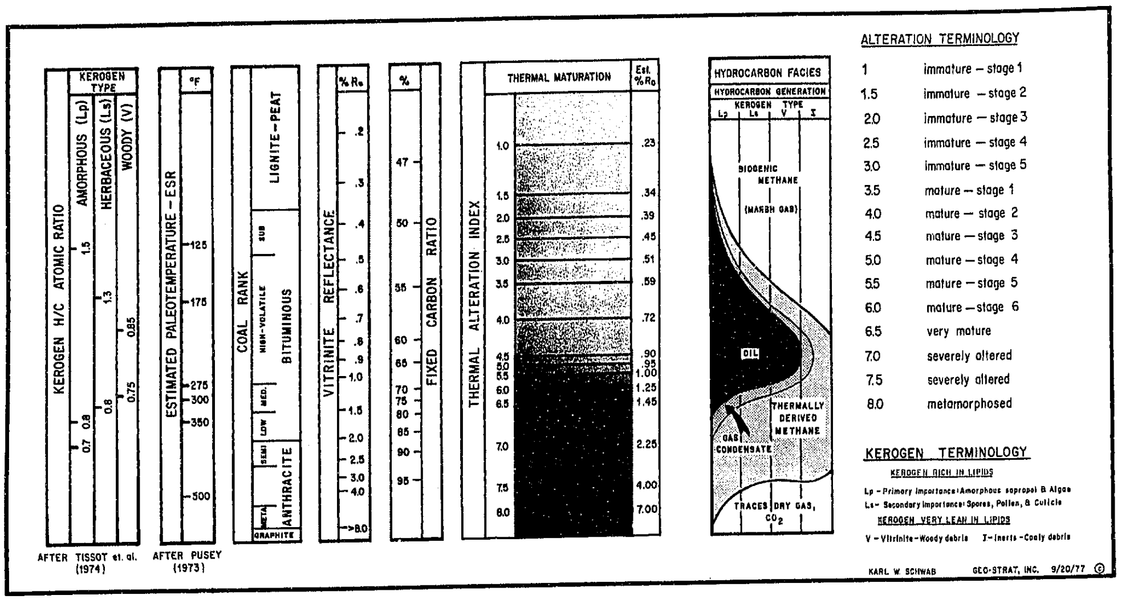
Waddell Sec. 5-1

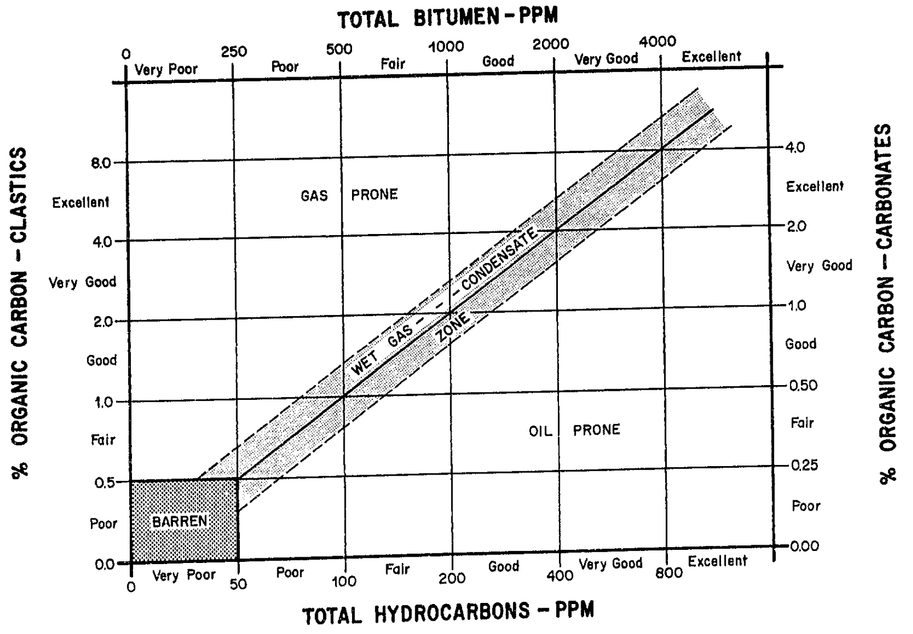
Text-Figure 4

COMPARISON OF GEOTHERMAL DIAGENETIC CRITERIA



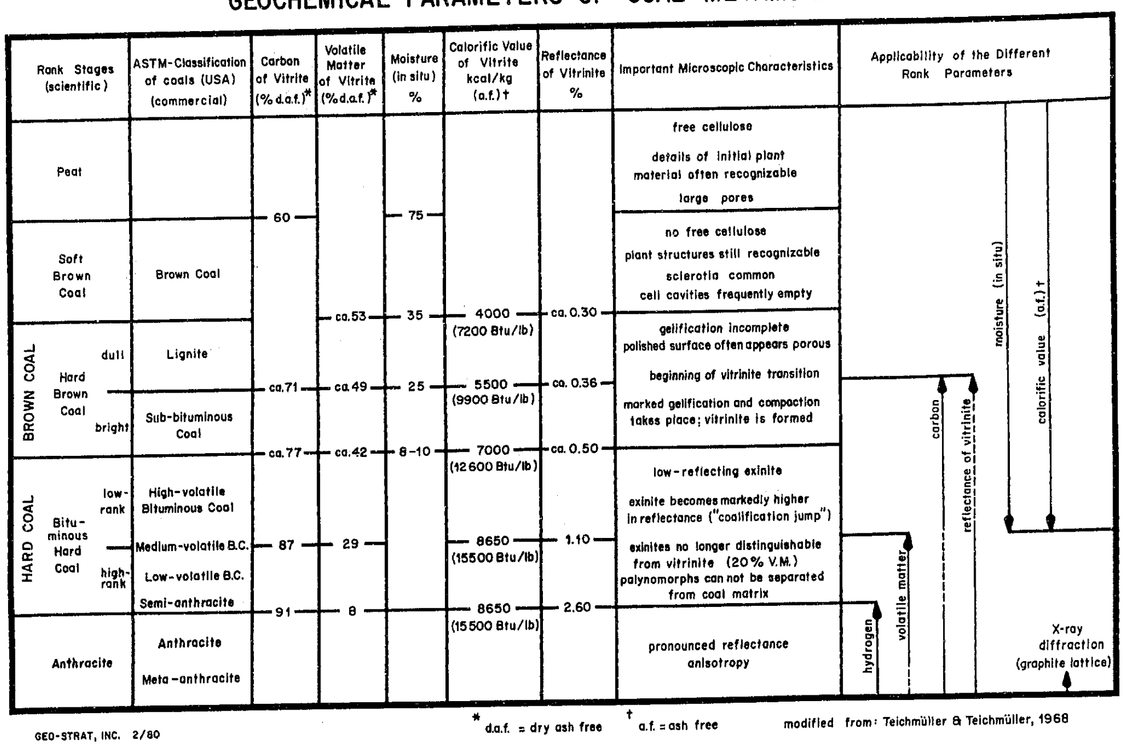
Text-Figure 5

SOURCE ROCK EVALUATION CHART



Text-Figure 6

GEOCHEMICAL PARAMETERS OF COAL METAMORPHISM



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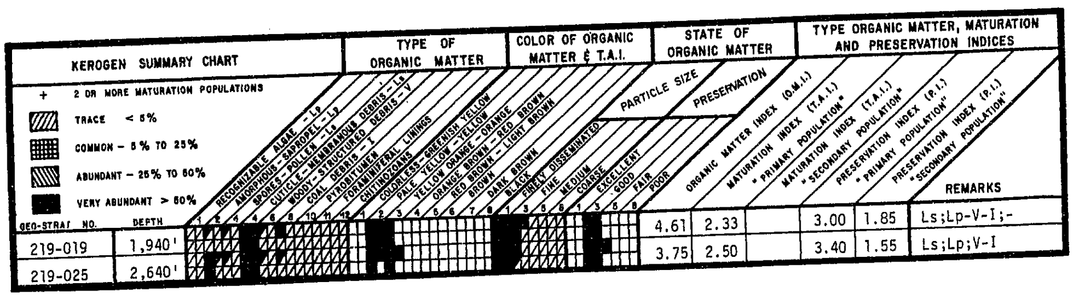
* d.a.f. = dry ash free † a.f. = ash free modified from: Teichmüller & Teichmüller, 1968

Text-Figure 7



SUMMARY OF ORGANIC MATTER TYPE: 219-019

½ block of amorphous debris	value	1.0
4½ blocks of spore-pollen and plant tissue	value	18.0
½ block of woody structured debris/vitrinite	value	3.0
1 block of coaly debris/inerts	value	8.0
TOTAL VALUE OF ALL BLOCKS	=	30.0

CALCULATED ORGANIC MATTER INDEX

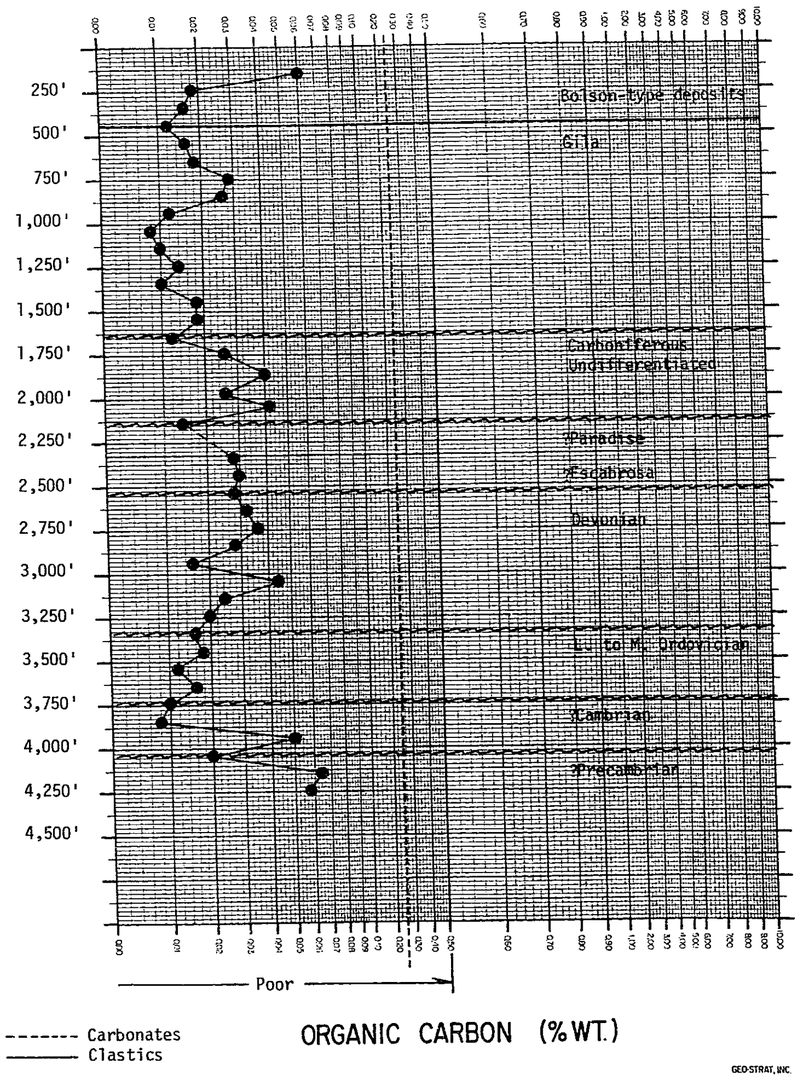
$$\frac{30.0}{\text{No. of Blocks}} \quad \frac{30.0}{6.5} = 4.61$$

SUMMARY OF PARTICLE SIZE: 219-025

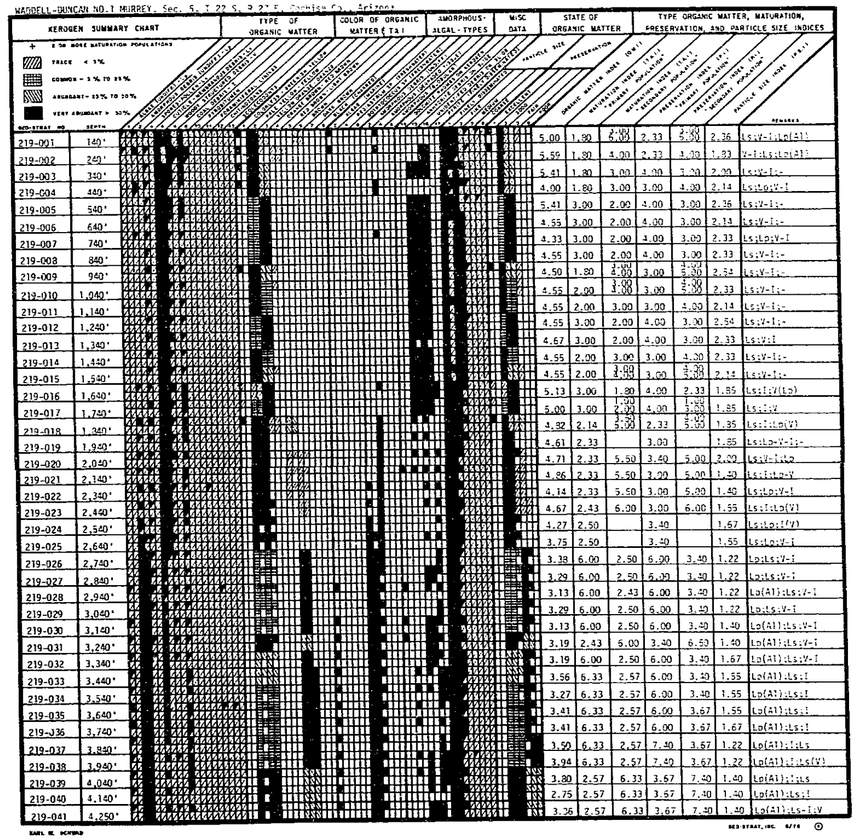
4 blocks of finely disseminated	value	4.0
1½ blocks of fine	value	4.5
TOTAL VALUE OF ALL BLOCKS	=	8.5

CALCULATED KEROGEN PARTICLE SIZE INDEX

$$\frac{8.5}{\text{No. of Blocks}} \quad \frac{8.5}{5.5} = 1.55$$



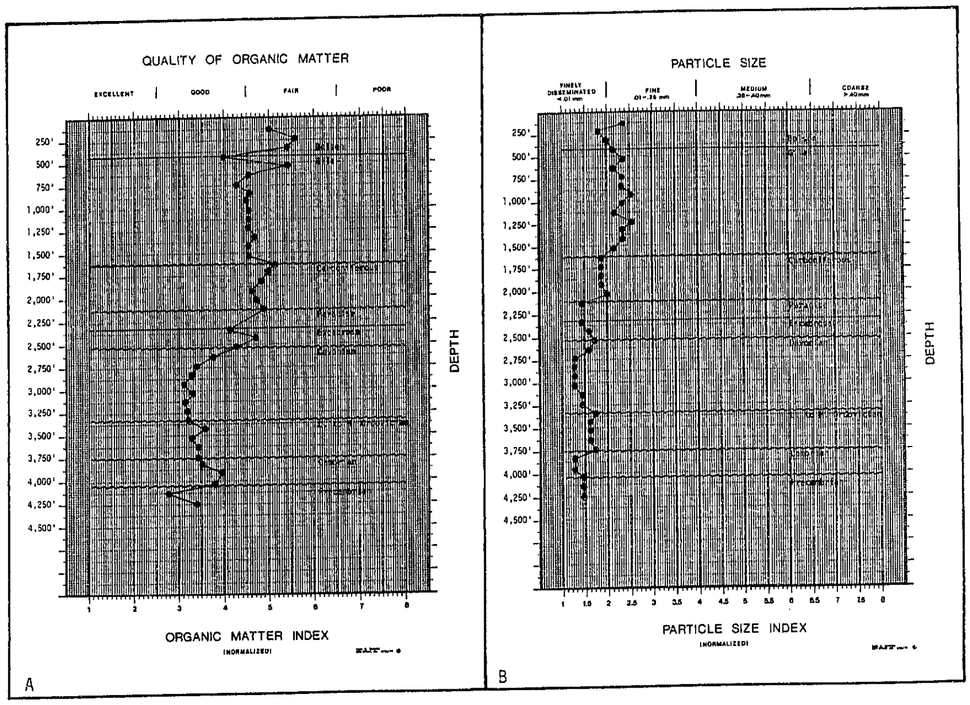
Text-Figure 8



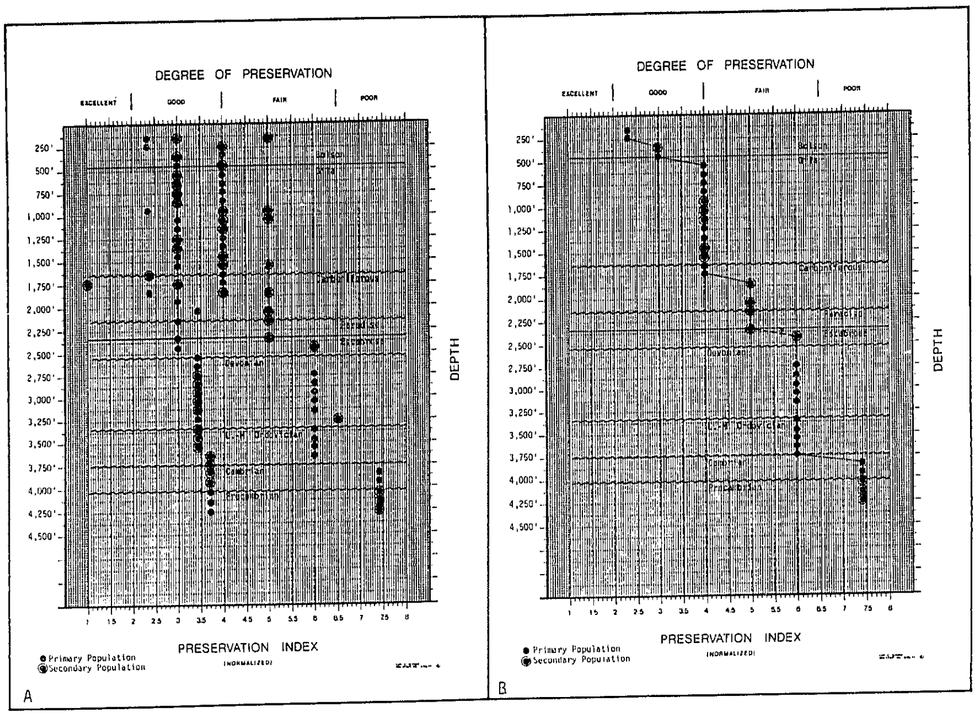
GEO-STRAT NO	DEPTH	OMI	TAI					REMARKS
219-001	140'	5.00	1.80	2.00 / 4.00	2.33	2.00 / 3.00	2.36	Ls;V-I;Lp(Al)
219-002	240'	5.59	1.80	4.00	2.33	4.00	1.33	V-I;Ls;Lp(Al)
219-003	340'	5.41	1.80	3.00	4.00	3.00	2.00	Ls;V-I;-
219-004	440'	4.00	1.80	3.00	3.00	4.00	2.14	Ls;Lp;V-I
219-005	540'	5.41	3.00	2.00	4.00	3.00	2.36	Ls;V-I;-
219-006	640'	4.55	3.00	2.00	4.00	3.00	2.14	Ls;V-I;-
219-007	740'	4.33	3.00	2.00	4.00	3.00	2.33	Ls;Lp;V-I
219-008	840'	4.55	3.00	2.00	4.00	3.00	2.33	Ls;V-I;-
219-009	940'	4.50	1.80	4.00 / 3.00	3.00	5.00 / 3.00	2.54	Ls;V-I;-
219-010	1,040'	4.55	2.00	3.00 / 4.00	3.00	5.00 / 3.00	2.33	Ls;V-I;-
219-011	1,140'	4.55	2.00	3.00	3.00	4.00	2.14	Ls;V-I;-
219-012	1,240'	4.55	3.00	2.00	4.00	3.00	2.54	Ls;V-I;-
219-013	1,340'	4.67	3.00	2.00	4.00	3.00	2.33	Ls;V;I
219-014	1,440'	4.55	2.00	3.00	3.00	4.00	2.33	Ls;V-I;-
219-015	1,540'	4.55	2.00	3.00 / 4.00	3.00	5.00 / 3.00	2.14	Ls;V-I;-
219-016	1,640'	5.13	3.00	1.80	4.00	2.33	1.85	Ls;I;V(Lp)
219-017	1,740'	5.00	3.00	1.00 / 2.00	4.00	1.00 / 3.00	1.85	Ls;I;V
219-018	1,840'	4.82	2.14	3.50 / 5.00	2.33	1.00 / 5.00	1.85	Ls;I;Lp(V)
219-019	1,940'	4.61	2.33		3.00		1.85	Ls;Lp-V-I;-
219-020	2,040'	4.71	2.33	5.50	3.40	5.00	2.00	Ls;V-I;Lp
219-021	2,140'	4.86	2.33	5.50	3.00	5.00	1.50	Ls;I;Lp-V
219-022	2,340'	4.14	2.33	5.50	3.00	5.00	1.40	Ls;Lp;V-I
219-023	2,440'	4.67	2.43	6.00	3.00	6.00	1.55	Ls;I;Lp(V)
219-024	2,540'	4.27	2.50		3.40		1.67	Ls;Lp;I(V)
219-025	2,640'	3.75	2.50		3.40		1.55	Ls;Lp;V-I
219-026	2,740'	3.38	6.00	2.50	6.00	3.40	1.22	Lp;Ls;V-I
219-027	2,840'	3.29	6.00	2.50	6.00	3.40	1.22	Lp;Ls;V-I
219-028	2,940'	3.13	6.00	2.43	6.00	3.40	1.22	Lp(Al);Ls;V-I
219-029	3,040'	3.29	6.00	2.50	6.00	3.40	1.22	Lp;Ls;V-I
219-030	3,140'	3.13	6.00	2.50	6.00	3.40	1.40	Lp(Al);Ls;V-I
219-031	3,240'	3.19	2.43	6.00	3.40	6.50	1.40	Lp(Al);Ls;V-I
219-032	3,340'	3.19	6.00	2.50	6.00	3.40	1.67	Lp(Al);Ls;V-I
219-033	3,440'	3.56	6.33	2.57	6.00	3.40	1.55	Lp(Al);Ls;I
219-034	3,540'	3.27	6.33	2.57	6.00	3.40	1.55	Lp(Al);Ls;I
219-035	3,640'	3.41	6.33	2.57	6.00	3.67	1.55	Lp(Al);Ls;I
219-036	3,740'	3.41	6.33	2.57	6.00	3.67	1.67	Lp(Al);Ls;I
219-037	3,840'	3.50	6.33	2.57	7.40	3.67	1.22	Lp(Al);I;Ls
219-038	3,940'	3.94	6.33	2.57	7.40	3.67	1.22	Lp(Al);I;Ls(V)
219-039	4,040'	3.80	2.57	6.33	3.67	7.40	1.40	Lp(Al);I;Ls
219-040	4,140'	2.75	2.57	6.33	3.67	7.40	1.40	Lp(Al);Ls;I
219-041	4,250'	3.36	2.57	6.33	3.67	7.40	1.40	Lp(Al);Ls-I;V

Text-Figure 9

Text-Figure 10

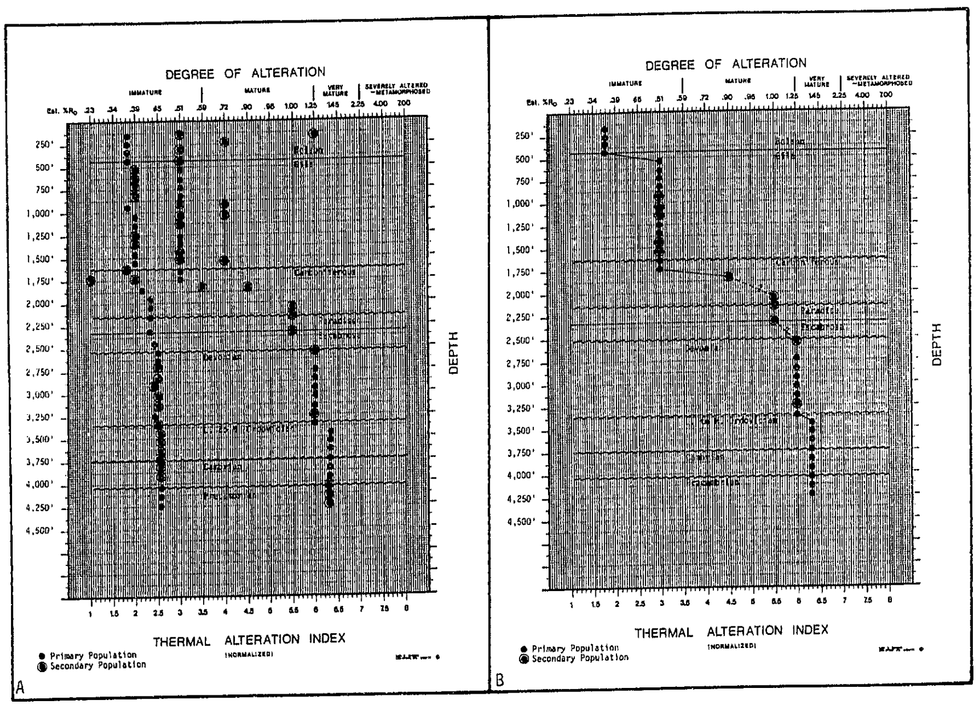


Text-Figure 11



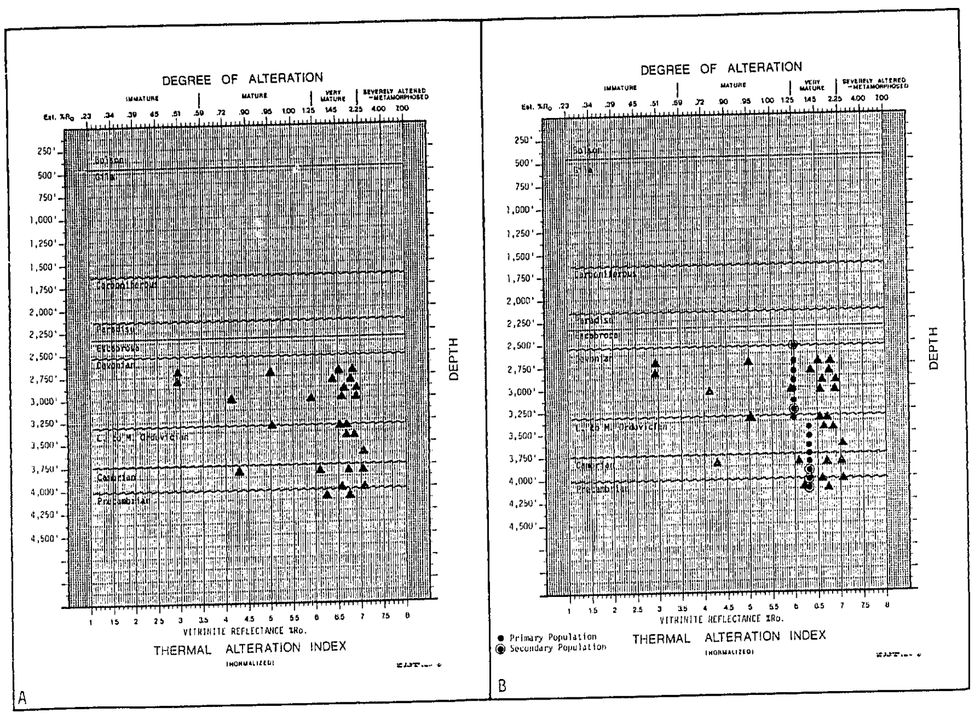
A - Total Populations
B - Populations considered to be in situ

Text-Figure 12

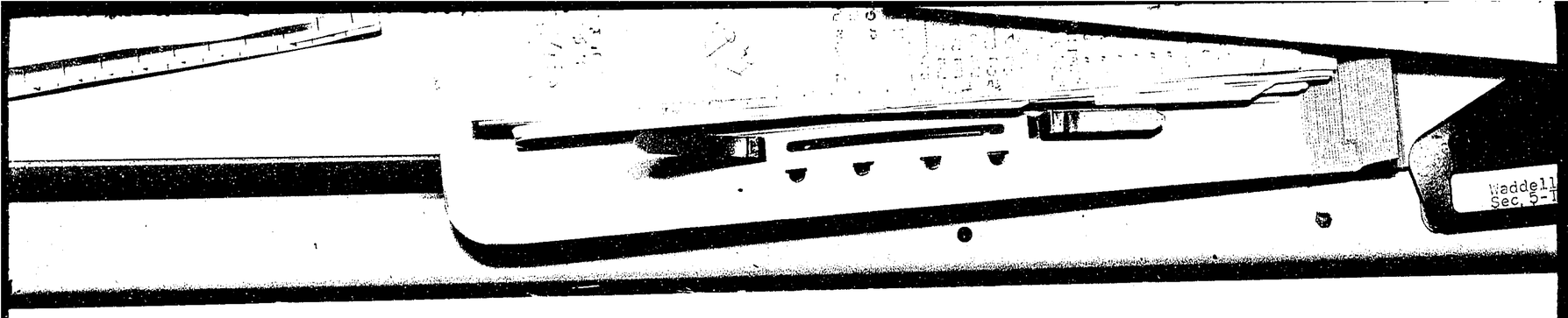


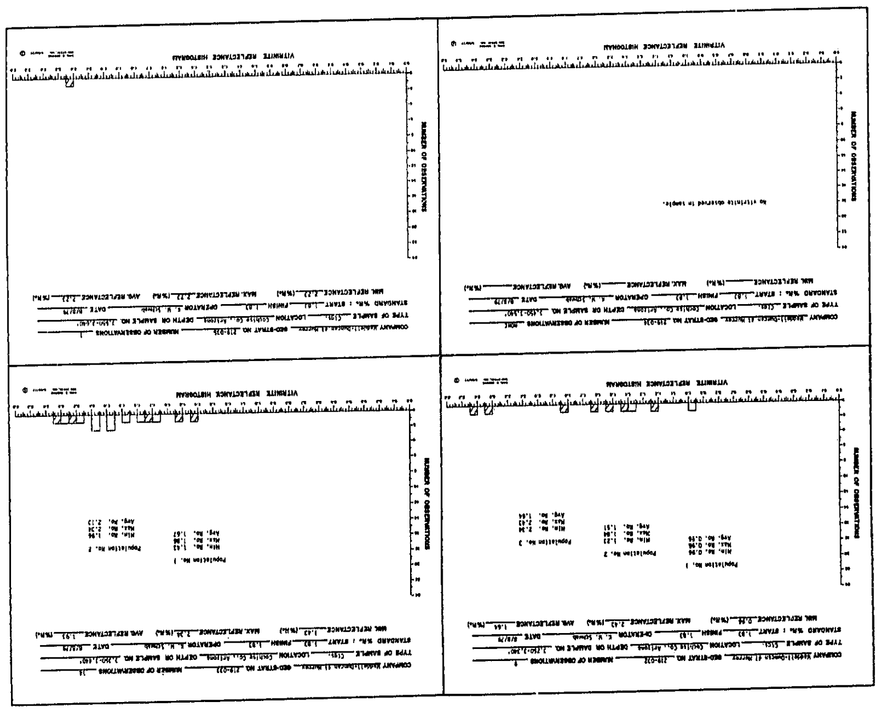
A - Total Populations
B - Populations considered to be in situ

Text-Figure 13

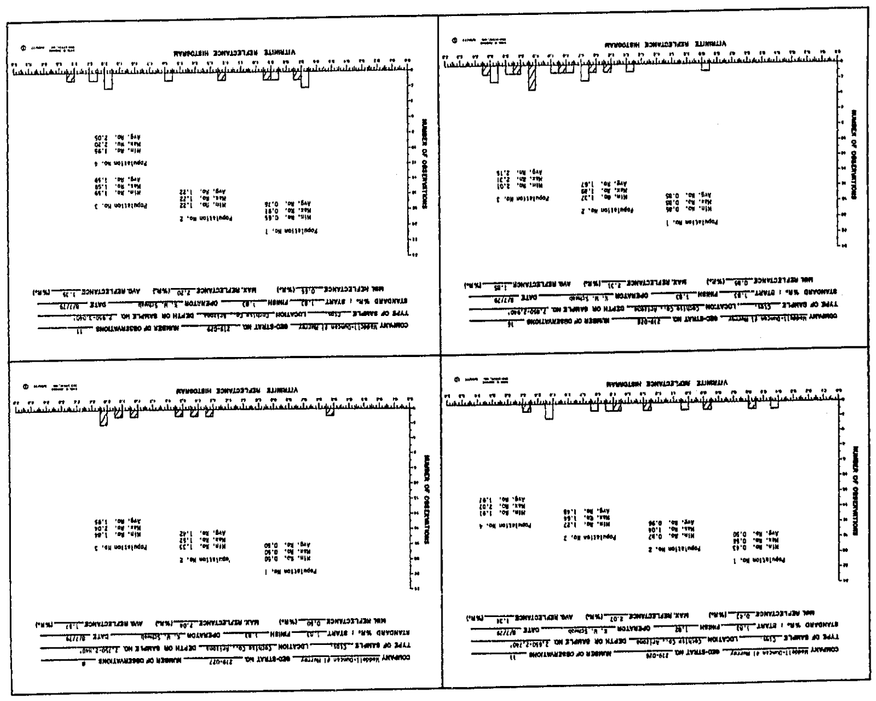


A - Total vitrinite populations
B - Comparison between vitrinite and kerogen values



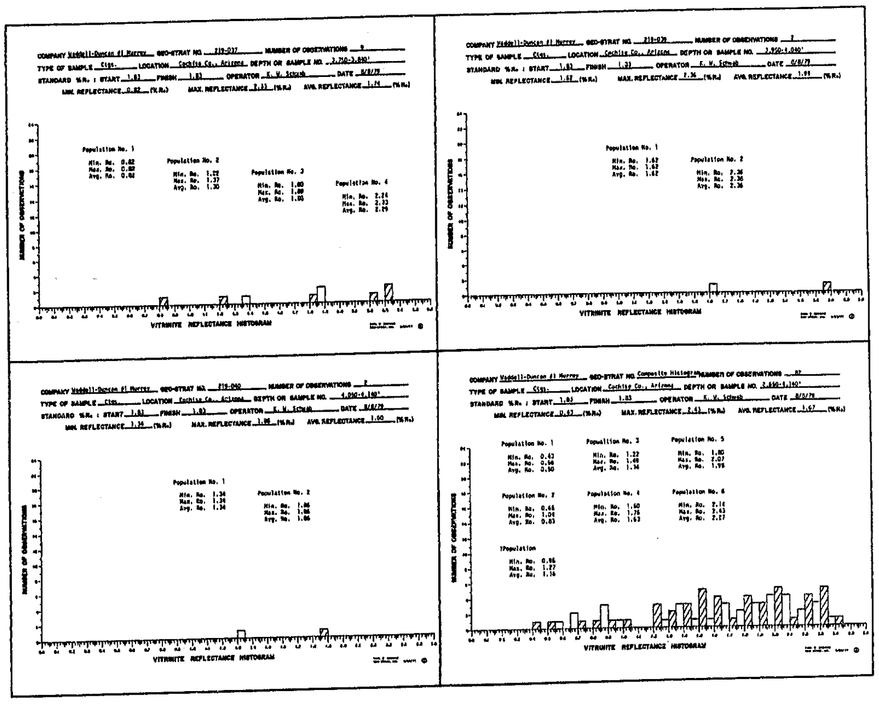


Text-Figure 15



Text-Figure 14

Text-Figure 16



TABLES

Table 1. Key exploration wells which have penetrated Paleozoic (or Precambrian) rocks in southeastern Arizona (Pima and Cochise counties).

	Name	Location	Elev.	Formation Tops (Ti = Tertiary intrusive rock)	Total Depth	Oil, Gas Shows	Completion Date
PIMA COUNTY:							
1.	Humble No. 1 St.(32) (strat.)	Sec. 5,T16S,R15E 2210'FSL, 2210'FWL	2886' KB	Surf.-Quat., 1143'-Tert. sed. rock (incl. evaporites), 6168'-Tert. vol. and sed. rock, 11,987'-fault-Precamb.(?) (Ti)	12,571' Precamb.(?)	None rept.	12-18-72
COCHISE COUNTY:							
2.	Duncan No. 2(1-X) St.	Sec. 33,T13S,R22E 1920'FSL, 960'FEL	4965' DF	Surf.-Quat., 520'(?)-Tert. sed. rock, 2160'-Tert.(?) vol. and sed. rock, 5220'-Precamb.(?)	5310' Precamb.(?)	None rept.	12-20-60
3.	Bomak No. 1 St.	Sec. 22,T14S,R21E 1665'FNL, 2262'FWL	4765' GL	Surf.-Escabrosa	200' Escabrosa	None rept.	10-15-60
4.	Moncrief No. 1 St.	Sec. 17,T21S,R23E 770'FSL, 550'FEL	4755' GL	Surf.-Colina, 592'-Earp, 1216'-Horquilla, 2440'-Escabrosa(?)	2446' Escabrosa(?)	Gas: 1600'-1640' 1840'-1884'	2-7-63
5.	Fraser No. 1 St	Sec. 19,T21S,R23E 2010'FSL, 1120'FEL	4479' KB	Surf.-Quat., 50'-Colina, 410' Earp, 1230'-Horquilla	1903' Horquilla	Gas, Oil: 1409'-1449'	10-30-68
6.	Moncrief No. 1 Davis-Clark	Sec. 5,T21S,R24E 2710'FNL, 2310'FEL	4594' KB	Surf.-Quat., above 300'-Morita, 1135'-Horquilla(?), 2480'-Escabrosa, 3026'-Martin, 3335'-Abrigo(?)	3525' Abrigo(?)	Oil: 1950'-1970'	2-7-63
7.	Southwest No. I Davis-Clark	Sec. 5,T21S,R24E 884'FNL, 660'FEL	4595' GL	Surf.-Quat., 200'-Morita, 1150'-Earp, 1575'-Horquilla, 2670'-Escabrosa, 3290'-Martin	3570' Martin	Oil: 2570'-2590'	10-17-67
8.	Waddell-Duncan No. 1 Murrey	Sec. 5,T22S,R27E 1980'FNL, 1980'FWL	4238' KB	Surf.-Quat., 515'-Gila, Tert. vol. rocks, 1755'-fault(?)-lower Horquilla (Atoka), 2245'-Paradise(?), 2305'-Escabrosa (Ti), 2570'-Martin (Ti), 2885'-Abrigo, 3525'-Bolsa, 3995'-Precamb.	4400' Precamb.	Oil: 1950'-1960', 2980'-2990' 3345'-3350'	5-16-52
9.	Ari-Tex No. 1 Goins	Sec. 4,T24S,R23E NW¼NW¼	4480' GL	Surf.-Quat., above 1005'-Permian(?)	1005' Perm.(?)	None rept.	5- -45
10.	Thomson No. 2 St.	Sec. 2,T24S,R31E 630'FNL, 530'FEL	4186' KB	Surf.-Quat., above 458'-Permian(?) (Epitaph-Colina?)	802' Perm.	Gas: 458'	12-28-61
11.	Guadalupe No. 1 St.	Sec. 2,T24S,R31E 2200'FSL, 2500'FWL	4363' KB	Surf.-Colina, 100'-Earp, 1296' (no spls.)-Horquilla, 2760'-Paradise(?), 2840'-Escabrosa, 4260'-Dev. (Pedregosa), 4555'-Montoya(?), 4712'-Abrigo, 5545'-Bolsa	5679' Bolsa	None	12-26-71

GEO-STRAT, INC., 3/80

Table 2

WADDELL-DUNCAN NO. 1 MURREY
Sec. 5, T 22 S, R 27 E, Cochise Co., Arizona

Geo-Strat Job No.	Depth	TOC (%WT)
219-001	50-140'	0.060
219-002	150-240'	0.018
219-003	240-340'	0.016
219-004	350-440'	0.012
219-005	450-540'	0.016
219-006	550-640'	0.018
219-007	650-740'	0.028
219-008	750-840'	0.026
219-009	850-940'	0.012
219-010	950-1040'	0.008
219-011	1050-1140'	0.010
219-012	1150-1240'	0.014
219-013	1250-1340'	0.010
219-014	1350-1440'	0.018
219-015	1450-1540'	0.018
219-016	1550-1640'	0.012
219-017	1650-1740'	0.026
219-018	1750-1840'	0.040
219-019	1850-1940'	0.026
219-020	1950-2040'	0.042
219-021	2050-2140'	0.014
219-022	2250-2340'	0.028
219-023	2350-2440'	0.030
219-024	2450-2540'	0.028
219-025	2550-2640'	0.032
219-026	2650-2740'	0.036
219-027	2750-2840'	0.028
219-028	2850-2940'	0.016
219-029	2950-3040'	0.044
219-030	3050-3140'	0.024
219-031	3150-3240'	0.020
219-032	3250-3340'	0.016
219-033	3350-3440'	0.018
219-034	3450-3540'	0.012
219-035	3550-3640'	0.016
219-036	3650-3740'	0.010
219-037	3750-3840'	0.008
219-038	3850-3940'	0.048
219-039	3950-4040'	0.020
219-040	4050-4140'	0.064
219-041	4150-4250'	0.058

TABLE 3 A COMPARISON OF METHODS USED IN SOURCE-ROCK CHARACTERIZATION

METHOD OF ANALYSIS		Abundance "Quantity" of organic matter	Quality of organic matter = type	Maturation of organic matter (T.A.I.)	Correlation between source-rock and petroleum
CLASS	TYPE				
Chemical (on rock)	Organic carbon	●			
Optical microscopy	Transmitted light (Palynofacies, alteration)	•	●	●	
	Reflected light		•	●	
	Fluorescent light		●	●	●
Pyrolysis (on rock)	Rock-Eval	●	●	●	
	C_R/C_T, etc....		•	•	
Physiochemical (on kerogen)	Elemental analysis		●	●	
	Infrared spectroscopy Thermal analysis (TGA) Electron microdiffraction		•	•	
	ESR		•	•	
	Carbon isotopes		•		•
Chemical (on bitumen and/or crude oil)	Amount of HC			●	
	Light HC			●	•
	n-Alkanes		•	●	•
	Isoprenoids		•	•	•
	Steroids, terpenes		•	•	●
	Porphyrins, metals			•	●
Physical (on bitumen, oil, or gas)	Carbon isotopes		●	●	●

Reliability: ● Good to excellent ● Fairly good • Poor

Geo-Strat, Inc. 7/80
Modified from Tissot and Welte, 1978

Table 4

COMPARISON OF THERMAL ALTERATION INDICES

(APPROXIMATE)

STAPLIN'S STANDARD	GEO-STRAT, INC.	GEOCHEM LABORATORIES	VITRINITE REFLECTANCE $\%R_o$
	1.00	1	0.23
	1.50	1+	0.34
1.0	2.00	1+ TO 2-	0.39
1.5	2.50	2-	0.45
2.3	3.00	2- TO 2	0.51
	3.50	2	0.59
2.6	4.00	2 TO 2+	0.72
	4.50	2+	0.90
3.0	5.00	2+ TO 3-	0.95
3.3	5.50	3-	1.00
3.8	6.00	3- TO 3	1.25
	6.50	3 TO 3+	1.45
3.8-3.9	7.00	3+ TO 4	2.25
4.5	7.50	4 TO 4+	3.00-4.00
4.8	8.00	4+ TO 5	5.00-7.00

GEO-STRAT, INC. 3/80

Table 5

VITRINITE SUMMARY CHART

Job Number	Depth/Sample No.	Total Cts.	Min. Reflectance	Max. Reflectance	Avg. Reflectance
219-026	2,650-2,740'	11	0.43	2.07	1.34
Population No. 1		2	0.43	0.56	0.50
Population No. 2		2	0.87	1.04	0.96
Population No. 3		4	1.27	1.64	1.28
Population No. 4		3	1.91	2.07	1.97
219-027	2,750-2,840'	8	0.50	2.04	1.57
Population No. 1		1	0.50	0.50	0.50
Population No. 2		3	1.33	1.52	1.42
Population No. 3		3	1.84	2.04	1.95
219-028	2,850-2,940'	17	0.85	2.31	1.85
Population No. 1		1	0.85	0.85	0.85
Population No. 2		8	1.37	1.89	1.67
Population No. 3		8	2.01	2.31	2.15
219-029	2,950-3,040'	11	0.65	2.20	1.35
Population No. 1		5	0.65	0.91	0.76
Population No. 2		1	1.22	1.22	1.22
Population No. 3		1	1.59	1.59	1.59
Population No. 4		4	1.95	2.20	2.05

Table 5

VITRINITE SUMMARY CHART

Job Number	Depth/Sample No.	Total Cts.	Min. Reflectance	Max. Reflectance	Avg. Reflectance
219-032	3,250-3,340'	9	0.96	2.43	1.64
Population No. 1		1	0.96	0.96	0.96
Population No. 2		6	1.23	1.84	1.51
Population No. 3		2	2.34	2.43	1.64
219-033	3,350-3,440'	14	1.43	2.34	1.93
Population No. 1		6	1.43	1.86	1.67
Population No. 2		8	1.96	2.34	2.13
219-034	3,450-3,540'		No Vitrinite Observed In Sample		
219-035	3,550-3,640'	1	2.23	2.23	2.23
219-037	3,750-3,840'	9	0.82	2.33	1.74
Population No. 1		1	0.82	0.82	0.82
Population No. 2		2	1.22	1.37	1.30
Population No. 3		3	1.80	1.89	1.85
Population No. 4		3	2.24	2.33	2.29
219-039	3,950-4,040'	2	1.62	2.36	1.99
Population No. 1		1	1.62	1.62	1.62
Population No. 2		1	2.36	2.36	2.36
219-040	4,050-4,140'	2	1.34	1.86	1.60
Population No. 1		1	1.34	1.34	1.34
Population No. 2		1	1.86	1.86	1.86

Table 5

VITRINITE SUMMARY CHART

Job Number	Depth/Sample No.	Total Cts.	Min. Reflectance	Max. Reflectance	Avg. Reflectance
219-026 to 040	"Composite Histogram"	82	0.43	2.43	1.67
Population No. 1		3	0.43	0.56	0.50
Population No. 2		10	0.65	1.04	0.83
Population No. 3		13	1.22	1.49	1.34
Population No. 4		16	1.50	1.76	1.63
Population No. 5		23	1.80	2.07	1.95
Population No. 6		17	2.14	2.43	2.27

NOTE: The above plugs were prepared from kerogen residues.

Table 6

SUMMARY OF GEOCHEMICAL PARAMETERS

GEOLOGIC AGE AND/OR FORMATION		DEPTH INTERVAL	AVG. O.M.I.*	AVG. P.S.I.*	AVG. T.A.I.*	AVG. P.I.*	AVG. % Ro†	AVG. %TOC	EST. PALEO-TEMP. °F	SOURCE ROCK CAPABILITIES
QUATERNARY-UNDIFF.		0 - 440'	5.00	2.08	1.80	2.67	?	0.027	100°	POOR
TERTIARY-UNDIFF.		450'-1,640'	4.65	2.28	3.00	4.00	0.51	0.017	130°	POOR
CARBONIFEROUS-UNDIFF.		1,650'-2,140'	4.80	1.70	5.00	4.50	0.78	0.027	200°	POOR
MISS.	? PARADISE	2,150'-2,340'	4.14	1.40	5.75	5.50	1.16	0.028	275°	POOR
	? ESCABROSA	2,350'-2,540'	4.47	1.61	5.75	5.50	1.16	0.029	275°	POOR
DEVONIAN-UNDIFF.		2,550'-3,340'	3.23	1.34	6.00	6.00	1.63	0.027	350°	POOR
L.-M. ORDOVICIAN		3,350'-3,740'	3.41	1.58	6.33	6.00	1.95	0.014	365°	POOR
? CAMBRIAN-UNDIFF.		3,750'-4,040'	3.75	1.28	6.33	7.40	1.95	0.021	365°	POOR
? PRECAMBRIAN "c"		4,050'-4,250'	"3.06"	"1.40"	"6.33"	"7.40"	"2.27"	"0.047"	"400°"	NONE

Geo-Strat, Inc. 3/80 ©

† Average % Ro values based on individual histograms or composite histogram.
"c" Kerogen values and total organic carbon content considered to be contamination due to cave.
* Considered to be in situ.
Estimated paleotemperature based on work by Pusey (1973)

Table 7

ESTIMATED DEPTHS OF BURIAL FOR SEDIMENTS IN THE WADDELL-DUNCAN NO. I MURREY WELL

FORMATION	DEPTH	GRADIENT*			
		0.6°F/100'	1.2°F/100'	1.6°F/100'	2.0°F/100'
Quaternary Undiff.	0-440'	4,166'	2,083'	1,562'	1,250'
Tertiary Undiff.	450-1,640'	9,166'	4,583'	3,437'	2,750'
Carboniferous Undiff.	1,650-2,140'	20,833'	10,416'	7,812'	6,250'
Mississippian	2,150-2,540'				
? Paradise	2,150-2,340'	33,333'	16,666'	12,500'	10,000'
? Escabrosa	2,350-2,540'	33,333'	16,666'	12,500'	10,000'
Devonian Undiff.	2,550-3,340'	45,833'	22,916'	17,187'	13,750'
L. to M. Ordovician	3,350-3,740'	48,333'	24,166'	18,125'	14,500'
?Cambrian Undiff.	3,750-4,040'	48,333'	24,166'	18,125'	14,500'
?Precambrian	4,050-4,250'	54,166'	27,038'	20,312'	16,250'

*Based on a surface temperature of 75° F and no temperature increase due to tectonic activity.

PLATES

PLATE 1

Figure 1. Specimen of Hystrichosphaeridium (Oligosphaeridium) sp. cf. H. complex. Overall diameter, 85.0 microns. Length of processes, 20.0 to 24.0 microns; central body, 37.0 microns. Phase contrast illumination. Sample 219-001, 16.4 x 122.0.

Figure 2. Unidentified dinoflagellate. Greatest length, 76.0 microns. Length of processes, 9.0 microns; central body area, approximately 50.0 microns. Phase contrast illumination. Sample 219-001, 17.4 x 107.1.

Figure 3. Unidentified dinoflagellate. Greatest length, 60.8 microns. Length of processes, 19 microns. 3a, bright field illumination; 3b, phase contrast illumination. Sample 219-001, 19.6 x 136.0.

Figure 4. Ambrosia sp. Specimen is 19.0 microns in diameter. Phase contrast illumination. Sample 219-001.

Figure 5. Cicatricosisporites dorogensis. Specimen is 47.5 microns in greatest length. 5a, bright field illumination; 5b, phase contrast illumination. Sample 219-001, 10.1 x 120.4.

Figure 6. Foraminiferal lining. Greatest length, 43.7 microns. 6a, bright field illumination; 6b, phase contrast illumination. Sample 219-022, 8.6 x 132.7.

Figure 7. Unidentified algal cyst. Greatest diameter, 76.0 microns. 7a, bright field illumination; 7b, phase contrast illumination. Sample 219-023, 7.7 x 121.9.

PLATE 1

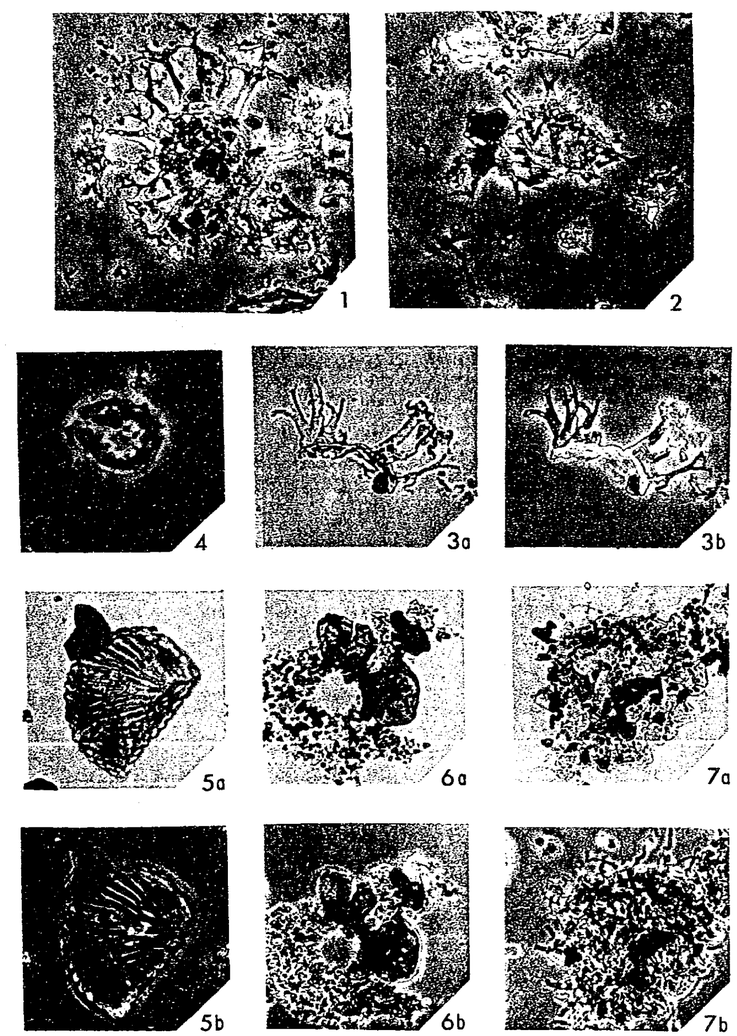


PLATE 2

Figure 1. Unidentified pollen. Greatest diameter, 20.9 microns. 1a,c, bright field illumination; 1b,d, phase contrast illumination. Sample 219-001, 8.7 x 112.8.

Figure 2. Chenopodiaceae-Amaranthaceae. Maximum diameter, 24.7 microns. Phase contrast illumination. Sample 219-016, 15.8 x 116.1.

Figure 3. Chenopodiaceae-Amaranthaceae. Maximum diameter, 28.5 microns. Phase contrast illumination. Sample 219-016, 16.9 x 135.1.

Figure 4. Unidentified tricolporate pollen. Maximum length, 24.7 microns. 4a, bright field illumination; 4b, phase contrast illumination. Sample 219-017, 20.3 x 131.5.

Figure 5. Unidentified dinoflagellate. Greatest diameter, 81.7 microns. Length of processes, 14.0 to 26.0 microns. Phase contrast illumination. Sample 219-002, 22.7 x 110.6.

Figure 6. Chenopodiaceae-Amaranthaceae. Maximum diameter, 24.7 microns. 6a, bright field illumination; 6b, phase contrast illumination. Sample 219-015, 2.9 x 137.8.

Figure 7. Unidentified palynomorph. Maximum length, 72.5 microns. Bright field illumination. Sample 219-020, 5.9 x 104.7.

Figure 8. <u>Baltisphaeridium</u> sp. (reworked from Paleozoic sediments). Overall diameter, 21.0 microns. Processes 7.5 microns, central body, 13.5 microns. Bright field illumination. Sample 219-002, 13.5 x 115.9.

PLATE 2

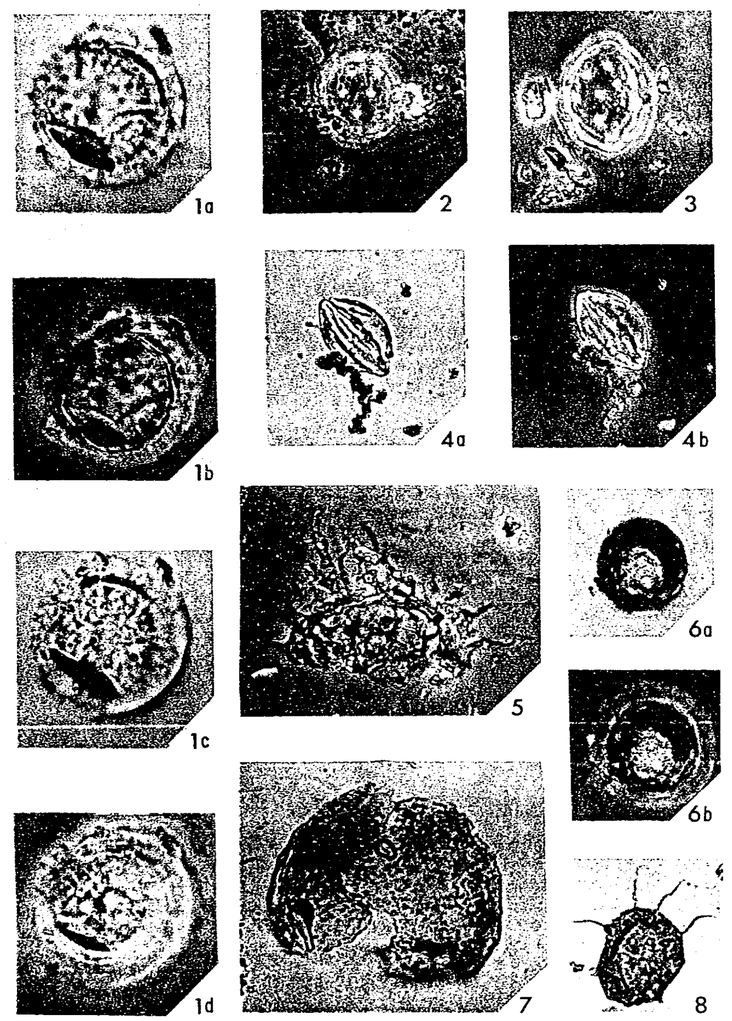


PLATE 3

Figure 1. Deflandrea sp. Maximum length, 40.0 microns. Phase contrast illumination. Sample 219-001, 14.7 x 135.1.

Figure 2. Lycopodiumsporites sp. Greatest diameter, 38.0 microns. Bright field illumination. Sample 219-018, 17.6 x 110.2.

Figure 3. Unidentified spore. Greatest diameter, 64.6 microns. Bright field illumination, Sample 219-020. 12.7 x 115.4.

Figure 4. Pityosporites sp. Greatest length, 47.5 microns. Bright field illumination. Sample 219-022, 5.1 x 114.5.

Figure 5. Stephanocolpate pollen. Maximum diameter, 38.0 microns. Depth of colpi, 13.3 microns. 5a, bright field illumination; 5b, phase contrast illumination. Sample 219-030, 8.0 x 108.0.

Figure 6. Pityosporites sp. Greatest length, 53.5 microns. Bright field illumination. Sample 219-022, 17.3 x 133.0.

Figure 7. Chenopodiaceae-Amaranthaceae. Maximum diameter, 17.0 microns. Phase contrast illumination. Sample 219-002, 10.0 x 123.9.

Figure 8. Pityosporites sp. Maximum length, 68.4 microns. Bright field illumination. Sample 219-024, 6.6 x 134.9.

Figure 9. Pityosporites sp. (Reworked from U. Paleozoic). Maximum length, 74.0 microns. 9a, bright field illumination; 9b, phase contrast illumination. Sample 219-022, 9.1 x 113.1.

Figure 10. Pityosporites sp. Maximum diameter, 43.7 microns. Bright field illumination. Sample 219-024, 3.7 x 122.8.

PLATE 3

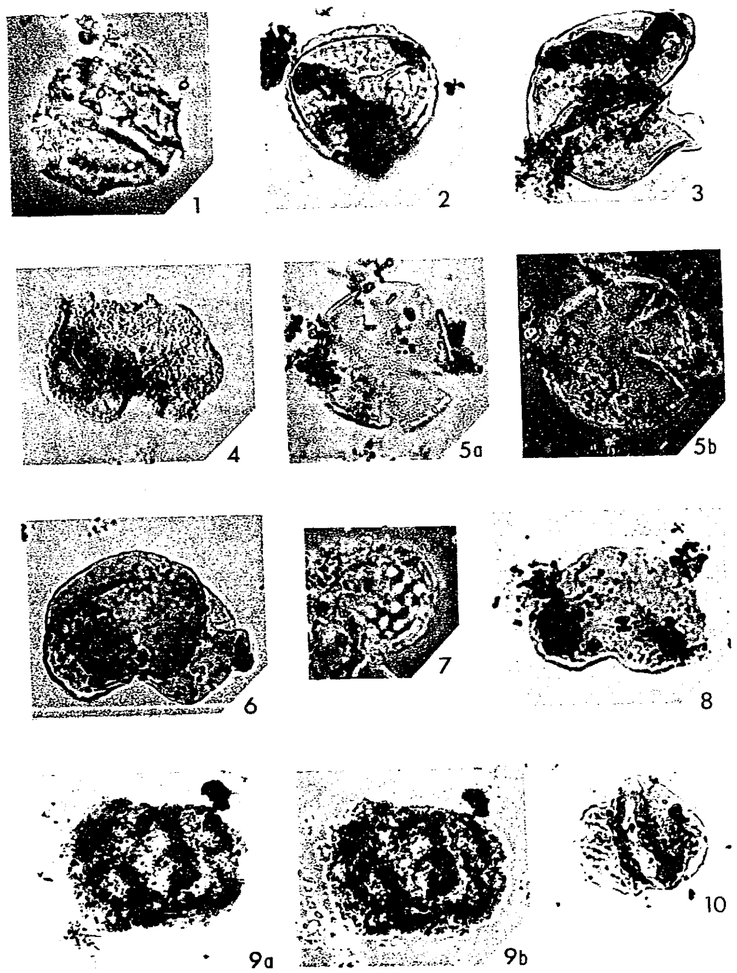


PLATE 4

Figure 1. Unidentified spore (?algal) surrounded by amorphous-algal debris. Diameter of spore, 28.5 microns. Bright field illumination. Sample 219-028, 15.7 x 128.9.

Figure 2. ?Chitinozoan fragment. Maximum length, 57.0 microns. Bright field illumination. Sample 219-028, 16.4 x 128.8.

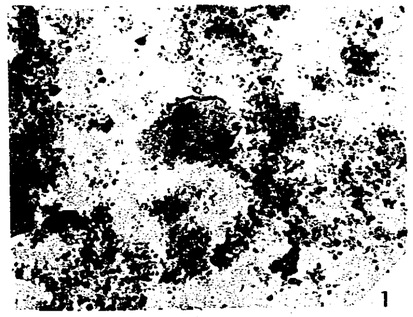
Figure 3. ?Desmochitina sp. (?Chitinozoan fragment). Maximum length, 27.9 microns. Bright-field illumination. Sample 219-035, 7.8 x 123.5.

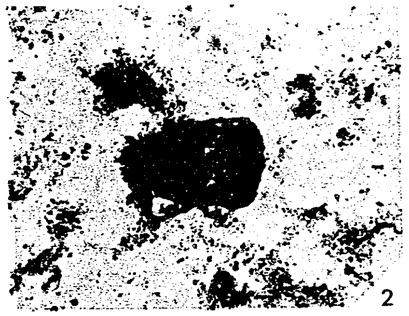
Figure 4. Baltisphaeridium sp. Overall diameter, 30.4 microns. Length of processes, approximately 5.4 microns. Central body, 19.0 microns. Bright field illumination. Sample 219-028, 6.7 x 132.0.

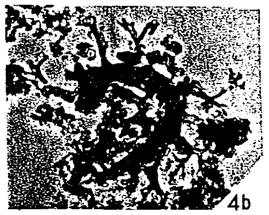
Figure 5. Leiosphere. Maximum diameter, 39.9 microns. Bright field illumination. Sample 219-028, 17.6 x 128.6.

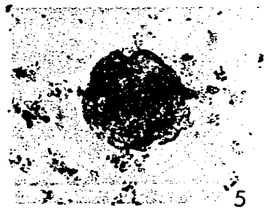
Figure 6. Micrhystridium sp. Maximum diameter, 19.0 microns. Bright field illumination. Sample 219-035, 18.3 x 123.6.

PLATE 4









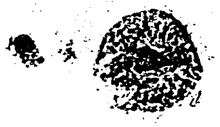


PLATE 5

Figure 1. Scolecodont. Maximum length, 104.5 microns. Bright field illumination. Slide 219-035, 13.6 x 121.5.

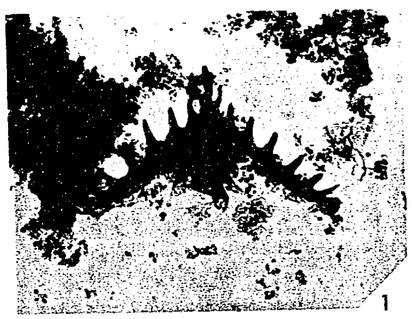
Figure 2. Leiosphere. Maximum diameter, 38.0 microns. Bright field illumination. Sample 219-033, 11.1 x 113.4.

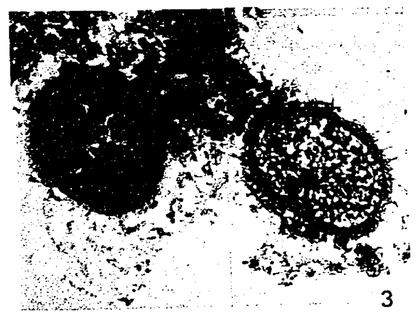
Figure 3. Unidentified acritarchs, possibly Micrhystridium sp. Maximum diameter of each specimen is 26.6 microns. Phase contrast illumination. Sample 219-033, 10.0 x 107.4.

Figure 4. Aff. Micrhystridium sp. Maximum diameter, 20.9 microns. 4a, bright field illumination; 4b, phase contrast illumination. Sample 219-035, 12.5 x 119.2.

Figure 5. Micrhystridium sp. Maximum diameter, 17.1 microns. 5a, bright field illumination; 5b, phase contrast illumination. Sample 219-035, 18.2 x 117.0.

PLATE 5





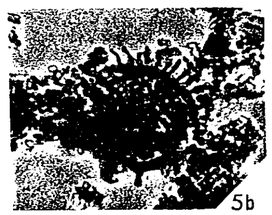


PLATE 6

Figure 1. Aff. Micrhystridium sp. Maximum diameter, 20.9 microns. 1a, bright field illumination; 1b, phase contrast illumination. Sample 219-032, 20.1 x 130.6.

Figure 2. Unidentified acritarch. Maximum diameter, 16.0 microns. Bright field illumination. Sample 219-035.

Figure 3. Aff. Micrhystridium sp. Maximum diameter, 19.0 microns. Bright field illumination. Sample 219-035.

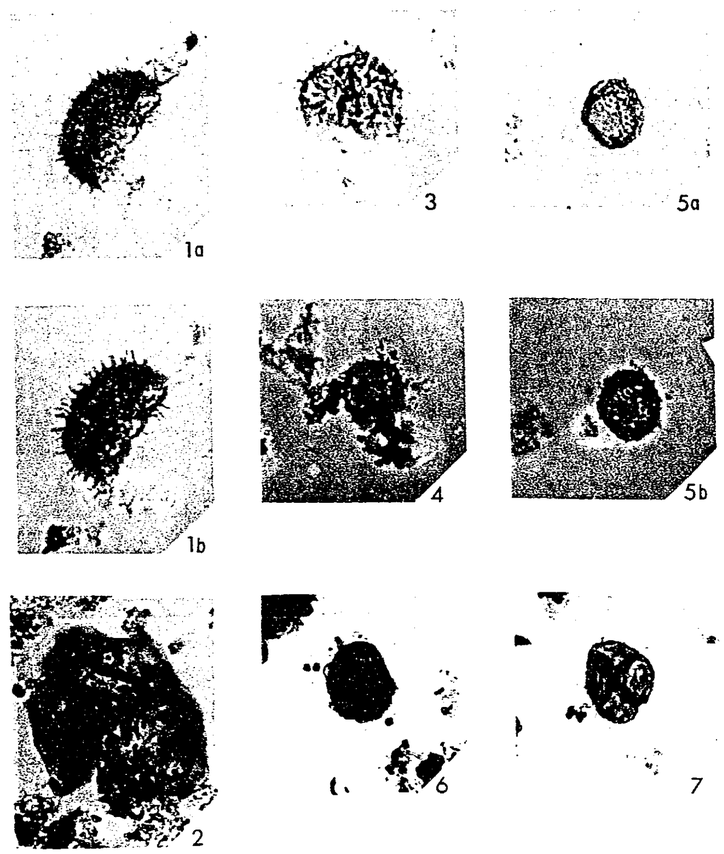
Figure 4. Micrhystridium sp. Maximum diameter, 11.4 microns. Phase contrast illumination. Sample 219-036, 11.7 x 127.9.

Figure 5. Micrhystridium sp. Maximum diameter, 11.4 microns. 5a, bright field illumination; 5b, phase contrast illumination. Sample 219-035, 12.6 x 117.4.

Figure 6. Algal tetraspore. Maximum diameter, 13.3 microns. Sample 219-035, 12.0 x 120.2.

Figure 7. Algal tetraspore. Maximum diameter, 13.3 microns. Sample 219-035, 12.3 x 119.3.

PLATE 6



#2-24

Waddell + Duncan #1 Murray

BIT RECORD

Form No. B R 1

BIT RECORD

Form BE-1

Graph No. _____ Started Under Surface [illegible] State Arizona

Spudded in [illegible] Set Sand String [illegible] County Apache Field

Company [illegible] Lease [illegible] Well No. 1 Sec. 5 T. 22S R. 27E

Contractor _____ Tool Pusher _____ Driller _____ Driller _____ Driller _____

Trip No.	Make of Bit	Size	Run No.	Type of Cone	Serial No. of Bit	DEPTH From	DEPTH To	Footage	Hrs. Run	Points Wgt.	Pump Press.	Rotary R.P.M.	Time Lost	REMARKS
1	Hughes	[illegible]	1	OWS	[illegible]	0	600	600	32	5	3 H.	90		
2	"	[illegible]	2	OWS	14016	600	[illegible]	[illegible]	28	6	3 Bl.	90		
3	"	[illegible]	3	OWS	[illegible]	1000	1300	300	—	6-8	3,200	90		
4	"	[illegible]	[illegible]	DSC-1	48338	1300	1775	475	—	8	400	90		
5	"	9 7/8	5	OWS	[illegible]	1775	1775	10	—	6	400	90		Ream
6	"	9 7/8	5	OWS	22528	[illegible]	1890	105	—	6	375	90		[illegible]
7	"	9 7/8	6	DSC-1	32057	1890	2005	115	—	5	375	90		
8	"	9 7/8	7	OWS	36754	2005	2147	142	—	8	375	90		
9	Hughes	9 7/8	7	OWS	22528	2147	2167	20	—	8	375	90		
10	Hughes	9 7/8	8	OWS	33590	2167	2185	18		9	375	90		
11	[illegible]	9 7/8	9	OWS	51059	2185	2211	26	—	8	350	90		
12	"	9 7/8	10	OWS	26854	2211	2231	20	—	8	350	90		
13	Reliance	9 7/8	10	OWS	26754	2231	2249	18	—	9	350	90		
14	Hughes	9 7/8	11	W7R	11365	2249	2360	111	—	10	350	90		
15	"	9 7/8	12	W7R	11971	2360	2600	240	—	10	375	90		
16	"	9 7/8	13	W7R	11335	2600	2733	133	—	11	375	85		
17	Reliance	9 7/8	13	W7R	11360	2733	2744	11	—	11	375	85		
18	Hughes	9 7/8	14	W7R	11330	2744	2793	49	—	11	375	85		
19	"	9 7/8	15	OWS	33632	2793	2803	10	—	9	375	85		
20	"	9 7/8	16	OWS	22632	2803	2818	15	—	9	375	85		
21	"	9 7/8	17	W7R	11344	2818	2859	41	—	11	375	85		
22	"	9 7/8	18	W7R	11356	2859	2925	66	—	11	375	85		
23	"	9 7/8	19	W7R	11349	2925	2983	58	—	11	400	85		
24	"	9 7/8	20	W7R	35802	2983	3125	142	—	11	400	85		
25	"	9 7/8	21	OWS	33631	3125	3160	35	—	10	400	85		
26	"	9 7/8	22	W7R	31329	3160	3210	50	—	12	410	90		
27	"	9 7/8	23	W7R	31330	3210	3269	59	—	11	410	90		
28	"	9 7/8	24	W7R	12972	3269	3305	36	—	12	410	90		
29	"	9 7/8	25	W7R	31334	3305	3345	40	—	12	400	90		
30	"	9 7/8	26	W7R	86353	3345	3422	77	—	11	400	90		
31	"	9 7/8	27	W7R	25482	3422	3604	182	—	11	400	90		
32	"	9 7/8	28	OWS	32473	3604	3759	155	—	9	400	90		
33	"	9 7/8	29	OWS	36578	3759	3795	36	—	9	400	90		
34	"	9 7/8	30	W7R	63769	3795	3820	25	—	10	400	90		
35	"	9 7/8	31	W7R	25485	3820	3836	16	—	11	375	85		Finish Ream
36	"	9 7/8	32	W7R	55645	3836	3850	14	—	12	350	85		last Return 3836
37	"	9 7/8	33	W7R	31327	3850	3868	18	9 hr.	12	350	85		
38	"	9 7/8	34	W7R	8749	3868	3890	22		12	400	85		Walk cone out
39	Reed	9 7/8	35	2HS1	90944	3890	3899	9		11	400	85		
40	Hughes	9 7/8	36	W7R	25800	3899	3912	13		12	400	85		

BIT RECORD

Form BE-1

Graph No. _____ Started Under Surface _____ State _____

Spudded in _____ Set Sand String _____ County _____ Field _____

Company _____ Lease _____ Well No. _____ Sec. _____ T. _____ R. _____

Contractor Oct. 17- _____ Tool Pusher _____ Driller _____ Driller _____ Driller _____

Trip No.	Make of Bit	Size	Run No.	Type of Cone	Serial No. of Bit	DEPTH From	DEPTH To	Footage	Hrs. Run	Points Wgt.	Pump Press.	Rotary R.P.M.	Time Lost	REMARKS
1	Hughes	9 7/8	37	W7R	25484	3912	3914	2	3	12	400	85		
2	"	7 7/8	38	W7R	52098	3914	3944	30	10	10	400	85		
3	"	7 7/8	39	W7R	58652	3944	3971	27	8	11	400	85		
4	"	7 7/8	H0	W7R	8327	3971	H006	35	9	8	400	85		
5	"	7 7/8	H1	W7R	8795	H006	H031	25	8	7	400	85		
6	"	7 7/8	H2	W7R	8804	H031	H057	26	7	9	400	85		
7	"	7 7/8	H3	W7R	8343	H057	H092	35	10	10	300	85		
8	"	7 7/8	H4	W7R	8315	H092	H115	23	9	9	250	85		
9	"	7 7/8	H5	W7R	8593	H115	H151	36	10	7	275	85		
10	"	7 7/8	H6	OWC	22404	H151	H159	8	6	7	250	85		
11	"	7 7/8	H7	OWC	21752	H159	H176	17	—	7	300	85		
12	"	7 7/8	H8	W7R	8588	H176	H195	19	—	9	400	85		
13	"	7 7/8	H9	W7R	35327	H195	H235	40	8	10	400	85		
14	"	7 7/8	50	W7R	35397	H235	H275	40	8	9	400	85		
15	"	7 7/8	51	W7R	35330	H275	H320	45	8	10	400	85		
16	"	7 7/8	52	W7R	35320	H320	H375	55	9	10	400	85		
17	"	7 7/8	53	W7R	52098	H375	H400	25	6	10	400	85		
18							T.D.		Nov	11-50				
19														
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40														

COMPANY Waddell & Wright FARM Murphy WELL NO. 2

SEC. 5 TWP 22s RGE 27E LOC C SE NW COUNTY Cochise STATE Arizona

CONTRACTOR SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

OIL & GAS CONSERVATION COMMISSION
STATE OF ARIZONA
4515 N. 7th AVE.
TELEPHONE: 271-5161
PHOENIX, ARIZONA 85013

Note: Frank Moore, Douglas has originals. #2-24

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS	DEPTH	TIME O'CLOCK	MIN.	REMARKS
610							
			1½ 30 min				
			45 min				
			5 hrs				
			5 hrs				
			35 min				
1365							
1388							
1388							
1388

COMPANY Waddell-Duncan Co. FARM Murrey WELL NO. 1

SEC. [illegible] TWP. [illegible] RGE. 21 LOC. SE-NE COUNTY [illegible] STATE [illegible]

CONTRACTOR [illegible] SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
1580	5P.		
1590	7:Em	3 Hrs	Mixing Mud
1600	7:45	45	Min
1610	8:30	45	"
1620	10:15	1 Hr	[illegible]
1630	10:30	1 Hr	15 "
1640	[illegible]	[illegible]	[illegible]
1650	1:30	1:30	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
1701	11:45		
Start	[illegible]		Drilling
			Lo[illegible]
[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]		
[illegible]	7:30		
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	20	[illegible]
[illegible]	[illegible]	12	[illegible]
[illegible]	[illegible]	38	[illegible]
[illegible]	[illegible]	[illegible]	
1840	10:38	48	
1845	11:23	47	
1850	12:05	30	Connect.
1855	12:35	20	
1860	1:15	50	
1865	2:06	51	
1870	3:[illegible]	54	
1875	3:40	40	
1880	4:15	35	
1885	5:PM	45	C.O.H.
1890	5:30	30	Lost Circulation 1890 Connected out
1895	8:25	25	Started drilling
~~1900~~	~~8:50~~	~~25~~	
~~1905~~	~~9:15~~	~~30~~	Connect.
~~1910~~	~~9:45~~		

DEPTH	TIME O'CLOCK	MIN.	REMARKS

KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell & Finney FARM Murray WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY Ochiltree STATE Oklahoma

CONTRACTOR SIZE HOLE 7 7/8 DRILL PIPE 4 1/2

REMARKS: SIZE PUMP LINERS 7 1/4 LENGTH STROKE 14

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
1900	8:50	25	
1905	9:15	25	Cond.
1910	9:40	30	
1920	10:50		
1925	11:45		
1930	12:50	1:00	
1935	1:00		
1940	2:30	30	
1945	2:50		
1950	3:20		
1955	4:00	45	
1955	4:50	30	
1960	5:20	30	
1965	5:35	35	
1970	6:20	45	Con. CHC & mud pump
1975	7:15	55	Mixed mud water on mud
1980	7:50	35	
1985	8:20	40	
1990	8:50	30	
1995	9:15	25	
2000	10:00	45	[illegible]
2005	3:50	5:15	Trip [illegible]
2010	4:00	1:15	
2015	4:30	30	
2020	5:10	40	
2025	5:50	40	
2030	6:[illegible]	1:05	[illegible]
2035	8:55	1:15	[illegible]
2040	10:00	1:05	5 [illegible] 1.15 [illegible]
41	10:10	10	
42	10:22	12	
43	10:31	9	
44	10:45	14	
45	10:56	11	
46	11:05	9	
47	11:18	13	
48	11:32	14	
49	11:46	14	
2050	12:00	14	TFD.
51	6:15	10	STARTED DRILLING 6:05
52	6:25	10	
53	6:40	15	
54	6:55	15	
55	7:10	15	
56	7:20	10	
57	7:30	10	
58	7:40	10	

DEPTH	TIME O'CLOCK	MIN.	REMARKS

DRILLING TIME SHEET
BLUE PRINT CO., WICHITA, KAN.

COMPANY [illegible] FARM [illegible] WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY [illegible] STATE [illegible]

CONTRACTOR SIZE HOLE DRILL PIPE 4 1/2

REMARKS: SIZE PUMP LINER [illegible] LENGTH STROKE [illegible]

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2057	7:50	10	9-13-[illegible]
60	8:06	10	LAUGHAN
61	8:15	9	VIS=34 WL=8.5
62	8:25	10	
63	8:34	9	
64	8:43	9	
65	8:50	7	
66	8:58	8	
67	9:05	7	
68	9:13	8	
69	9:18	5	
70	9:24	6	
71	9:31	7	
72	9:40	9	
73	9:50	10	
74	9:58	8	
75	10:05	7	
76	10:40	10	25 min [illegible]
77	10:50	10	
78	10:59	9	VIS=[illegible] WL=8.4
79	11:08	9	[illegible]
2080	11:18	10	
81	11:25	7	
82	11:32	7	
83	11:[illegible]	7	
84	11:[illegible]	12	[illegible]
85	[illegible]	[illegible]	
86	[illegible]	5	
87	12:[illegible]	7	
88	12:[illegible]	6	
89	12:22	11	
2090	12:26	4	
91	[illegible]	9	[illegible]
92	[illegible]	7	
93	12:55	8	
94	[illegible]	[illegible]	
95	[illegible]	5	
96	[illegible]	5	
97	1:22	7	
98	1:27	5	VIS=38 [illegible]
99	1:32	5	
2100	1:36	4	
1	1:44	8	
2	1:5[illegible]	7	
3	1:57	6	
4	2:02	5	
5	2:06	4	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	2:12	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	3:15	1	
[illegible]	[illegible]	1	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	4:02	12	[illegible]
[illegible]	4:10	8	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	7	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	1	
[illegible]	5:14	12	
2130	5:26	12	
31	5:36	10	
32	5:53	17	[illegible]
33	6:05	12	VIS=[illegible] WL=[illegible]
34	6:15	10	
35	6:25	10	
36	6:35	10	
37	7:00	25	15 [illegible]
38	7:10	10	
39	7:20	10	
2140	7:35	[illegible]	[illegible]
1	8:35	10	50 [illegible]
2	8:[illegible]	[illegible]	
3	8:51	[illegible]	
4	9:00	[illegible]	
2145	9:12	[illegible]	
6	9:24	[illegible]	Rough
7	9:56	[illegible]	" → TRIP
[illegible]	12:55	[illegible]	ON BOTTOM 12:35 PM
9	1:05	[illegible]	2:39 [illegible]
2150	1:30	[illegible]	5 min connection

ROTARY DRILLING LINE SHEET 300
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY [illegible] FARM Murray WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY [illegible] STATE [illegible]

CONTRACTOR SIZE HOLE 7 7/8" DRILL PIPE 4 1/2"

REMARKS: SIZE PUMP LINERS 7 1/4 LENGTH STROKE 11"

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2151	2:30	25	Flood
2	2:35	35	"
3	2:55	25	
4	3:10	15	Lost
2155	3:27	17	
56	3:37	10	
57	3:55	18	
58	4:13	18	
59	4:34	21	
2160	4:55	21	
61	5:20	25	
62	5:39	19	
63	6:03	24	
64	6:27	24	
65	7:15	33	15 MIN ON ROTARY CLUTCH
66	7:50	35	Vis=33 WT=8-5
67	8:30	40	TRIP Reamed 10 Times
68	11:10	15	O.B. 10:55
69	11:25	15	
2170	11:35	10	
71	11:43	8	
72	12:00	17	
73	12:18	18	
74	12:50	32	
75	1:05	15	
76	1:25	20	Vis. 33 Wt. 8.2
77	1:48	23	
78	2:10	22	
79	2:37	27	
2180	3:15	38	
81	4:00	45 (15)	30 MIN OUT CON + WORKING ROTARY TORQUE
82	4:15	15	
83	4:32	17	
84	4:47	15	
85	5:05	20 (5)	5 MIN OUT FOR FLOW
86	10:50 11:08	18	TRIP & Repairs on Bottom at 10:50
87	11:25	17	
88	11:46	21	
89	12:00	14	
2190	12:10	10	
91	12:20	10	
92	12:31	11	
93	12:43	12	
94	12:56	13	
95	1:10	14	
96	1:22	12	
97	1:33	11	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
98	1:43	10	Vis: 35 Wt. 8.2
99	2:02	9	
2200	2:10	8	
1	2:16	6	
2	2:22	6	
3	2:30	8	
4	2:38	8	
2205	2:47	9	
6	2:58	11	
7	3:10	12	
8	3:27	17	
9	3:43	15	
2210	4:PM.	17	
11	4:30	30	TRIP O.B. 8:35 was on motor & mud pump
12	8:49	14	
13	9:01	12	
14	9:13	12	
15	9:25	12	
16	9:40	15	
17	10:05	15	10 MIN ON MUD PUMP
18	10:32	12	15 " " " "
19	10:56	13	Vis=36 Wt=9-2
2220	11:PM.	10	
21	11:16	10	
22	11:23	7	
23	11:50	27 (20)	5 MIN OUT GREASE LINE
24	12:07	17	
25	12:25	18	
26	12:44	19	Vis=34 Wt 8.9
27	1:03	19	
28	1:23	20	
29	1:43	20	
2230	2:02	19	TRIP 2231 & Repair Pump
31	2:27	25	Started drilling 1:00
32	1:00 1:12	12	Vis: 34 Wt. 9
33	1:22	10	
34	1:30	8	
35	1:38	8	
36	1:46	8	
37	1:54	8	
38	2:03	9	
39	2:12	9	
2240	2:20	8	
41	2:34	9	Corrections: 5 min
42	2:44	10	
43	2:55	11	
44	3:30	22	23 MIN ON MUD PUMP

ROTARY-DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO. WICHITA, KAN.

COMPANY Waddell & Duncan FARM Murray WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY Cochran STATE Ga

CONTRACTOR SIZE HOLE 9 7/8 DRILL PIPE 3 1/2

REMARKS: SIZE PUMP LINERS 7 1/4 LENGTH STROKE 14

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2245	3:40	10	
46	3:49	9	
47	3:58	9	
48	4:04	6	
49	4:10	6	TRIP WORKING ON
2250	11:06	6	DRAWWORKS, REAMED
51	11:10	4	35 FT To BOTTOM. 0:00 AM
52	11:12	2	
53	11:15	3	
54	11:18	3	
55	11:21	3	
56	11:24	3	
57	11:28	4	
58	11:35	7	
59	11:40	5	
2260	12:00	20	10 min out mixing mud
61	12:05	5	Vis [illegible]
62	12:12	7	
63	12:17	5	
64	12:28	11	
65	12:32	4	
66	12:37	5	
67	12:45	8	
68	12:50	5	
69	12:54	4	
2270	1:00	6	
71	1:12	12	5 min. out. con.
72	1:16	4	
73	1:21	5	
74	1:27	6	
75	1:32	5	
76	1:37	5	
77	1:43	6	
78	1:47	4	
79	1:52	5	
2280	1:57	5	
81	2:01	4	
82	2:08	7	
83	2:15	7	
84	2:22	7	
85	2:30	8	
86	2:38	8	
87	2:46	8	
88	2:54	8	
89	3:01	7	
2290	3:09	8	
91	3:15	6	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
92	3:22	7	
93	3:27	5	
94	3:35	8	
95	3:46	11	
96	4:10	24	15 min out mixing mud
97	4:40	30	20 min out [illegible]
98	4:50	10	
99	4:[illegible]	[illegible]	
2300	5:05	15	
1	5:20	10	
2	5:30	10	
3	5:42	12	12 min. out. con.
4	6:20	15	15 min out mixing mud
5	6:30	10	[illegible]
6	[illegible]		Vis 35 Wt 8.9
7	[illegible]	[illegible]	
8	[illegible]	[illegible]	
9	[illegible]	[illegible]	
2310	[illegible]	[illegible]	
11	[illegible]	[illegible]	
12	[illegible]	[illegible]	
13	[illegible]	[illegible]	
14	[illegible]	[illegible]	
15	[illegible]	7	
16	[illegible]	[illegible]	
17	10:43	10	
18	10:57	8	
19	11:00	7	
2320	11:09	9	
21	11:18	9	
22	11:27	9	Drawn 3 1/2 Collars
23	2:30	9	
24	2:38	8	
25	2:47	9	
26	2:55	8	
27	3:03	8	Vis: 36 Wt. 9.2
28	3:12	9	
29	3:22	10	
2330	3:32	10	
31	3:42	10	
32	3:53	11	
33	4:40	12	35 MIN DOWN ON MUDPUMP
34	4:58	18	
35	5:16	18	
36	5:33	17	MIXING MUD
37	5:50	17	
2338	6:05	15	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Mitchell & Duncan FARM Murray WELL NO. 1

SEC. TWP. 5 RGE. 27 LOC. 27E COUNTY Trego STATE Kan

CONTRACTOR SIZE HOLE 9 7/8 DRILL PIPE 4 1/2

SIZE PUMP LINERS 7 LENGTH STROKE 14

REMARKS:

2377

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2339	6:20	15	
40	6:33	13	
41	6:46	13	
42	7:P.M.	14	
43	7:14	14	
44	7:28	14	
45	7:42	14	VIS=36 WT=9-1
46	7:54	12	
47	8:05	11	
48	8:21	16	
49	8:37	16	
2350	8:53	16	
51	9:09	16	
52	9:25	16	
53	9:39	14	
54	9:53	14	
55	10:07	14	
56	10:21	14	
57	10:34	13	
58	10:47	13	
59	11:06	19	
2360	11:36	30	TRIP [illegible]
61	3:19	9	[illegible] O.B. 3:10
62	3:29	10	
63	3:46	10	7 MIN CON
64	3:55	9	
65	4:04	9	VIS=35 WT=8.8
66	4:15	11	
67	4:26	11	
68	4:37	11	
69	4:49	12	
2370	4:58	9	
71	5:06	8	
72	5:14	8	
73	5:22	8	
74	5:30	8	
75	5:38	8	
76	5:48	10	
77	5:57	9	
78	6:05	8	VIS=36 WT=9
79	6:13	8	
2380	6:22	9	
81	6:31	9	
82	6:41	10	
83	6:51	10	
84	7:A.M.	9	
85	7:08	8	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	VIS: 35 WT: 9
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]

COMPANY [illegible] FARM [illegible] WELL NO. [illegible]

SEC. [illegible] TWP. [illegible] RGE. [illegible] LOC. [illegible] COUNTY [illegible] STATE [illegible]

CONTRACTOR [illegible] SIZE HOLE [illegible] DRILL PIPE [illegible]

REMARKS: SIZE PUMP LINERS [illegible] LENGTH STROKE [illegible]

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2425	4:11	7	
27	4:19	8	
30	4:26	7	
31	4:34	8	
32	4:42	5	
33	4:50	8	
34	4:55	5	
35	5:06	8	
36	5:14	8	
37	5:23	9	
38	5:30	7	
39	5:37	7	
2440	5:45	8	
41	5:54	9	
42	6:03	9	
43	6:11	8	
44	6:19	8	
45	6:27	8	
46	6:35	8	
47	6:43	8	
48	6:52	9	
49	7:00	8	
2450	7:18	9	9 minutes
51	7:27	9	
52	7:35	8	
53	7:44	9	
54	7:54	10	
55	8:02	8	
56	8:10	8	
57	8:17	7	
58	8:25	8	
59	8:33	8	
2460	8:45	12	
61	8:55	10	
62	9:05	10	
63	9:15	10	
64	9:27	12	
65	9:36	9	
66	9:45	9	VIS=35 Wt 8-7
67	9:54	9	
68	10:04	10	
69	10:14	10	
2470	10:25	11	
71	10:37	12	
72	10:48	11	
73	10:58	10	
74	11:07	9	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2475	11:16	9	
76	11:25	9	
77	11:34	9	
78	11:46	12	
79	11:58	12	
2480	12:08	[illegible]	[illegible]
81	[illegible]	[illegible]	
82	12:46	10	[illegible]
83	[illegible]	[illegible]	
84	[illegible]	[illegible]	
85	[illegible]	9	
86	[illegible]	[illegible]	
87	[illegible]	[illegible]	
88	[illegible]	[illegible]	
89	[illegible]	[illegible]	
90	[illegible]	[illegible]	
2490	[illegible]	[illegible]	
1	[illegible]	[illegible]	
2	[illegible]	[illegible]	
3	[illegible]	[illegible]	
4	[illegible]	[illegible]	
5	[illegible]	[illegible]	
6	[illegible]	[illegible]	
7	[illegible]	[illegible]	
8	[illegible]	[illegible]	
9	[illegible]	[illegible]	
2500	[illegible]	[illegible]	
1	[illegible]	[illegible]	
2	5:34	7	
3	5:43	9	
4	5:52	9	
5	4:00	8	
6	4:09	9	
7	4:19	10	
8	4:28	9	
9	4:39	11	
2510	4:58	11	[illegible] 2 min
1	5:08	10	
2	5:18	10	
3	5:28	10	
4	5:37	9	
5	5:46	9	
6	5:56	10	
7	6:05	9	
8	6:14	9	
9	6:22	8	
2520	6:31	9	

ROTARY DRILLING TIME SHEET - 505
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY _____ FARM _____ WELL NO. _____

SEC. TWP. RGE. LOC. COUNTY _____ STATE _____

CONTRACTOR _____ SIZE HOLE _____ DRILL PIPE _____

REMARKS: SIZE PUMP LINERS _____ LENGTH STROKE _____

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2521			

CONTRACTOR _____ SIZE HOLE _____ DRILL PIPE _____

REMARKS: SIZE PUMP LINERS _____ LENGTH STROKE _____

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2615			

COMPANY [illegible] FARM Murray WELL NO. 1

SEC. 5 TWP. [illegible] RGE. [illegible] LOC. [illegible] COUNTY [illegible] STATE [illegible]

CONTRACTOR [illegible] SIZE HOLE [illegible] DRILL PIPE [illegible]

REMARKS: SIZE PUMP LINERS [illegible] LENGTH STROKE [illegible]

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
[illegible]	[illegible]	9	
10	10:42/10:49	7	
11	10:58	9	
2	11:07	9	
3	11:14	7	
4	11:20	6	
5	[illegible]	10	[illegible]
6	[illegible]	[illegible]	
7	[illegible]	7	
8	[illegible]	9	
9	[illegible]	5	
3220	[illegible]	9	
21	[illegible]	6	
22	12:35	7	Vis 35 Wt 9.0
23	[illegible]	10	Conn Drill
24	[illegible]	11	
25	[illegible]	12	
26	[illegible]	11	
27	[illegible]	12	
28	[illegible]	20	
29	[illegible]	[illegible]	
3120	2:40	20	
31	3:00	15	
32	3:15	15	
33	[illegible]	17	[illegible]
34	9:17	12	Vis: 36 Wt. 8.9
35	9:20	13	
36	9:32	12	
37	9:54	12	
38	10:05	11	
39	10:15	10	
3940	10:27	12	
41	10:42	15	
42	11:02	20	
43	11:27	25	
44	11:52	25	[illegible] Engine Repairs
45	12:20/1:10	10	Cpl 22 [illegible]
46	1:07	[illegible]	
47	1:16	9	
48	1:24	8	
49	1:30	6	Vis 37 [illegible]
4950	1:37	7	
51	1:44	7	
52	1:51	7	
53	1:56	5	
54	2:02	6	
55	2:08	6	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
[illegible]	[illegible]	7	[illegible]
[illegible]	[illegible]	8	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	15	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	11:35	9	
[illegible]	11:46	11	
[illegible]	5:05	9.1	
12	5:17	11	
[illegible]	[illegible]	10	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	11	
[illegible]	[illegible]	7	
[illegible]	[illegible]	25	
[illegible]	7:55	30	
[illegible]	8:20	25	
[illegible]	[illegible]	30	
[illegible]	8:57	17	
[illegible]	9:09	12	
[illegible]	9:21	11	[illegible]
[illegible]	[illegible]	10	Vis: 35 Wt. 9.
[illegible]	9:46	10	
[illegible]	9:56	10	
[illegible]	10:20	24	
[illegible]	10:48	28	
2700	11:28	40	
1	11:56	28	
2	12:30	34	
3	1:20	50	Trip 1 hr, 50 min
4	3:30/3:50	20	Reaming 6'
5	4:09	19	Vis: 36 Wt. 9
6	4:17	14	
7	4:32	15	
8	4:43	11	
9	4:53	10	
2800	5:05	12	
1	5:20/5:32	12	15 MIN CHECKING MOTOR & RIG
2	5:54	22	

KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Mad[illegible] Dr[illegible] Co. FARM Mu[illegible] WELL NO. 1

SEC. ___ TWP. ___ RGE. ___ LOC. ___ COUNTY ___ STATE ___

CONTRACTOR ___ SIZE HOLE ___ DRILL PIPE ___

REMARKS: SIZE PUMP LINERS ___ LENGTH STROKE ___

3 7-2
3 9-11
3 8-10

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2803	6:26	32	
4	9:35 9:3	45	30 min on 6 inches / 6:56
5	10:07	37	TR = 0:13 [illegible]
6	10:23	[illegible]	VIS = 34 WT = 8-9
7	10:51	24	14 min on [illegible]
8	11:[illegible]	[illegible]	
9	11:50	[illegible]	
2810	12:[illegible]	[illegible]	
11	12:[illegible]	[illegible]	
12	1:[illegible]	17	
13	1:[illegible]	[illegible]	
14	1:30	[illegible]	
15	1:[illegible]	[illegible]	
16	[illegible]	20	[illegible]
17	[illegible]	27	
18	[illegible]	15	TR 0:13
19	6:[illegible]	20	
2820	3:34 3:54	22	
21	4:10	16	
22	4:35 4:50	15	25 min [illegible]
23	5:10	20	
24	5:30	20	
25	5:50	20	
26	6:06	16	
27	6:24	18	[illegible]
28	8:10 8:[illegible]	18	VIS = 36 WT = 9
29	8:44	19	
2830	9:P.M.	16	
31	9:13	12	
32	9:26	13	
33	9:37	11	
34	9:50	13	
35	10:P.M.	10	
36	10:11	11	
37	10:25	14	
38	10:42	17	
39	10:55	13	
2840	11:09	14	
41	11:23	14	
42	11:45	18	
43	12:05	20	
44	12:13 12:33	20	8 min on [illegible]
45	12:47	14	
46	1:00	18	VIS = 36 WT = [illegible]
47	1:12	12	
48	1:23	11	
2849	1:40	17	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2850	[illegible]	[illegible]	
51	[illegible]	[illegible]	
52	[illegible]	[illegible]	
53	[illegible]	[illegible]	
54	[illegible]	[illegible]	
55	[illegible]	[illegible]	
56	3:[illegible]	[illegible]	
57	3:[illegible]	[illegible]	
58	[illegible]	[illegible]	
59	[illegible]	[illegible]	
2860	3:34 3:46	[illegible]	[illegible]
61	3:58	[illegible]	
62	4:10	[illegible]	
63	4:26	[illegible]	
64	4:45	[illegible]	
65	5:04	[illegible]	
66	5:23	[illegible]	
67	5:37	[illegible]	
68	5:54	[illegible]	
69	6:18	[illegible]	
70	6:30	[illegible]	VIS = 28 [illegible]
71	[illegible]	[illegible]	
72	7:13	[illegible]	
73	7:35	[illegible]	
74	7:45 7:59	[illegible]	10 MIN C.O.H
75	8:07		
76	8:16		
77	8:28	[illegible]	
78	8:40	[illegible]	
79	8:52	[illegible]	
2880	9:05	[illegible]	
81	9:25	20	
82	9:50	25	
83	10:23	28	5 hrs working on drawworks
84	3:[illegible] 3:55	20	
85	4:10	15	
86	4:25	15	
87	4:35 4:50	15	10 min on Circ. Clk
88	5:07	17	
89	5:25	18	VIS = [illegible] WT = 7.1
2890	5:35	10	
91	5:47	14	
92	6:00	11	
93	6:12	12	
94	6:24	12	
95	6:35	11	
2896	6:50	15	

ROTARY DRILLING TIME SHEET 303
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell-Duncan Co FARM Murry WELL NO. 1

SEC. 5 TWP. 22S RGE. 27E LOC. COUNTY Cochise STATE Arizona

CONTRACTOR SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2897	~~6:00~~ 7:00	10	
98	7:15	15	
99	7:50	10	growing Big 26 mi.
2900	8:08	18	
1	8:24	16	
2	8:36	12	
3	9:00	10	connection & Rig 10 mi.
4	9:18	18	Vis: 34 Wt. 9.1
5	9:36	18	
6	9:53	17	
7	[illegible]	10	
8	10:13	10	
9	10:21	8	
2910	10:29	8	
1	10:36	7	
12	10:42	6	
13	10:48	6	
14	10:57	9	
15	11:10	13	
16	[illegible]	10	
17	11:30	18	
18	11:46	16	
19	12:00	14	
20	12:10	10	
1	12:17	7	
2	12:24	7	
3	12:29	5	
4	12:34	5	
5	12:42	8	× Trip & Repair
6	~~11:50~~ 11:50	6	
7	12:11	12	
8	12:14	3	
9	12:17	3	
2930	12:25	8	
1	~~12:35~~ 1:02	7	35 min. out. pump
2	1:08	6	
3	1:13	5	Vis 34. Wt. 9-1
4	~~1:25~~ 1:32	7	Conn & Drill Guard 12 min
5	1:40	8	
6	1:50	10	
7	2:02	12	
8	2:15	13	
9	2:29	14	
2940	2:43	14	
1	2:58	14	
2	3:16	18	
3	3:37	21	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
4	3:57	20	
5	4:13	16	
6	4:30	17	
7	4:50	20	
8	5:07	17	
9	5:28	21	
2950	5:50	22	
1	6:05	15	
2	6:22	17	
3	6:42	20	
4	6:57	15	
5	7:10	13	
6	7:24	14	Vis: 35 Wt. 9.2
7	~~7:35~~ 7:45	10	growing Big 26 mi.
8	8:17	12	
9	8:27	10	
2960	8:39	12	
1	8:41	12	
2	8:55	14	
3	9:15	20	Battery & Cutter 9 hr.
4	~~11:15~~ 11:30	15	
5	11:50	20	
6	12:15	25	
7	12:40	25	
8	1:00	20	
9	1:17	17	
2970	1:32	15	
1	1:47	15	
2	1:57	10	
3	2:15	18	
4	2:32	17	
5	2:57	25	
6	3:10	13	
7	~~3:40~~ 3:55	15	30 MIN DOWN ON DRAW WORKS
8	4:15	20	
9	~~4:25~~ 4:50	25	10 MIN DOWN ON DRAW WORK
2980	5:15	25	
81	5:40	25	
82	6:P.M.	20	
83	6:25	25	TRIP WORK ON DRAW WORKS
84	~~12:50~~ 1:00	10	OB 12:50 A.M.
85	1:07	7	
86	1:15	8	
87	1:25	10	
88	~~1:30~~ 1:38	8	25 min. out on pump
89	2:04	6	
2990	2:07	3	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Wardell & Duncan Co. FARM Murry WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY Cochise STATE Arizona

CONTRACTOR SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
2991	~~1:12~~	6	
92	1:22	14	
93	1:30	8	
94	1:40	10	VIS 36 WT 9-2
95	~~1:50~~ 1:50	10	10 min out. con.
96	2:10	10	
97	~~1:50~~ 3:00	10	1 hr + 40 min on. con. chain.
98	3:09	9	
99	3:14	5	
3000	3:24	10	
1	3:50	20	
2	4:02	12	
3	4:16	14	
4	4:30	14	15 min on circulate.
5	~~4:45~~ 5:01	16	
6	5:16	15	
7	5:30	14	Vis: 36 Wt. 9.2
8	5:44	14	
9	5:58	14	
3010	6:12	14	
11	6:24	12	
12	6:36	12	
13	6:48	12	
14	7:00	12	
15	7:10	10	
16	7:20	10	
17	7:30	10	
18	7:40	10	
19	7:50	10	
3020	7:59	9	
21	8:08	9	
22	8:17	9	
23	8:27	10	
24	8:37	10	Connection & weight [illegible]
25	~~11:50~~ 12:00	10	1 hr 15 min
26	12:15	15	
27	12:30	15	
28	12:44	14	Vis: 36 Wt. 9.
29	12:58	14	
3030	1:12	14	
1	1:24	12	
2	1:34	10	
3	1:44	10	
4	1:54	10	
5	2:06	12	
6	2:16	9	Vis: 35 Wt. 9.3
7	2:25	10	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
8	2:33	8	
9	2:42	9	
3040	2:50	8	
1	2:59	9	
2	3:07	8	
3	3:16	9	
4	3:25	9	
5	3:33	8	
6	~~3:40~~ 3:42	2	7 min checking rig
7	3:44	2	
8	3:45	1	
9	3:46	1	
3050	3:47	1	
51	~~4:57~~ 4:57	3	Circulated 1 hr 7 m.
52	5:10	13	for samples
53	5:30	20	Vis=36 Wt=9-3
54	5:43	13	
55	~~5:55~~ 6:07	7	12 min con.
56	6:17	10	
57	6:29	12	
58	6:41	12	
59	6:45	4	
3060	6:48	3	
61	6:55	7	
62	6:59	4	
63	7:06	7	
64	7:16	10	
65	7:30	14	
66	7:47	17	
67	8:03	16	
68	8:20	17	
69	8:39	19	
3070	8:55	16	10 min jetting shale p
71	~~9:05~~ 9:18	13	
72	9:34	16	Vis=35 Wt=9-3
73	9:54	20	
74	10:08	12	
75	10:23	15	
76	10:35	12	
77	10:55	20	
78	11:15	20	
79	11:42	27	
3080	11:52	10	
81	11:55	3	
82	11:56	1	
83	11:57	1	
84	12:00	3	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell + Dunning FARM _____ WELL NO. _____

SEC. TWP. RGE. LOC. COUNTY _____ STATE _____

CONTRACTOR _____ SIZE HOLE _____ DRILL PIPE _____

REMARKS: SIZE PUMP LINERS _____ LENGTH STROKE _____

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3085	1:04	4	Circulated for
6	[illegible]	3	Cam Lavin (Drilling)
7	1:33	1	
8	1:34	5	
9	1:40	2	
3090	1:4[illegible]	[illegible]	
91	1:55	10	
92	2:00	5	
93	2:03	3	
94	2:08	5	
95	2:10	2	
96	2:13	3	
97	2:17	4	
98	2:20	3	
99	2:24	4	
3100	2:30	6	
1	2:35	5	
2	2:39	4	
3	2:41	2	
4	2:45	4	
5	2:52	7	
6	3:11	19	
7	3:15	4	
8	3:27	12	
9	3:33	6	
3110	3:45	10	
11	3:50	7	
12	3:55	5	
13	3:58	3	
14	4:01	3	
15	4:04	3	
16	4:13 / 4:22	9	9 min. Conn.
17	4:30	8	
18	4:41	11	
19	4:45	4	
3120	4:47	2	
21	4:49	2	
22	4:50	1	
23	4:51	1	
24	4:59	8	
25	5:16	17	x Trip x
26	8:30 / 8:40	10	
27	8:55	15	Vis 35 Wt. 9.4
28	9:07	12	
29	9:17	10	
3130	9:28	11	
31	9:38	10	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3132	9:48	10	
33	9:57	9	
34	10:07	10	
35	10:17	10	
36	10:27	10	
37	10:36	9	
38	10:46	10	
39	10:58	12	
3140	11:10	12	
41	11:22	12	
42	11:32	10	
43	11:41	9	
44	11:47	6	Vis. 35 Wt. 9.4
45	11:54	7	
46	3:20 / 3:32	12	Repair Chain and [illegible]
47	3:46	14	
48	4:04	18	
49	4:21	17	
3150	4:37	16	13 Min Down on Pump
51	4:50 / 5:07	17	
52	5:22	15	
53	5:40	18	
54	5:57	17	Vis = 38. Wt. = 9-3½
55	6:15	18	
56	6:34	19	
57	6:54	20	
58	7:18	24	
59	7:40	22	
3160	8:17	37	x Trip x
61	11:32 / 11:43	21	
62	12:12	24	Vis 48 Wt. 9.3
63	12:24 / 12:43	19	19 min. on Pump
64	1:03	20	
65	1:20	17	
66	1:45	25	
67	2:04	19	
68	2:23	19	
69	2:35	12	
3170	3:02	27	
71	3:26	24	
72	3:50	24	
73	4:08	18	
74	4:30	22	
75	5:06	30	
76	5:32	22	
77	5:55	23	
3178	6:10 / 6:29	19	15 min Conn.

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell & Duncan FARM Murray WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY STATE

CONTRACTOR SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3177	6:41	23	
3180	7:07	18	TRIP ON CLUTCH
81	7:28	20	
82	7:35	8	
83	7:39	4	
84	7:44	5	
85	8:00	16	
86	8:20	20	
87	8:36	16	
88	8:52	16	
89	9:10	18	
3190	9:27	17	
1	9:44	17	
2	10:00	16	VIS: 35 WL 9.2
3	10:15	15	
4	10:35	20	
5	10:53	18	
6	11:10	17	
7	11:26	16	
8	11:40	14	
9	11:50	10	
3200	12:05	15	
1	12:25	20	
2	12:45	20	
3	1:05	20	
4	1:30	25	
5	1:50	20	
6	2:10	20	
7	2:30	20	7 MIN CON.
8	4:19 / 4:33	23	1 HR. 33 MIN ON PUMP
9	5:05	29	
3210	5:45	40	TRIP
11	10:20 / 10:47	27	VIS=38 WT=9-3
12	11:06	19	
13	11:33	27	
14	11:53	20	
15	12:15	22	VIS: 45 - 9-4
16	12:35	20	
17	12:54	19	
18	1:17	23	
19	1:35	18	
3220	1:55	20	
21	2:07 / 2:22	15	12 MIN ON PUMP
22	2:25	3	
23	2:26	1	
24	2:27	1	
25	2:29	2	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
26	2:32	3	
27	2:34	2	Cir. Sample
28	[illegible]	8	STARTED [illegible] 3:55
29	4:18	15	
3230	4:32	15	
31	4:51	18	
32	5:12	17	
33	5:30	17	
34	5:[illegible]	25	
35	6:17	22	
36	6:34	17	
37	6:54	[illegible]	
38	7:42 / [illegible]	15	[illegible]
39	8:10	[illegible]	VIS: 37 [illegible]
3240	8:30	20	
41	8:45	[illegible]	
42	9:01	[illegible]	
43	9:[illegible]	[illegible]	
44	[illegible]	[illegible]	
45	[illegible]	[illegible]	Run Total [illegible]
46			VIS 42 WL 9.5 [illegible]
47			
48			
49			
3250			
51			
52			
53			
54	10:43 / 10:56	11	
55	11:10	14	
56	11:26	16	
57	11:40	[illegible]	
58	11:50	[illegible]	
59	12:00	[illegible]	
3260	12:09	9	
61	12:19	8	
62	12:28	9	
63	12:39	11	
64	12:55	16	
65	1:13	18	
66	1:32	17	
67	1:51	19	
68	2:10	19	
69	2:27	17	TRIP
3270	5:10 / 5:25	15	
71	5:40	15	25 MIN ON MUD PUMP
3272	6:02 / 6:18	13	

KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY WADDELL + DUNCAN FARM MURRAY WELL NO. 1

SEC. 5 TWP. 22S RGE 27E LOCA [redacted] SE NW COUNTY Cochise STATE ARIZ

CONTRACTOR SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

OIL & GAS CONSERVATION COMMISSION
STATE OF ARIZONA
4515 N. 7th AVE.
TELEPHONE: 271-5161
PHOENIX, ARIZONA 85013

#2-24

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3273	6:33	15	
74	6:50	17	40 VIS AT 1000-CC WT=9-8
75	7:06	16	
76	7:23	17	
77	7:40	17	6 MIN CON
78	~~7:45~~ 8:00	14	
79	8:16	16	
3280	8:34	18	
81	8:55	21	
82	9:16	21	
83	9:35	19	
84	9:56	21	
85	10:16	20	
86	10:42	27	
87	11:10	27	
88	11:35	25	
89	11:51	16	
3290	[illegible]	15	
91	[illegible]	12	
92	[illegible]	12	
93	[illegible]	24	
94	[illegible]	[illegible]	VIS=38 WT=9.1
95	1:41	16	
96	1:58	17	
97	2:22	24	
98	[illegible]	21	
99	[illegible]	21	
3300	3:21	22	
1	3:[illegible]	26	
2	4:10	12	
3	4:40	30	
4	5:15	35	
5	5:45	30	Trip 3 hr. 25 min.
6	9:30 ~~9:38~~	18	
7	9:53	15	VIS 38 WT 9.5
8	10:00 ~~10:18~~	12	CONNECTION 6 min
9	10:30	12	VIS 55 WT. 9.5
3310	10:42	12	
11	10:54	12	
12	11:10	16	
13	11:30	20	
14	11:50	20	
15	12:08	18	
16	12:24	16	
17	12:41	17	
18	12:59	18	
19	1:16	17	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
[illegible]	[illegible]	17	
[illegible]	[illegible]	16	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	4	
[illegible]	[illegible]	16	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	17	
[illegible]	3:[illegible]7	13	[illegible]
[illegible]	~~3:[illegible]~~ 4:[illegible]4	19	[illegible]
[illegible]	4:26	20	
3320	4:44	18	
21	5:05	21	
22	5:26	21	
23	5:49	23	
[illegible]	6:13	24	VIS=36 WT=9.1
[illegible]	6:35	22	
[illegible]	7:00	25	
[illegible]	7:26	6	
[illegible]	7:30	4	2 MIN CON
[illegible]	~~7:[illegible]~~ 8:12	2	
3340	8:32	[illegible]	
41	8:52	[illegible]	
42	9:10	18	
43	9:30	20	
44	9:55	25	
45	10:30	35	Trip
46	~~[illegible]~~	15	O.B. [illegible]
47	[illegible]	10	
48	[illegible]:00	15	
49	~~[illegible]~~:08	8	
3350	3:20	12	
51	3:32	12	VIS=40-9.4
52	3:48	12	
53	4:00	12	
54	4:17	17	
55	4:37	20	
56	4:55	18	
57	5:13	18	
58	5:30	17	
59	5:45	15	
3360	5:57	12	
61	6:07	10	
62	6:28	21	
63	6:40	12	
64	6:50	10	
65	~~10:05~~ 10:15	10	WORKING ON MUD PUMP
3366	10:30	15	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell & Duncan FARM Murray WELL NO. 1

SEC. TWP. 22 RGE 27 E LOC. COUNTY Ellis STATE Kansas

CONTRACTOR Co. SIZE HOLE 7 DRILL PIPE 4 1/2

REMARKS: SIZE PUMP LINER LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3369	10:50	20	VIS=40 WT=9-4
68	11:10	20	
69	~~11:30~~ 11:40	20	10 MIN CON CHECK PUMP
70	11:51	11	
71	12:02	12	
72	12:19	16	
73	12:32	12	
74	12:[illegible]	20	
75	1:[illegible]	19	
76	1:[illegible]	14	
77	1:[illegible]	14	
78	1:[illegible]	19	
79	2:08	13	
3380	2:23	15	VIS=[illegible]
81	2:50	27	
82	~~3:06~~ 3:18	12	10 MIN CON PUMP
83	3:31	18	
84	3:40	10	
85	[illegible]	–	
86	4:06	14	
87	4:20	14	
88	4:33	13	
89	4:50	17	
3390	5:02	12	VIS:38 WT [illegible]
91	5:15	13	
92	5:30	15	
93	5:43	13	
94	5:54	11	
95	6:09	14	
96	6:20	12	
97	6:32	12	
98	~~6:43~~ 6:45	11	10 MIN OUT PUMP
99	~~7:03~~ 7:15	12	10 MIN. CON.
3400	7:27	12	
1	7:39	12	
2	~~7:54~~ 8:10	12	greasing Rig & getting out / 19 out
3	8:22	12	
4	8:34	12	
5	8:48	14	Vis 38 WT 9.5
6	8.59	11	
7	9:10	11	
8	9:24	14	
9	9.39	15	
3410	9.54	15	
1	10.08	14	
2	10.20	12	
3	10.31	11	

DEPTH	TIME O'CLOCK	IN.	REMARKS
4	10:43	1	
5	10:53	1	
6	11:03	10	
7	11:13	10	
8	11:24	11	
9	11.35	11	
3420	11:50	15	
21	12:02	12	
22	12:13		Trip
23	~~3:17~~ 3:18	6	
24	3:26	8	
25	3:34	8	
26	3:42	8	
27	3:50	8	
28	3:57	7	15 MIN CON WASHED [illegible]
29	~~4:11~~ 4:21	9	
3430	4:30	9	
31	4:39	9	
32	4:[illegible]	[illegible]	
33	4:5[illegible]	10	
34	5:07	10	
35	5:18	9	
36	5:26	8	
37	5:34	8	
38	5:42	8	
39	5:52	10	
3440	6:01	9	VIS=36 WT=9-4
41	6:11	10	
42	6:21	10	
43	6:31	10	
44	6:42	11	
45	6:52	10	
46	7:02	10	
47	7:11	9	
48	7:21	10	
49	7:30	9	
3450	7:39	9	
51	7:49	10	
52	7:59	10	
53	8:08	9	
54	8:16	8	
55	8:26	10	
56	8:35	9	
57	8:46	11	
58	8:56	10	9 MIN CON
59	~~9:03~~ 9:11	7	
3460	9:19	8	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

SEC. [illegible] TWP. 22S RGE. 23E LOC. COUNTY COCHISE STATE ARIZ.

CONTRACTOR SIZE HOLE 9 7/8 DRILL PIPE 4 1/2

REMARKS: SIZE PUMP LINERS LENGTH TROKE 14

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3461	9:29	5	
62	9:35	8	
63	9:44	9	
64	9:53	9	
65	10:03	10	
66	10:11	8	
67	10:18	7	
68	10:27	9	
69	10:34	7	[illegible]
3470	10:41		
71	10:50	9	
72	11:00	10	
73	11:10	10	
74	11:20	10	
75	11:30	10	Vis [illegible]
76	11:42	12	
77	[illegible]	[illegible]	
78	12:[illegible]	10	
79	[illegible]	[illegible]	
3480	[illegible]	[illegible]	
81	[illegible]	9	
[illegible]	12:[illegible]	10	
[illegible]	1:05	14	
[illegible]	1:16	11	
85	1:29	13	
86	1:40	11	
87	1:51	11	
88	1:62	10	
89	2:02 2:15	12	Vis 38 8 mis
3490	2:22	7	
91	2:29	5	
92	2:34	7	
93	2:43	9	
94	2:55	12	
95	3:04	9	
96	3:15	14	
97	3:28	10	
98	3:41	13	
99	3:52	11	
3500	4:10	18	
01	4:18	8	
02	4:28	10	
03	4:38	10	
04	4:50	12	
05	4:58	8	
06	5:05	7	
07	5:13	8	VIS = 37 WT. 9 = 7

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3508	[illegible]	7	
09	[illegible]	[illegible]	
3510	5:37	7	
11	5:45	8	
12	5:52	7	
13	5:59	7	
14	6:[illegible]	7	
15	6:[illegible]	8	
16	6:[illegible]	7	
17	6:[illegible]	7	
18	6:29	7	
19	6:37	8	
20	[illegible]	7	[illegible]
21	[illegible]	7	[illegible]
22	[illegible]	7	
23	7:31	10	
24	7:43	9	
25	7:[illegible]	9	
26	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	
28	[illegible]	[illegible]	Vis [illegible]
29	[illegible]	[illegible]	
3530	[illegible]	8	
31	[illegible]	6	
32	8:11	9	
33	8:27	8	
34	8:35	8	
35	8:43	8	
36	8:52	9	
37	9:00	8	
38	9:09	9	
39	9:18	9	
3540	9:29	11	
41	9:39	10	Vis: 37 Wt 9.5
42	9:49	10	
43	9:58	9	
44	10:07	9	
45	10:16	9	
46	10:25	9	
47	10:34	9	
48	10:43	9	
49	10:52	9	CONECTION 6 min.
3550	11:05	7	
51	11:14	9	
52	11:23	9	Vis 38 Wt. 9.5
53	11:32	9	
3554	11:43	11	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waldron-Drilling Co FARM Murry WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY STATE

CONTRACTOR SIZE HOLE DRILL PIPE

REMARKS: SIZE PUMP LINERS LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3555	1:50	11	
6	1:04	10	
7	1:15	11	
8	1:27	12	
9	1:38	11	
3560	1:47	9	
1	1:54	7	
2	2:01	7	
3	2:09	8	
4	2:17	8	
5	2:25	8	
6	2:32	7	
7	2:38	6	
8	2:45	7	
9	2:53	8	
3570	3:02	9	VIS 38 WT 9.5
71	3:13	11	
72	3:25	12	
73	3:35	10	
74	3:50	15	
75	4:03	13	
76	4:14	11	
77	4:27	13	
78	4:38	11	
79	4:50	12	10 MIN CON CHECK RIG
3580	5:00 / 5:10	10	
81	5:20	10	
82	5:32	12	
83	5:48	16	
84	5:57	9	
85	6:05	10	
86	6:17	12	
87	6:28	11	
88	6:40	12	VIS = 39 WT = 9.5
89	6:52	12	
3590	7:04	12	
91	7:12	8	
92	7:23	11	
93	7:34	11	
94	7:42	8	
95	7:53	11	
96	8:03	10	
97	8:15	12	
98	8:28	13	
99	8:40	12	
3600	8:57	17	
01	9:11	14	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3602	9:29	13	VIS 39 WT [illegible]
3	9:40	12	
4	9:59	19	TRIP OUT [illegible]
5	10:11	4	
6	1:14	3	
7	1:21	7	
8	1:27	6	
9	[illegible]		
3610	[illegible]	7	[illegible]
11	[illegible]		
12	[illegible]		
13	[illegible]		
14	[illegible]		
15	[illegible]		
16	[illegible]	5	
17	2:21	5	
18	[illegible]	[illegible]	
19	[illegible]		
3620	[illegible]		
1			[illegible] 9.4
[illegible]	[illegible]		
[illegible]	[illegible]		
[illegible]	[illegible]		
23	3:08	5	
24	3:15	7	
25	3:21	6	
26	3:30	7	
27	3:39	9	
3630	3:46	7	
31	3:55	9	
32	4:02	7	
33	4:09	6	
34	4:13	5	
35	4:19	6	
36	4:23	4	
37	4:30	7	
38	4:50 / 4:55	5	20 MIN. ON. PUMP
39	5:03	8	
3640	5:10	7	
41	5:30 / 5:35	5	20 MIN MARSH CON.
42	5:41	6	AND WORK ON RIG
43	5:48	7	
44	5:55	7	
45	6:03	8	
46	6:10	7	
47	6:17	7	
3648	6:25	8	

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY [illegible] FARM [illegible] WELL NO. 1

SEC. 5 TWP. 22 S RGE. 27 E LOC. COUNTY [illegible] STATE ARIZONA

CONTRACTOR [illegible] SIZE HOLE 7 7/8 DRILL PIPE 4 1/2

REMARKS: SIZE PUMP LINERS [illegible] LENGTH STROKE "

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3649	6:55	7	
5650	6:10	8	
51	6:19	9	
52	6:25	6	
53	7:01	6	
54	7:08	7	
55	7:16	8	
56	7:24	8	
57	7:32	8	
58	7:40	8	
59	9:00/9:14	9	Change oil [illegible]
3660	9:22	8	[illegible]
1	9:31	9	
2	9:39	8	
3	9:46	7	
4	9:53	7	
5	10:00	7	
6	10:07	7	
7	10:15	8	
8	10:23	8	
9	10:31	8	
3670	10:39	8	
1	10:50/10:58	8	CONECTION 11 min
2	11:06	8	
3	11:14	8	
4	11:21	7	
5	11:28	7	
6	11:35	7	
7	11:42	7	
8	11:51	9	
9	12:00	9	
3680	12:10	10	
1	12:20	10	Vis 37 Wt. 9.4
2	12:31	11	
3	12:41	10	
4	12:50	9	
5	12:59	9	
6	1:07	8	
7	1:14	7	
8	1:21	7	
9	1:29	8	
3690	1:36	7	
1	1:44	8	
2	1:53	9	
3	2:03	10	
4	2:15	12	
5	2:27	12	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
6	2:37	10	
7	2:50	13	
8	3:35/3:48	13	45 MIN ON PUMP CLUTCH
9	3:58	10	10 MIN ON MUD PUMP
3700	4:39/4:49	10	10 MIN ON MUD PUMP
1	4:48/4:58	10	8 MIN CON
2	5:06	8	
3	5:12	6	
4	5:21	9	
5	5:34	13	
6	5:45	11	
7	5:55	10	
8	6:05	10	
9	6:15	10	
3710	6:32	17	
11	6:46	14	
12	6:59	13	
13	7:10	11	
14	7:23	13	
15	7:40	17	
16	7:57	17	
17	8:12	15	
18	8:26	14	
19	8:38	12	
3720	8:50	12	
21	9:15/9:27	12	25 MIN ON MUD PUMP
22	9:37	10	
23	9:48	11	VIS = 37 WT = 9.4
24	10:PM	12	
25	10:13	13	
26	10:25	12	
27	10:36	11	
28	11:15/11:28	13	
29	11:00/12:07	7	32 min on pump
3730	12:15	8	
31	12:25	10	
32	12:36/12:43	13	5 min. con.
33	12:53	10	
34	1:00	7	
35	1:10	10	
36	1:19	9	VIS = 35 WT. 9.4
37	1:28	9	
38	1:49	21	
39	1:55	14	
3740	2:06	11	
41	2:17	11	
3742	2:30	13	

ROTARY DRILLING TIME SHEET # 603
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY [illegible] DUNCAN FARM [illegible] WELL NO. 1

SEC. [illegible] TWP. [illegible] RGE. LOC. COUNTY [illegible] STATE [illegible]

CONTRACTOR [illegible] SIZE HOLE DRILL PIPE [illegible]

REMARKS: SIZE PUMP LINERS 7 LENGTH STROKE [illegible]

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3743	[illegible]	12	
44	[illegible]	12	
45	[illegible]	10	
46	3:14	9	
47	[illegible]	12	
48	[illegible]	12	
49	[illegible]	12	
3850	[illegible]	12	
51	[illegible]	10	
52	[illegible]	11	
53	4:35	14	
54	4:48	13	
55	[illegible]	12	
56	[illegible]	17	
57	[illegible]	11	
58	5:36	10	
59	[illegible]	12	Trip [illegible]
3860	9:59 / 9:55	8	
61	10:06	8	
62	10:14	8	
63	10:22	8	
64	10:30	8	
65	10:37	7	
66	10:44	7	
67	10:51	7	
68	10:58	7	
69	11:05	7	
3870	11:13	8	
1	11:20	7	
2	11:27	7	
3	11:35	8	
4	11:43	8	
5	11:50	7	
6	11:56	6	
7	12:00	4	
8	12:05	5	Vis 36 Wt [illegible]
9	12:10	5	
3780	12:15	5	
1	12:20	5	
2	12:27	7	
3	12:35	8	
4	12:42	7	
5	12:49	7	
6	12:55	6	
7	1:00	5	
8	1:07	7	
9	1:16	9	Wt 9.6

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3890	1:56 / 2:12	10	Connection [illegible]
91	2:22	10	
92	2:32	10	
93	2:44	12	
94	3:17	33	
95	4:05	48	TRIP 4 hrs 5 min
96	8:18 / 8:26	16	Work on rig
97	8:33	7	
98	8:40	7	
99	8:47	7	
3900	8:53	6	
1	9:10	17	
2	9:29	19	
3	9:50	23	Vis=36 Wt=9.5
4	10:14	24	
5	10:31	17	
6	10:45	14	
7	11:09	24	
8	11:30	21	
9	11:51	21	
3910	12:[illegible]	19	
11	12:[illegible]	22	
12	1:02	0	
13	1:26	23	
14	1:50	25	
15	2:13	23	Vis=36 Wt 9.6
16	2:33	20	
17	2:52	19	
18	3:12	15	
19	3:35	20	
3920	4:03	27	TRIP 4 hrs 43 min
1	8:44 / 8:57	12	
2	9:08	11	
3	9:19	11	
4	9:30	11	
5	9:42	12	Vis 35 Wt 9.5
6	10:12	30	
7	10:26	14	
8	10:40	14	
9	10:51	11	Vis 49 Wt 9.8
3930	11:02	11	
1	11:22	20	
2	11:43	21	
3	12:00	17	Hard [illegible] Sand
4	12:20	20	Quartzite [illegible]
5	12:38	18	[illegible]
3936	1:10	32	TRIP [illegible]

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY [illegible] FARM [illegible] WELL NO. [illegible]

SEC. TWP. RGE. LOC. COUNTY [illegible] STATE [illegible]

CONTRACTOR [illegible] SIZE HOLE [illegible] DRILL PIPE [illegible]

REMARKS: SIZE PUMP LINERS LENGTH STROKE

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3837	[illegible]	[illegible]	[illegible]
38	[illegible]	[illegible]	
39	[illegible]	7	
3840	3:50	18	
41	3:55	25	
42	4:03	8	
43	4:12	9	
44	[illegible]	23	
45	4:48	12	
46	[illegible]	9	
47	[illegible]	20	
48	[illegible]	3	
49	5:42	17	
3850	[illegible]	22	38 MIN [illegible]
1	[illegible]	15	[illegible]
2	12:15	10	
3	12:25	10	
4	12:[illegible]	8	[illegible]
5	12:51	8	
6	12:58	7	
7	1:04	6	[illegible]
8	1:10	6	
9	1:17	7	
3860	1:24	7	
1	1:31	7	
2	1:39	8	
3	1:47	8	
4	1:57	10	
5	2:11	14	[illegible]
6	2:34	23	
7	3:17	42	15 MIN CHECKING RIG
8	3:32 / 4:15	42	TRIP. 4 HRS
9	8:15 / 8:24	9	
3870	8:34	10	
71	8:44	10	
72	8:56	12	
73	9:06	10	
74	9:14	8	
75	9:24	10	
76	9:34	10	
77	9:48	14	
78	10:02	14	
79	10:12	10	
3880	10:20	8	
81	10:28	8	
82	10:38	10	
83	10:48	10	VIS = 38. WT = 9.1

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3884	11:55 / [illegible]	2	2 MIN CON
85	11:13	3	
86	11:23 / 11:51	18	27 MIN [illegible]
87	[illegible]	[illegible]	
88	[illegible]		
89	[illegible]	1	
3890	1:17	2	[illegible]
91	[illegible]	5	
92	[illegible]	15	
93	[illegible]	[illegible]	
94	7:17	[illegible]	
95	7:24	7	
96	7:44 / [illegible]	16	[illegible] rig 20 min
97	[illegible]	23	
98	9:05	42	
99	9:55	50	
3900	3:30 / 3:42	12	Trip to Reaming
1	3:50 / 3:59	9	8 MIN CHECKING RIG
2	4:09	10	
3	4:19	10	
4	4:38	9	VIS = 38 WT = [illegible]
5	4:34	6	
6	4:44	10	
7	4:50	6	
8	5:05	15	
9	5:23	18	
3910	6:05	42	
11	6:35	30	
12	7:03	28	TRIP
13	10:50 / 11:05	15	13 MIN CON.
3914	11:18 / 11:55	37	Down
15			Testing & running
16			pipe to drilling
17			two plugs
18			
19			
3920			
1			
2			
3			
4			
5			
6			
7			
8			
9			

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO. WICHITA, KAN.

COMPANY Wardell Duncan Co FARM Murray WELL NO.

SEC. TWP. RGE. LOC. COUNTY Cochise STATE Ariz.

CONTRACTOR Company SIZE HOLE 7 7/8" DRILL PIPE 4 1/2

REMARKS: Please [illegible] SIZE PUMP LINERS 7 LENGTH STROKE 12

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3918	[illegible]	20	Stopped drilling to
6	[illegible]	[illegible]	make tests & run pipe
7	[illegible]	[illegible]	
8	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	10:37	18	
[illegible]	10:53	16	
[illegible]	[illegible]	14	
5	11:21	14	
6	11:37	16	
7	11:43	16	
8	12:03	20	
9	12:23	20	[illegible] 92
3930	12:43	20	
1	1:03	20	
2	1:21	18	
3	1:35	14	
4	1:49	14	
5	2:07	18	
6	2:25	18	
7	2:45	20	
8	3:08	23	
9	3:26	18	
3940	3:38 / 4:PM	22	
41	4:20	20	
42	4:45	25	
43	5:09	24	
44	5:35	26	TRIP 4 HRS
45	9:35 / 9:53	18	
46	10:10	18	
47	10:27	17	
48	10:40	13	
49	10:58	18	
3950	11:16	18	
51	11:35	19	
52	11:50	15	
53	12:04	14	
54	12:20	16	
55	12:35	15	
56	12:47	12	
57	1:02	15	
58	1:18	16	
59	1:31	13	
3960	1:42	11	
61	1:53	11	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3962	[illegible]	9	
63	2:12	10	
64	2:22	10	
65	2:30	8	
66	2:54	24	
67	3:13	19	
68	3:32	19	
69	3:46	13	
3970	4:05	20	
71	[illegible]	15	[illegible] CON.
72	[illegible]	10	[illegible]
73	10:50	10	
74	10:59	9	
75	11:08	9	
76	11:18	10	
77	11:30	12	
78	11:42	12	
3979	11:[illegible]	12	
3980			

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell-Duncan Co. FARM Murray WELL NO. 1

SEC. TWP. RGE. LOC. COUNTY Cochise STATE Ariz.

CONTRACTOR Co. SIZE HOLE 7 7/8 DRILL PIPE 4 1/2

REMARKS: SIZE PUMP LINER 7" LENGTH STROKE 14"

DATE Oct. 26/50

DEPTH	TIME O'CLOCK	MIN.	REMARKS
3980	12:05	11	
1	12:15	10	
2	12:26	11	
3	12:37	11	
4	12:48	11	
5	12:59	11	
6	1:10	11	
7	1:20	10	
8	1:29	9	
9	1:40	11	
3990	1:53	13	
1	2:07	14	Rec. 3990 - Hallibrand
2	2:23	16	
3	2:41	18	
4	2:57	12	
5	3:09	12	
6	3:20	11	
7	3:32	12	
8	3:40 / 3:55	15	
9	4:11	16	
4000	4:23	12	8 MIN CON
1	4:31 / 4:40	9	
2	4:53	13	
3	5:09	17	
4	5:22	13	
5	5:35	13	
6	6:P.M.	25	4 HRS TRIP (W/K)
7	10:PM / 10:07	7	
8	10:14	7	
9	10:22	8	
4010	10:31	9	
11	10:41	10	
12	10:50	9	
13	11:P.M.	10	
14	11:10	10	
15	11:20	10	
16	11:32	12	
17	11:38 / 11:48	10	6 MIN. GREASING UP
18	11:55	7	
19	12:10	15	
4020	12:23	13	
21	12:35	12	
22	12:47	12	
23	1:00	13	
24	1:13	13	
25	1:28	15	
26	1:43	15	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
4027	1:55	12	
28	2:10	15	
29	2:28	18	
4030	2:43	15	
31	3:00	18	Trip. w/ F.
32	1:PM / 1:07	7	Mixing mud & Repairing
33	1:15	8	
34	1:22	7	
35	1:29	7	
6	1:35	6	
7	1:41	6	
8	1:47	6	
9	1:53	6	
4040	1:59	6	
1	2:05	6	
2	2:12	7	
3	2:18	6	
4	2:24	6	
5	2:30	6	
6	2:36	6	
7	2:42	6	
8	2:48	6	
9	2:55	7	
4050	3:04	9	
1	3:13	9	
4052	3:48 / 4:04	16	Circulating

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY Waddell-Duncan Co FARM Murray WELL NO. 2

SEC. TWP. 22 RGE. 27E LOC. COUNTY Cochise STATE Ariz

CONTRACTOR SIZE HOLE 7 7/8 DRILL PIPE 4 1/2

SIZE PUMP LINERS 7 LENGTH STROKE 18

REMARKS:

DATE Oct. 27

DEPTH	TIME O'CLOCK	MIN.	REMARKS
4053	4:20	16	
54	4:35	15	
55	4:48	13	Lost Circulation
56	4:~~11:33~~	15	A.M.
57	4:57	24	Trip. Lost circulation
58	11:20 ~~11:40~~	20	Oct-31
59	11:51	11	
4060	12:~~12:20~~	8	CONDITION 19 mi
1	12:29	9	
2	12:39	10	
3	12:53	14	
4	1:09	16	
5	1:26	17	
6	1:46	20	
7	2:02	18	Vis. 52 wt. 8.9
8	2:22	20	
9	2:40	18	
4070	2:57	17	
1	3:13	16	
2	3:27	14	
3	3:41	14	
4	3:55	14	
5	4:09	14	
6	4.23	14	
7	4.37	14	
8	4.52	15	
9	5.10	18	
4080	5.28	18	
1	5.44	16	
2	6.00	16	
3	6.17	17	
4	6.34	17	
5	6.50	16	
6	7.06	16	
7	7.21	15	
8	7.35	14	
9	7.49	14	
4090	8:03	14	
91	8:20	17	
92	8:38	18	
93	1:~~1:10~~	10	Trip
94	1:20	10	
95	1:30	10	
96	~~9:29~~ 9:32	12	Vis=43. wt=8.6
97	9:50	18	
98	10:04	14	
99	10:20	16	

DEPTH	TIME O'CLOCK	MIN.	REMARKS
4100	10:35	15	vis 44 wt = 8-9
1	10:53	18	
2	11:12	19	
3	11:30	18	vis 44 wt = 8-9
4	11:50	20	
5	12:12	22	
6	12:34	22	vis=43 wt = 8-9
7	12:56	22	
8	1:20	24	vis=40 wt = 8-9
9	1:44	24	
4110	2:07	23	
11	2:28	21	vis=40 wt = 8-9
12	2:52	24	
13	3:16	24	
14	3:40	24	vis=42 wt =
15	4:10	30	Trip
16	~~7:40~~ 7:52	12	
17	8:03	11	vis=37 wt = 8.5
18	8:14	[illegible]	
19	8:26	12	vis=55 wt. 8.[illegible]
4120	8:38	12	
1	8:51	13	vis=43 - wt 9.
2	~~9:09~~ 9:18	18	con. 9 mi.
3	9:36	18	
4	9:53	17	
5	10:09	16	vis=40 - wt 9.
6	10:26	17	
7	10:43	17	
8	11:07	24	
9	11:26	19	
4130	11:42	16	
1	12:00	18	vis.=40 - wt 9.
2	12:20	20	
3	12:42	22	
4	1.00	18	
5	1:22	22	vis. 43 - wt 9.
6	1:41	19	
7	2:00	19	
8	2:20	20	vis. 44 - wt 8.9
9	2:39	19	
4140	2:58	19	
1	3:25	27	
2			
3			
4			
5			

Missing 4141 — 4329

ROTARY DRILLING TIME SHEET # 503
KANSAS BLUE PRINT CO., WICHITA, KAN.

COMPANY [illegible] Duncan Co. FARM Murray WELL NO. 1

SEC. TWP. 22 RGE. 27 LOC. COUNTY Ford STATE Kan

CONTRACTOR SIZE HOLE 7 7/8 DRILL PIPE 4 1/2

REMARKS: 30-7 SIZE PUMP LINERS 7" LENGTH STROKE 14
30-2

DATE

DEPTH	TIME O'CLOCK	MIN.	REMARKS
4320	12:57	12	
1	1:10	13	
2	1:24	14	
3	1:38	14	
4	3:33 / 3:44	14	2Hr 6min. Con & work on motor
5	3:59	15	
6	4:15	16	
7	6:15 / 6:30	15	2 Hrs on motor
8	6:45	15	
9	7:45 / 8:00	15	1 Hr Down on motor
4340	8:12 / 8:25	15	10 min " " "
1	8:39	14	
2	8:53	14	
3	9:09	14	Vis 35 wt 8.6
4	9:21	14	
5	9:35	14	
6	9:50	15	
7	10:05	15	
8	10:21	16	
9	10:35	14	
4350	10:50	15	
1	11:05	15	Nov 11.
2	11:20	15	Vis 34 - wt 8.7
3	11:36	16	
4	11:50	14	
5	12:04	14	
6	12:19	15	
7	12:34	15	
8	12:49	15	
9	1:03	14	
4360	1:17	14	
1	1:32	15	
2	1:47	15	
3	2:02 / 3:32	16	connection & misc. 30 min.
4	2:49	16	
5	3:06	17	
6	3:25	19	
7	3:42	17	
8	3:59	17	
9	4:16	19	
4370	4:32	16	
1	4:47	15	
2	5:02	15	
3	5:18	16	
4	5:34	16	
5	5:50	16	Trip - 1 Hr. 25 min

DEPTH	TIME O'CLOCK	MIN.	REMARKS
6	10:15 / 10:30	[illegible]	
7	10:43	[illegible]	
8	10:54	11	
9	11:10	[illegible]	
4380	11:23	[illegible]	
1	11:36	[illegible]	
2	11:50	[illegible]	
3	11:59 / 12:09	[illegible]	5 min connection
4	12:25	[illegible]	
5	12:40	15	
6	12:50	[illegible]	
7	1:01	[illegible]	
8	1:18	[illegible]	
9	1:35	17	
4390	1:54	[illegible]	
1	2:10	16	
2	2:28	18	
3	2:46	18	
4	3:05	19	
5	3:19 / 3:30	12	8 min con.
6	3:45	15	
7	4:03	18	
8	4:20	17	
9	4:40	20	
4400	5:05	25	

ROTARY DRILLING TIME SHEET # 603.
KANSAS BLUE PRINT CO., WICHITA, KAN.

Annotated (2-24)

COMPANY: [illegible]
WELL: [illegible] No. 1
FIELD: [illegible]
LOCATION: [illegible] 5-22S-27E
COUNTY: COCHISE
STATE: ARIZONA
FILING No.

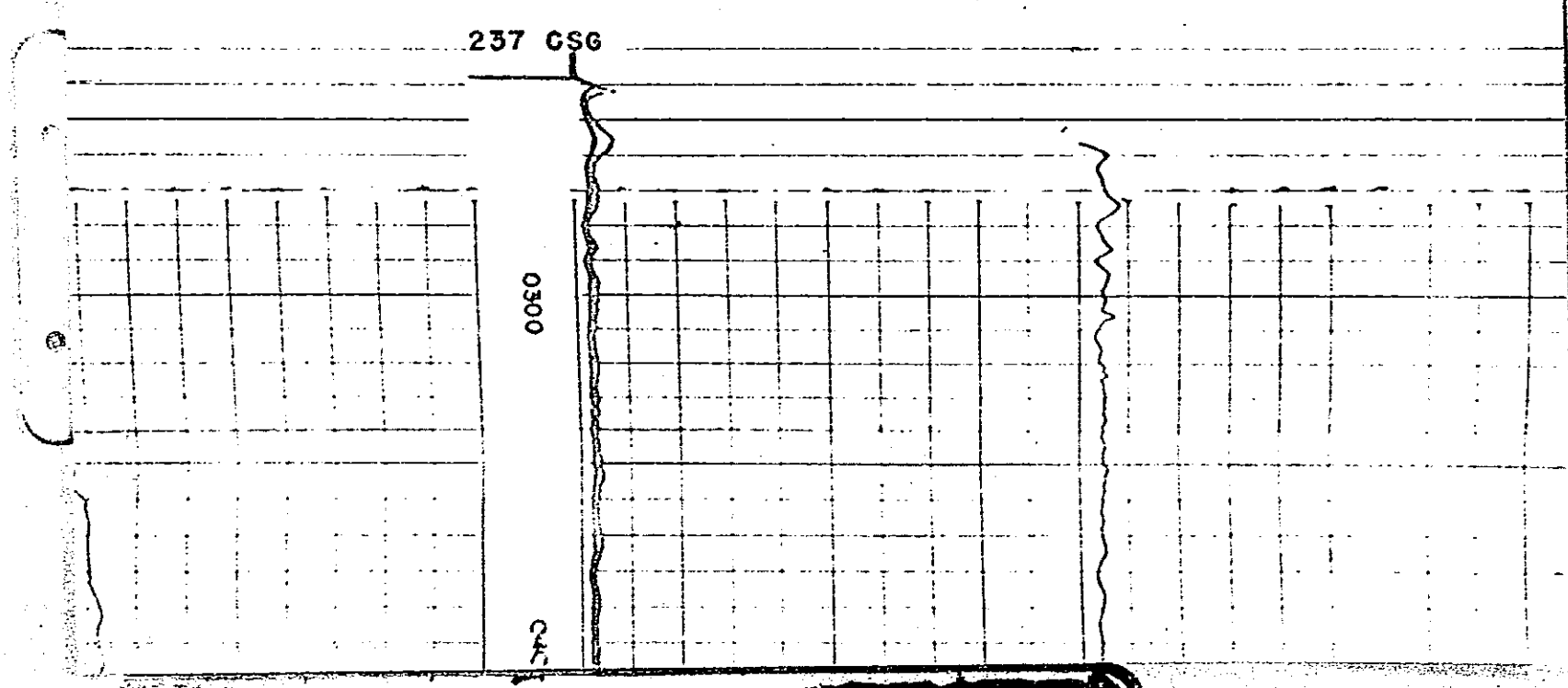
COMPANY: [illegible] CO.
WELL: [illegible] No. 1
FIELD OR
LOCATION: WILDCAT
COUNTY: COCHISE STATE: ARIZONA

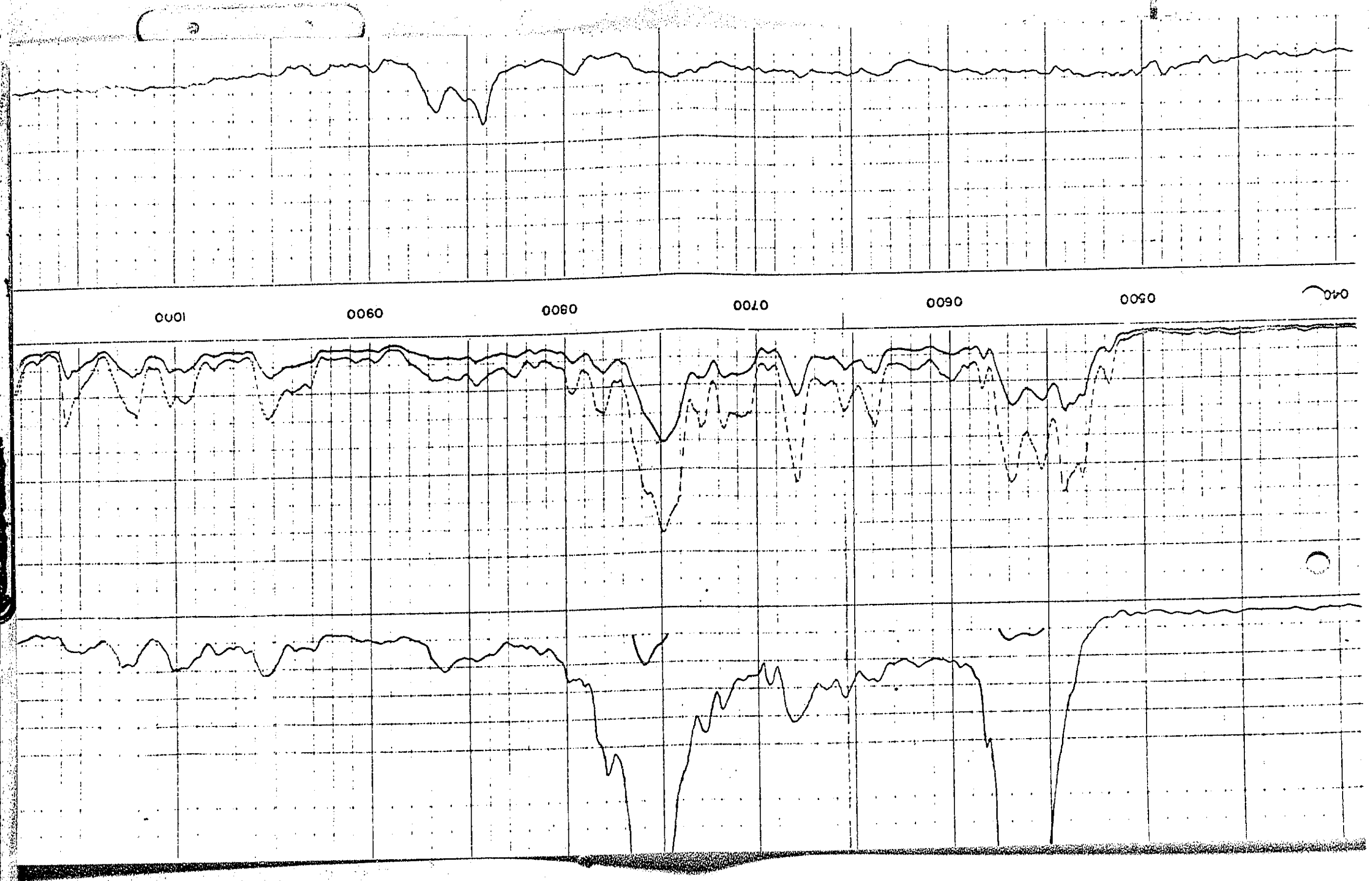
Run No.	1	2	3
Date	[illegible]		
First Reading	[illegible]		
Last Reading	237		
Footage Measured	237		
Csg Size & Setting	[illegible]		
Csg Driller	[illegible] (CSG)		
Hole Driller	[illegible]		
Hole Diameter	[illegible]		
Depth Driller	[illegible] CC 23° obtr. Gr.		
Mud Weight	[illegible]		
" Density	23		
" Viscosity	[illegible] @ 70°F	@ °F	@ °F
" Resistivity	3.6 @ 85°F	@ °F	@ °F
" pH	@ °F	@ °F	@ °F
" Water loss	CC 30 Min	CC/30 Min	CC/30 Min
Max. Rec. Temp. °F	95		
Est. Cement Top	2 5/8		
Cement Type	[illegible]		
Spacers	[illegible]		
Equipment	30		
Location	[illegible]		
Recorded by	[illegible]		
Witnessed by	[illegible]		

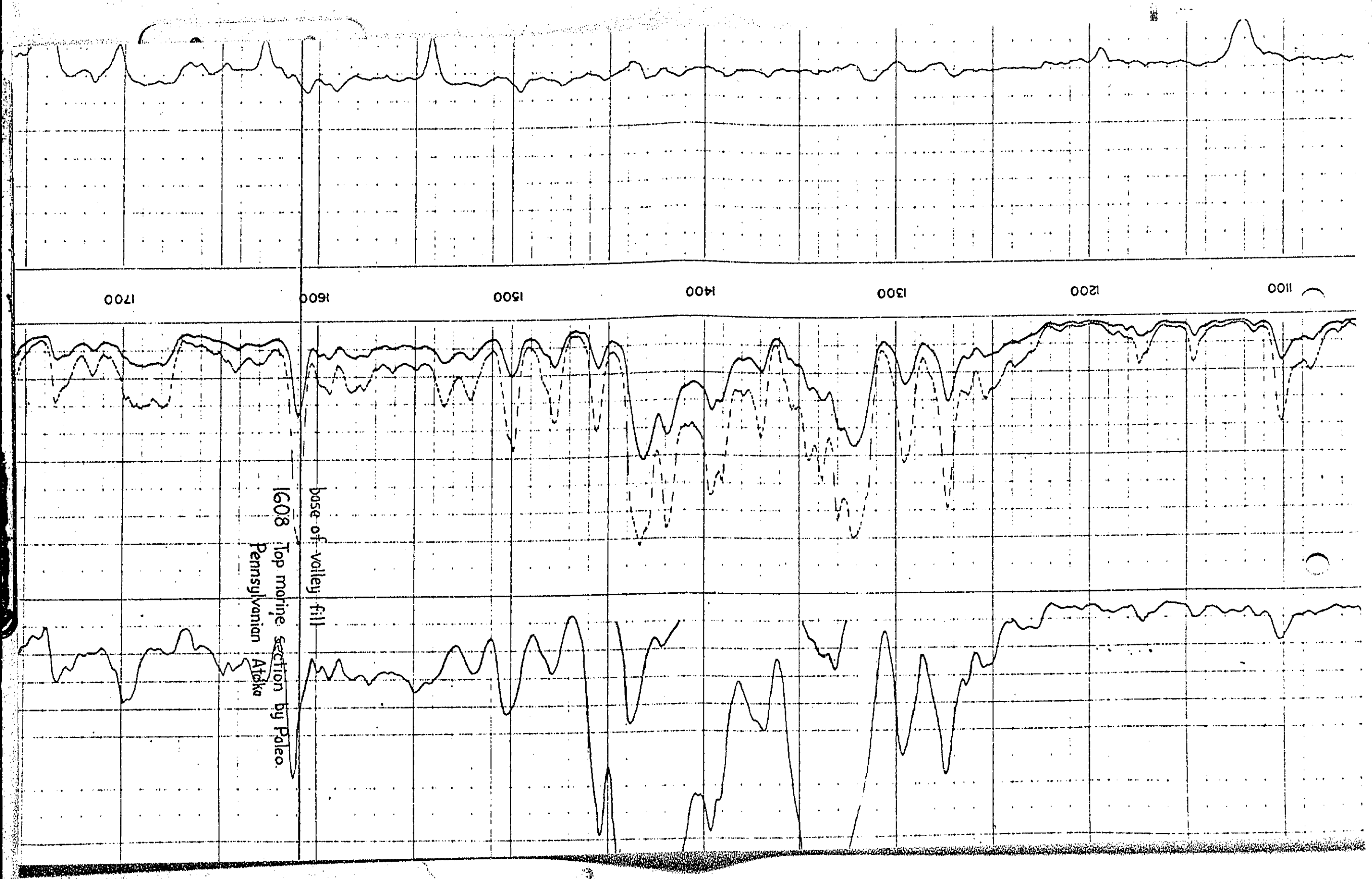
Elevation: D.F. ..... K.B. ..... G.L. .....

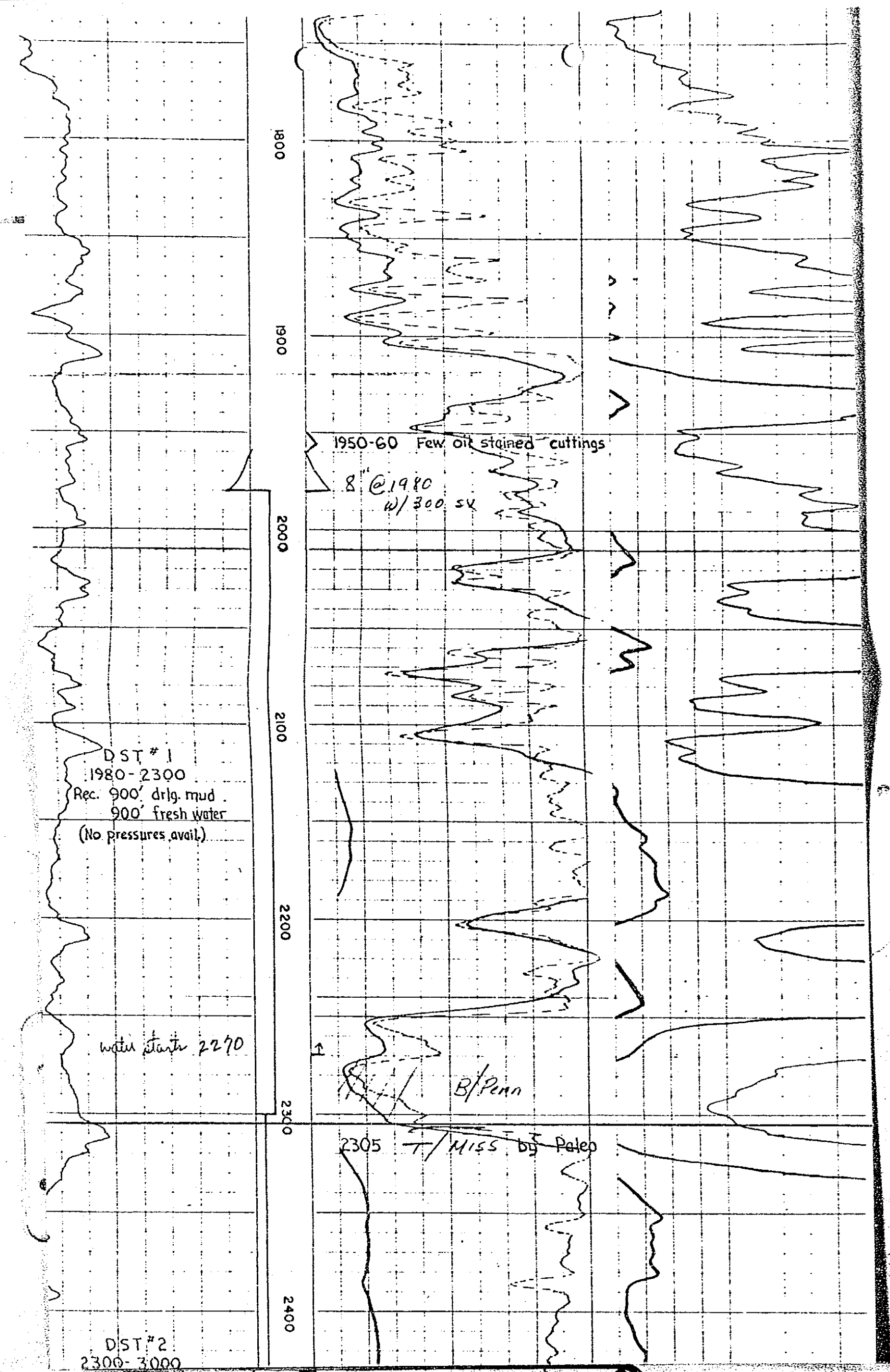
Mud sample from mud pit.

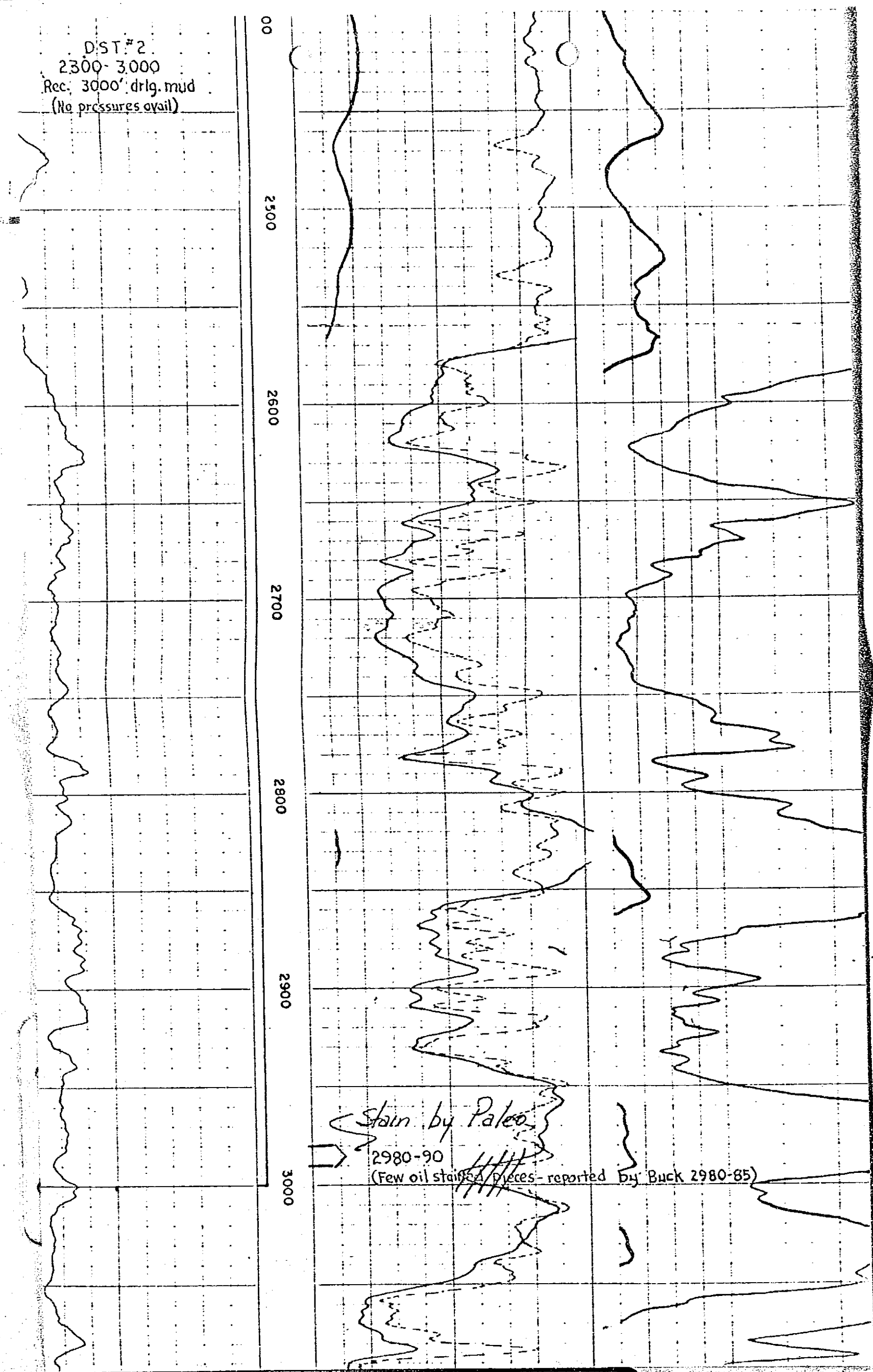
NATURAL POTENTIAL millivolts	DEPTHS	RESISTIVITY -ohms. m²/m.	RESISTIVITY -ohms. m²/m.
− |← 8 →| +		10" Normal 0 — 400; 0 — 4000	19' Lateral 0 — 20; 0 — 200; 20000
RADIOACTIVITY INCREASES —·—·—→		32" Limestone 0 — 200	

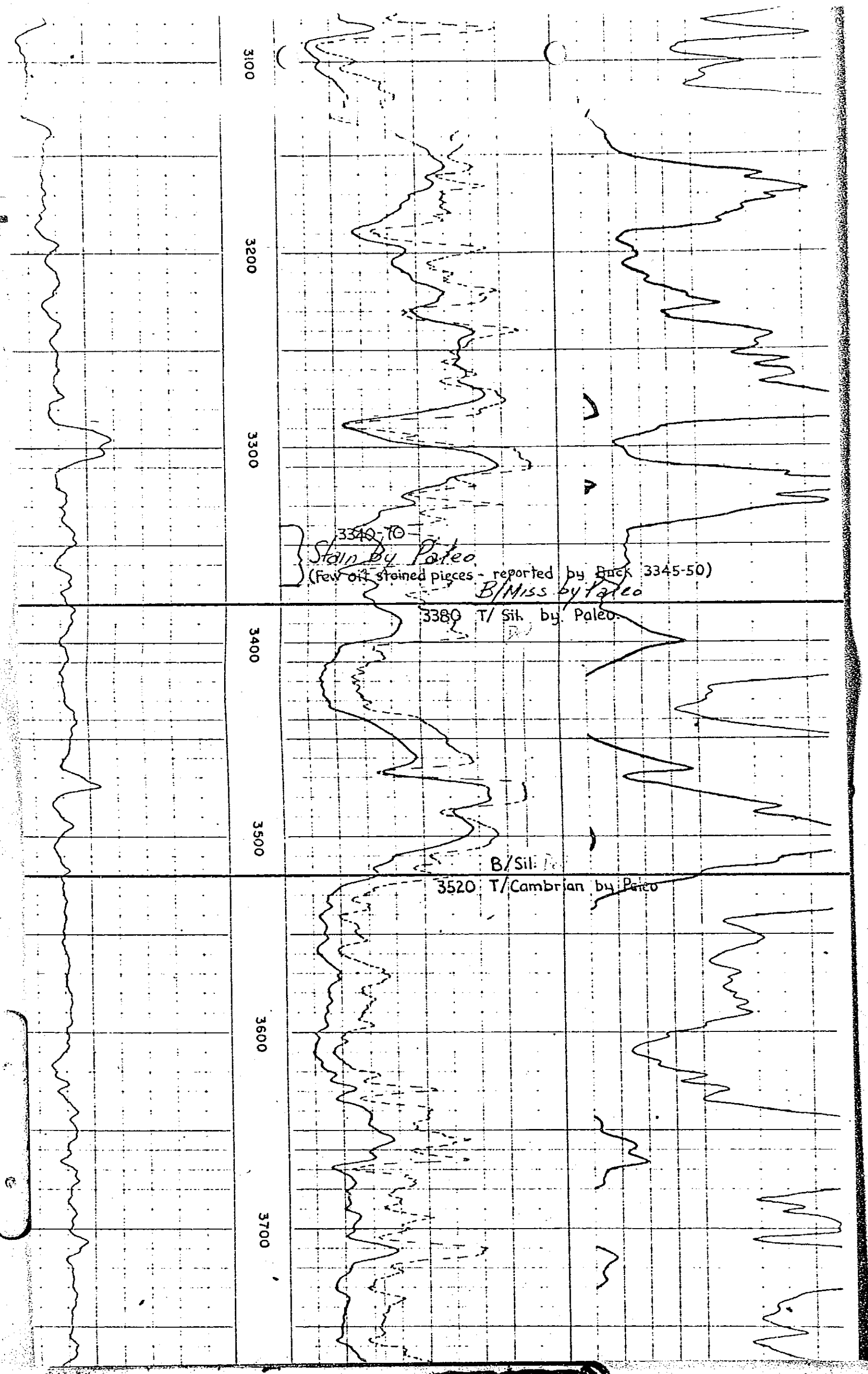


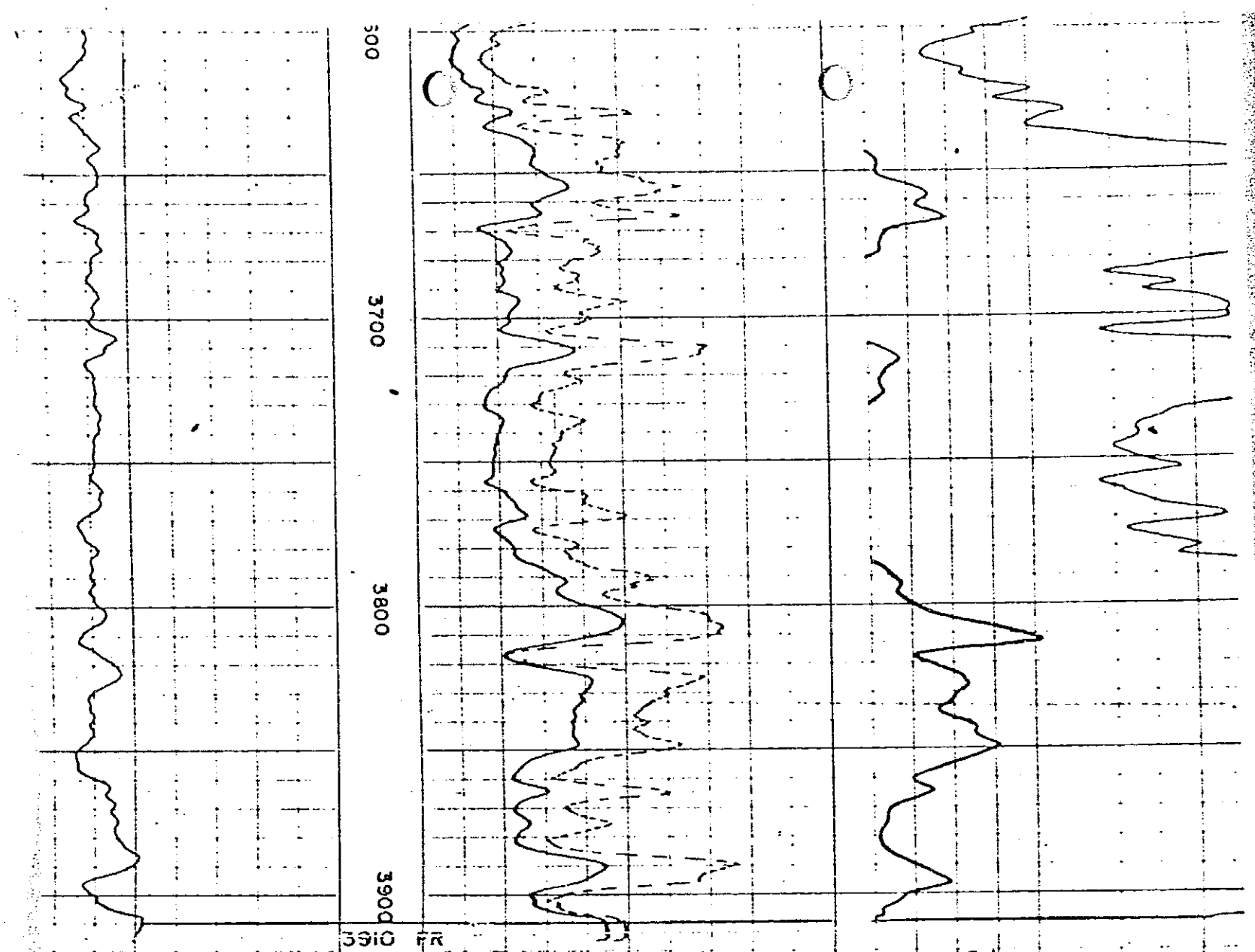

1000
0900
0800
0700
0600
0500
0400


1100
1200
1300
1400
1500
1600
1700
base of valley fill
1608 Top marine section by Paleo.
Pennsylvanian Atoka


1800
1900
2000
2100
2200
2300
2400
1950-60 Few oil stained cuttings
8" @1980
w/300 sx
DST # 1
1980-2300
Rec. 900' drlg. mud
900' fresh water
(No pressures avail.)
water start 2270
B/Penn
2305 T/Miss by Paleo
DST #2
2300-3000


DST #2
2300-3000
Rec. 3000' drlg. mud
(No pressures avail)
2500
2600
2700
2800
2900
3000
Stain by Paleo
2980-90
(Few oil stained pieces- reported by Buck 2980-85)


3100
3200
3300
3400
3500
3600
3700
3340-70
Stain By Paleo
(Few oil stained pieces - reported by Buck 3345-50)
B/Miss by Paleo
3380 T/ Sil. by Paleo
B/Sil.
3520 T/Cambrian by Paleo



Pre-Cambrian granite called at 3990 by Paleo.

TD 4400
Ran 4,000 / 5½"

OFFICE OF
Oil and Gas Conservation Commission
STATE OF ARIZONA
4515 NORTH 7TH AVE.
PHOENIX, ARIZONA 85013
PHONE: (602) 271-5161

April 7, 1971

Sr. Arsenio Navarro Galindo
Petroleos Mexicanos
Box 2406
El Paso, Texas 79952

Dear Sir:

In appreciation for your cooperation regarding the wells your company is drilling in Chihuahua, Mr. John Bannister has requested I send you all reliable information we have on wells drilled in southeastern Arizona.

Under separate cover I am sending you a number of electric logs on some of these wells. They are shown on the enclosed list.

Transmitted herewith is information on some of the above wells and on other wells in Cochise and Santa Cruz counties. We are sending you the data on all known Paleozoic tests as well as other tests indicating the thicknesses of the Qaternary and Tertiary formations in the Intermontane valleys.

The enclosed data includes the following:

Cochise County

Fraser #1 State Section 19-T21S-R23E
Sample Log by Loren Buck

R. B. Moncrief #1 Davis-Clark Section 5-T21S-R24E
The Am-Strat sample tops on this well are as follows:

Cretaceous	0'
Permo-Pennsylvanian	1135'
Mississippian	2520'
Devonian	3026'
Cambrian	3510'
Total Depth	3525'

Waddell-Duncan #1 Murray

Southwest Oil Company #1 Davis-Clark Section 5-T21S-R24E
Drill Stem Test #1
Sample Log
Letter report by Kenneth G. Smith (Continental Company). (We have no additional information as to how heavily oil cut the mud was in the drill stem test mentioned by Mr. Smith.)

Allen #1 Davis Section 25-T21S-R25E
The electric log of this well to a depth of 4947' sent under separate cover is of the original hole which was drilled to a total depth of 5450' ending in Tertiary (?) in 1953. In 1963 R. B. Moncrief set 9-5/8" casing at 385' and drilled a new hole to 4024' and made some tests.

Waddell-Duncan #1 Murray Section 5-T22S-R27E
Electric Log is included with this letter.
Tops: Loren Buck and Richard Hollingworth, both experienced geologists, have examined samples from this well. Their correlations differ slightly and a composite of them would be as follows:

Valley Fill	0'
Morita (shaley conglomerate)	560'
Naco	1610'
Mississippian	2305'
Devonian	3380'
Cambrian	3520'
Pre-Cambrian	3990'

Shows of gas and oil were reported from this well; and, casing was run and perforated at various levels but only 900' of water and 900' of mud was recovered.

Ari-Tex #1 Goins Section 4-T24S-R23E
No logs are available on this well but it is believed to have stopped in the Permian.

Thomson #2 State Section 2-T24S-R31E
This well is believed to have started and ended in the Naco group.

Santa Cruz County

R. L. Jones #1 Larimore Section 9-T20S-R16E
Halliburton Well Log is enclosed with this letter.

A relatively large number of wells drilled in Cochise County have reported shows of oil and gas including some of the wells for which we are sending you electric logs. We are unable at this time to determine which of these alleged

shows are authentic; although, apparently there have been some genuine shows of oil and gas in some wells.

Within a few days we expect to be able to send you a geologic report and maps of the Guadalupe Structure near the southeastern corner of Cochise County on which a deep test may be drilled this year. The proposed well will be located near the center of Section 2-T24S-R31E.

We trust the data we are sending you will prove of some value to you. We will be happy to answer any questions you may have regarding these wells.

Sincerely,

Edward A. Koester

Edward A. Koester
Staff Geologist

EAK:jd
Enc.

LIST OF DATA SENT TO SR. ARSENIO NAVARRO GALINDO

IN MAILING TUBE

Waddell-Duncan #1 McComb Section 23-T13S-R24E

Lane Wells Log
Electric Log

Arizona Oil & Gas #1 State Section 36-T14S-R30E

Micro-Log

R. B. Moncrief #1 State Section 17-T21S-R23E

Welex Tracer Logs #1 and #2
Simco Formation Log

Fraser #1 State Section 19-T21S-R23E

Radio Log

R. B. Moncrief #1 Davis-Clark Section 5-T21S-R24E

Induction Electric Log

Southwest Oil Company #1 Davis-Clark Section 5-T21S-R24E

Electric Log

Allen #1 Davis Section 25-T21S-R25E

Electric Log

FORM O. & G. 3

ARIZONA
STATE LAND DEPARTMENT

Lease or Permit No.....

Lessee's Monthly Report of Operations

WADDELL-DUNCAN CO. COCHISE AND GRAHAM COUNTIES, ARIZONA

The following is a correct report of operations and production (including drilling and producing wells) for the month of JULY 1950

Agent's Address Box 311, Willcox, Arizona

Company WADDELL-DUNCAN CO.

Signed

Telephone 185

Agent's Title

Section and ¼ of ¼	Township	Range	Days Produced	Barrels of Oil	Gravity	Cubic Feet of Gas (in Thousands)	Gallons of Gasoline	Barrels of Water (if None so State)	Remarks (if drilling, depth; if shutdown, cause; date and result of test for gasoline content of gas)
ERECTED LARGE DERRICK AND ROTARY RIG FOR 7500 Ft. TEST WELL									
SE¼NW¼, SECTION FIVE, TOWNSHIP 22S, RANGE 27 EAST, COCHISE County,									
CEMENTED THIRTEEN THREE EIGHTS INCH SURFACE CASING USING 125 SACKS									
CEMENT. HALLIBURTON OIL WELL CEMENTING CO. OF MIDLAND, TEXAS FINISHED									
RUNNING CEMENT AT DAYBREAK AUGUST FIRST. 1950									

NOTE:—There were NO runs or sales of oil; NO runs or sales of gas; ..... runs or sales of gasoline during the month. (Write "no" where applicable.)

NOTE:—Report on this form is required for each calendar month, regardless of the status of operations, and must be filed in triplicate with the Commissioner by the 6th of the succeeding month, unless otherwise directed by the Commissioner.

Approved:

Date

WADDELL-DUNCAN CO.
Company

By LLOYD DUNCAN Lloyd Duncan
Title

PARTNER BOX 311.
Address

Well Waddell-Duncan-Murray No. 1 Type Rig Rotary A B C D Location (D-22-27)5

Location sec. 5-T 22 S, R 27 E County Cochise Date begun

Date completed May 16, 1952 Run by R. E. Geer

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor Constituents	Major Constituents	Cement	Remarks
50'	Clayey sand	Medium brown 5YR4/4	Fine, angular to rounded.				
60'	Silty sand	Light brown 5YR6/4	do.				
70-90	Clayey sand	Medium brown 5YR4/4	do.				
100-110	Silty sand	Light brown 5YR6/4	do.				
120-150	Gravel	Pale red 10R6/2	Angular to rounded				Pebbles up to 20 mm. Volcanic material.
160-170	do.	do.					Pebbles up to 10 mm.
180-190	Pebbley sand	Grayish red 10R4/2	Very coarse to very fine				
200'	Gravel	do.	Angular to rounded.				50% granules. Pebbles max. 7 mm.
[illegible]-240	do.	do.	do.				Pebbles max. 7 mm. Considerable sand.
240'	do.	Pale red 10R6/2	do.				Volcanic material 80% 8 mm. in diameter.
250'	do.	do.	do.				Volcanic material 40% 8 mm.
260'	do.	do.	do.			Some calcite	do.
270-280	do.	do.	do.				Volcanic material 50% 8 mm.
290'	Pebbley sand.	do.	do.				Pebbles avg. 10 mm.

Well Waddell-Duncan-Murray Type Rig [illegible]otary A B C D [illegible]cation (D-22-27) 5

Location _____ sec. 5 T 22 S, R 27 E County Cochise Date begun _____

Date completed May 16, 1952 Run by R.E. Geer

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor Constituents	Composition: Major Constituents	Cement	Remarks
300	Sand with granules	Pale red 10R6/2	Angular to rounded				
310-350	Sand	do.	Very coarse to very fine, angular to rounded.				
360	Gravel	do.	Angular to rounded.				Well sorted; 95% pebbles, avg. 9 mm. of volcanic origin 50% rounded. Some dark limestone.
370	Pebbley sand	Light brownish gray 5YR6/1	do. Very coarse to very fine sand			Some calcite	Some dark gray limestone fragments with the volcanics.
380-390	do.	Pale red 10R6/2	do.			do.	do.
400	Gravel some silt	do.	Angular to rounded	Muscovite magnetite calcite chalcedony		do.	90% rocks of volcanic origin. 5% pink and white limestone.
410	Pebbley sand some silt	do.	Very coarse to very fine sand, angular to rounded.			do.	Pebbles max. 10 mm. avg. 5 mm. Volcanics and limestone.
420-490	Sand, some pebbles & silt	do.	do.			do.	Pebbles max. 5 mm. Volcanics & limestone
500-530	Pebbley coarse sand	do.	do.	Magnetite chalcedony calcite		Some calcite	95% rocks of volcanic origin 5% limestone

[illegible]

Well Waddell-Duncan-Murray Type Rig Rotary A B C D Location (D-22-27) 5

Location sec. 5 T 22 S, R 27 E County Cochise Date begun

Date completed May 16, 1952 Run by R.E. Geer

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor Constituents	Composition: Major Constituents	Cement	Remarks
540	Subgray-wacke	Pale red 10R6/2	Very coarse to very fine sand, angular to rounded. but 90% angular and subangular fragments	Magnetite chalcedony calcite		Silica, some calcite	Composed of the same or similar volcanic rocks as those in the shallower samples.
550-560	do.	do.	Angular & subangular, very few rounded.	do.		do.	do. Much tramp iron
570-580	do.	do.	Angular & subangular	do.		do.	
590	do.	do.	do.			do.	Fragments avg. only 2 mm.
600-610	do.	do.	do.	Magnetite chalcedony calcite		do.	do.
620	do.	do.	do.			do.	Considerable do. magnetite
630	do.	do.	do.				
640-670	do.	do.	do.			Silica, some calcite	
680	do.	do.	do.			do.	do. Considerable magnetite
690	do.	do.	do.			do.	
700-720	do.	do.	do.	do.		Silica	do. Calcite rhombs noticable. Less chalcedony than at 600'.
730	do.	do.	do. 15% rounded & subrounded	do.		do.	Coarser material than 700' avg. 2mm.

A B C D location (D-22-27)5

Well Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor Constituents	Composition: Major Constituents	Cement	Remarks
740-760	Subgraywacke	Pale red 10R6/2	Angular & subangular 15% rounded and subrounded			Silica	Some rounded pebbles up to 6mm. & calcareous gypsum(?)
770	do.	do.	Angular & subangular, 5% rounded and subrounded			do.	More fine & very fine material
780-790	do.	do.	Angular & subangular			do.	do. Few rounded grains.
800-880	do.	Grayish red 10R4/2	Angular & subangular	Magnetite chalcedony calcite		Silica, some calcite	Calcite rhombs less conspicuous than at 700 ft. Stains conspicuous of Limonite
[illegible]0	do.	Pale red 10R6/2	do.			do.	Color from 830-890 gradually becomes lighter
900	do.	do.	do.	Magnetite Chalcedony		Silica	No calcite or calcareous gypsum (?) Limonite stains much less conspicuous.
910-940	do.	Grayish red 10R4/2	do.			do.	
950-960	do.	do.	do. A very few rounded and subrounded.	do. Psilomelane (?) Calcite		Do. some calcite	
970-990	do.	do.	Angular & subangular				
1000-1050	do.	do.	do.	Magnetite Chalcedony Psilomelane(?)		Silica	Finer material than at 950', 20% med. to very fine frags.
[illegible]0-1080	do.	Grayish red 5R4/2	do.				
1090	do.	Pale red 10R6/2	do.	Magnetite, Calcite, Chalcedony		Silica & Calcite	Coarse to fine fragments.
1100-1190	do.	Grayish red 10R4/2	do.				

Well Waddell-Duncan-Murray

B C D location (D-23-27)5

Depth	Rock name	Color	Texture angularity size, shape	Composition Minor Constituents	Composition Major Constituents	Cement	Remarks
1200	Subgraywacke	Grayish red 10R4/2	Angular & subangular	Magnetite Calcite Chalcedony	Pink to dark gray felsites. Some purple andesite ? and also tuff.	Silica and Calcite	Some aragonite filling small fissures.
1210-1250	do.	do.	do.				Dark gray volcanic noticeable
1260	do.	do. & Dark gray N3	do.		60% a dark gray volcanic, possibly an altered gabbro & felsite		
1270-1290	do.	do.	do.		50% dark gray volcanic		
1300	do.	do.		Magnetite Calcite Chalcedony	do. Dark gray felsite & gabbro. Lighter colored felsite, tuff & andesite	do.	Some calcite rhombs
1310-1360	do.	do.	do.				Some rounded granules, probably from higher in the well.
1370	do.	do.	do.				Material<062 mm. very noticeable.
1380-1390	do.	do.	do.			do.	
1400	do.	do.	do.	Magnetite Chalcedony Calcite	70% dark gray gabbro(?)& felsite. 30% light colored andesite, felsite & some tuff		Much less magnetite and chalcedony than in previous samples
1410-1470	do.	do.	do.		70% dark volcanics		
1480	do.	do.	do.		80% dark volcanics		
1490	do.	do.	do.		50% dark volcanics		
1500	do.	Grayish red 10R4/2	do.	Magnetite Calcite some Chalcedony	80% gray & greenish gray felsite. 20% reddish brown felsite, andesite (?) & some tuff	do.	Washed sample is Blackish red 5R2/2 with a few light colored grains
1510-1530	do.	do.	do.				
1540-1550	do.	do.	do.				Some rounded grans.

A B C D location (D-22-27)5

Well Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor Constituents	Composition: Major Constituents	Cement	Remarks
1560	Subgraywacke	Grayish red 10R4/2	Angular & subangular				Considerable fine material & calcite cement
1570-1580	do.	do.	do.				
1590	do. & limestone	Grayish red 5R4/2 white grains noticeable	do.	Magnetite Calcite	Gray, greenish gray & brown felsite & andesite (?). Light colored tuff & Calcite. Aphanitic volcanics in equal proportions comprise 90% of the sample	Calcite some Silica	Some rounded pebbles and granules. Some limestone fragments.
			(Top Permian 1610 ±)	Buck and Hollingsworth			
1600-1610	do.	Brownish gray 5YR4/1	do. some rounded	do.			Some limestone
1620	do.	do.	do.				Considerably more limestone chips.
1630	do.	White & dark gray N3	Angular & subangular	do.	50% white & pink limestone 50% gray, greenish gray & brown felsite; some tuff	Calcite	Some rounded volcanic & limestone grain Sample appears to be washed.
1640	do.	Variegated, gray, pink & brown	do.	do.	70% felsite & some altered volcanics. 20% limestone 10% calcite cemented grains.	do.	do. Some dog-tooth calcite crystals.
50	do.	do.	do.	do.	Less limestone & cemented grains than at 1640	do.	Sample appears to be washed.
1660	do.	do.	do.	do.	15% limestone 80% volcanics including felsite, andesite, & diabase(?) Some brown quartzite	do.	Some rounded volcanics Clear calcite cement. Sample appears to be washed
1670	do.	Grayish orange pink 5YR4/2	do.			do.	Some well rounded grains - Raw sample (?)

A B c D location (D-22-27) 5

Well Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor Constituents	Composition: Major Constituents	Cement	Remarks
1680-1690	Subgraywacke & limestone	Grayish orange pink 5YR4/2	Angular & subangular			Calcite	
1700	do.	Washed sample variagated, brown gray & pink	do.	Magnetite calcite	15% limestone 80% volcanics, mostly felsite	do.	Finer material than 1660', avg. less than 2 mm in diameter.
1710-1750	Subgraywacke & limestone	Pale brown 5YR5/2	Angular & subangular, coarse to very fine.			do.	Silty?
1755	do.	Variagated, gray brown & white.	Angular & subangular, some rounded & subrounded.	do.	70% gray & brown felsite. 15% limestone 15% brown tuff, altered diabase(?) & some chert.	do.	Some limestone pebbles are well rounded. Sample appears to be washed.
1760	do.	Variagated dark gray & white.	do.		45% white or very light gray limestone 55% volcanics described at 1760.		Limestone fragments avg. 6 mm. Most are angular & subangular. Some volcanics are well rounded. Sample appears to be washed. Crinoid stems in one limestone chip.
1765	Limestone & subgraywacke	do.	Angular & subangular. Limestone is aphanitic.		80% gray & white limestone. 15% volcanics 5% chert		Fusulinius in limestone & chert. Some volcanics rounded.
1770-1785	Limestone some subgraywacke	do.	Aphanitic; angular & subangular				

no permit

Well Waddell-Duncan-Murray

A B C D location (D-22-27) 5

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor constituents	Composition: Major constituents	Cement	Remarks
1790	Sandy calcareous claystone	Medium light gray N6	Fine, sub-angular to rounded		85% claystone 10% volcanics 5% limestone		Claystone contains organic material & is probably a product of the drilling.
1795	Limestone	Variagated, dark gray & white	do.		50% limestone & sandy calcareous claystone. 50% angular to rounded.		Volcanics probably from above the Naco.
1800	do.	do. Some red & purple.	Angular & sub-angular, Aphanitic & fine grained limestone.		80% gray & white limestone. 5% pinklimestone 5% red " 5% purple "		Fragments avg. 15 mm. Some volcanics & sandy calcareous claystone.
1805	do.	Pink, light gray & white	do.		75% limestone 20% claystone		Some volcanics.
1810-1825	Limestone	Variagated dark gray to white, some pink.	Angular & sub-angular. Aphanitic; pink limestone is medium grained.				Some pink dog tooth calcite crystals.
30	Limestone Some silt-stone	do., Some red	do.		70% red, pink, gray & white limestone. 20% gray & shaley brown siltstone. 10% claystone & green mudstone.		Fusulinids very abundant in the pink limestone. Bryozoans & diatoms are also present in the limestones.
1840-1860	do.	do.	Angular & sub-angular, mostly aphanitic.				
1870-1890	do.	do.	do.				

No permit

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Well Waddell-Duncan-Murray

A B C D location (B-22-27) 5

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor constituents	Composition: Major constituents	Cement	Remarks
1900	Limestone, Some silt-stone	Variagated dark gray to white, Some pink & red.	Angular & sub-angular, mostly aphanitic.				Some white material similar to serpentine. 10% round pebbles may be from above.
1910	do.	do.	do.				Very little red silt-stone & pink lime-stone.
1920	Limestone	Medium gray to white Some pink.	Angular & sub-angular, aphanitic.				Many diatoms, some fusulinids.
1930-1950	do.	do.	do.				
1960	do.	do.	do.				Some dark red medium grained limestone.
1970-1980	do.	do.	do.				
1985	do.	do.	do.				Some pink dog tooth calcite.
1990-2000	do.	do.	do.				
2005	do.	do. Some purple	do.				5% purple siltstone.
2010-2020	Limestone & mudstone	Medium gray to white. Some purple & pink.	do.		80% limestone 20% mudstone		Mudstones purple.
2025-2030	do.	do.	do.		do.		Some dog tooth calcite crystals.

N. permit

Well Waddell-Duncan-Murray

A B C D location (D-22-27) 5

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor constituents	Composition: Major constituents	Cement	Remarks
2035	Limestone & mudstone	Medium gray to white. Some purple & pink.	Angular & sub-angular, aphanitic.		75% limestone 25% mudstone		
2040	do.	do.	do.		80% limestone 20% mudstone		
2045	do.	do.	do.		do.		Some reddish brown calcareous claystone.
2050	do.	do.	do.		do.		
2055	do.	do.	do.		85% limestone 15% mudstone		
2060	do.	do.	do.		do.		Some pink chert.
2065-2070	do.	do.	do.		80% limestone 20% mudstone		
2075	do.	do.	do.		do. Some green silty limestone with pyrite cubes.		Some agal or oblitic pink limestone. No ~~fusulinids~~. fusulinids
2080-2085	do.	do.	Angular & sub-angular, aphanitic. Some medium.		80% limestone 20% mudstone.		
2090-2095	do.	do. Some pale green	do.		70% limestone 20% mudstone 10% graywacke		Graywacke is pale green & containes pyrite cubes & serpantine.
2100	do.	do.	do.		do.		Some dog tooth calcite crystals.
2105	do.	do.	do.		do.		Dog tooth calcite crystals very noticable.
2110-2115	do.	do.	do.		do.		
2120-2125	do.	do.	do.		do.		Clear calcite rhombs

Per permit

Well Waddell-Duncan-Murray

A B C D location (D-22-27) 5

Depth	Rock name	Color	Texture angularity size, shape	Composition: Minor constituents	Composition: Major constituents	Cement	Remarks
2130	Limestone & mudstone	Medium gray to white. Some purple & pink. Some pale green.	Angular & sub-angular, aphanitic. Some medium.		80% limestone 15% mudstone 5% graywacke		
35	do.	do.	do.		60% limestone 30% mudstone 10% graywacke.		
2140-2145	do.	do.	do.		70% limestone 20% mudstone 10% graywacke		

There was an estimated flow of 75-100 gpm from this well. Temp. 129° F. approx.

No permit

Well Waddell-Duncan-Murray

(D-22-27)5

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2150-2155	Limestone and mudstone	Medium gray to white, some purple pink & pale green	Angular & subangular aphanitic, some medium grained	-	70% limestone 20% mudstone 10% graywacke	-	-
2[illegible]	do.	do.	do.	-	50% mudstone 35% limestone 15% graywacke	-	-
2165	do.	Purple and medium gray to white, some pink & green	do.	-	70% mudstone 20% limestone 10% graywacke	-	Some purple siltstones, contour glauconite, small amounts of chert
2170-2190	do. & some quartzite	Dark gray to white, some purple, pink and pale green	do.	-	40% mudstone 50% limestone 10% graywacke and dark gray quartzite	-	-
2195	do.	do.	do.	-	65% limestone 25% mudstone 10% graywacke & quartzite	-	-
2200-2210	Limestone & mudstone some quartzite	Medium dark gray to white, some purple, pink & pale green	do.	-	do.	-	30% of the limestone is buff and sandy

See remark

Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	COMPOSITION Major constituents	Cement	Remarks
2220-2235	Limestone & mudstone	Med. dark gray to white some purple, pink & pale green	Angular and subangular aphanitic, some med. grained	-	65% limestone 30% mudstone 5% graywacke and quartzite	-	-
2240	do. some conglomerate	do.	do.	-	60% limestone 25% mudstone 10% lime cemented conglomerate 5% graywacke and quartzite	-	-
2245	Limestone & mudstone	do.	do.	-	70% limestone 30% mudstone	-	-
2250-2255	do.	do.	do.	-	do.	-	Some chert, some medium-grained limestone
2260	do.	do.	do.	-	50% limestone 25% mudstone 25% altered volcanics & quartzite	-	
2265-2280	Quartzite & limestone, some shale	Pink & gray to white, medium some purple	do.	-	50% gray and some pink limestone 40% pink and some white quartzite 10% mudstone	-	50% of the limestone is med. grained. Some dog-tooth calcite. Quartzite is mostly aphanitic
2285	do.	do.	do.	-	75% pink quartzite, some white and gray 20% gray and pink limestone	-	Very little mudstone

No permeability

Waddell-Duncan-Murray

(D-22-27)5

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2290	Quartzite	Pink & med. gray to white, some purple	Angular and subangular aphanitic, some medium grained	-	80% quartzite 20% limestone	-	Very little mudstone
5	do.	do.	do.	-	90% quartzite 10% limestone	-	do.
2300-2305	do.	do.	do.	-	95% quartzite 5% limestone	-	do.
2310-2320	do.	do.	do.	-	90% quartzite 10% limestone	-	do.
2325-2335	Limestone	Med. gray to white, some pink and purple	Angular and subangular, aphanitic to coarse grained	-	80% limestone 15% quartzite 5% mudstone	-	-
2340	do.	do.	Angular and subangular, aphanitic to coarse grained, mostly med. grained	-	85% limestone 10% mudstone 5% quartzite		
2345	do.	do.	do.	-	95% limestone 5% mudstone, some quartzite	-	80% of limestone is medium grained, some chips contain unidentifiable brachiopod shells
2350	do.	do.	do.	-	90% limestone 10% mudstone	-	-

No permit

Waddell-Duncan-Murray

(D-22-27)5

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2355-2370	Limestone	Med. gray to white, some pink and purple	Angular and subangular, aphanitic to coarse grained, mostly med. grained	-	95% limestone 5% mudstone	-	One chip with a cup coral? fossil
5-2380	do.	Med. dark gray to white some pink and purple	Angular and subangular, med. and fine grained, some coarse grained and aphanitic	-	do.	-	-
2385-2400	do.	do.	do.	-	95% limestone 5% dark gray quartzite & some purple mudstone	-	-
2405	do.	do.	do.	-	95% limestone 5% mudstone		
10	do.	do.	do.	-	do.	-	More white limestone than in previous samples - roughly 50%
2415-2420	do.	do.	do.	-	do.	-	60% white limestone
2425-2450	do.	do.	do.	-	90% limestone 10% mudstone	-	Some chert

Per permit

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Depth	Rock name	Color	Texture Angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2455-2460	Limestone	Med. ~~dark~~ gray to white some pink & purple	Angular and subangular, med. and fine grained, some coarse grained & aphanitic	-	85% limestone 10% dense mudstone 5% shaley mudstone	-	Mudstone of previous samples has been, for the most part, shaley
2465-2470	do.	do.	do.	-	90% limestone 5% dense mudstone 5% shaley mudstone	-	Some quartzite
2475	do.	do.	do.	-	85% limestone 5% dense mudstone 5% shaley mudstone 5% pink quartzite		
2480	do.	do.	do.	-	70% limestone 30% mudstone, mostly dense	-	Some pink quartzite
2485	do.	do.	do.	-	60% limestone 40% dense mudstone	-	do.
2490-2505	do.	do.	do.	-	70% limestone 30% dense mudstone	-	do., most of the limestone is white medium grained
2510-2520	do.	do.	do.	-	80% limestone 20% dense mudstone	-	do.
2525-2530	do.	do.	do.	-	75% limestone 20% mudstone 5% quartzite and chert		

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Waddell-Duncan-Murray (D-22-27)5

Depth	Rock name	Color	Texture Angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2535-2540	Limestone	Med. dark gray to white some pink & purple	Angular and subangular, med. and fine grained, some coarse grained & aphanitic	-	80% limestone 20% mudstone	-	-
[illegible]	do.	do.	do.	-	80% limestone 10% mudstone 10% aphanitic reddish brown felsite		
2550-2555	do.	Med. gray to white some pink & purple	do.	-	70% limestone 15% mudstone 15% volcanics	-	Most of the limestone is pink
2560	do.	do.	do.	-	do.	-	do. Some fault breccia
2565-2575	do.	Pink & med. dark gray to white some purple	do.	-	80% limestone 10% mudstone 10% volcanics and dolomite(?)	-	-
2580-2590	do.	Pale red & med. dark gray to white, some purple	do.	-	90% limestone 10% mudstone and volcanics	-	80% fine granular limestone Pale red 10R6/2
2600	do.	do. & pink	do.	-	do.	-	90% pink & pale red, fine granular limestone
2605-2615	do.	do.	do.	-	do.	-	45% pink and red limestone 45% gray limestone

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17.

Waddell-Duncan-Murray

Depth	Rock name	Color	Texture Angularity Size, shape	COMPOSITION Minor constituents	COMPOSITION Major constituents	Cement	Remarks
2620-2635	Limestone	Pale red & pink, some med. dark gray to white	Angular and subangular, fine grained, some coarse and aphanitic	-	95% limestone 5% mudstone	-	20% of the limestone is gray
2640	do.	do.	do.	-	do.	-	40% of the limestone is gray
2645	do.	do.	do.	-	do.	-	10% of the limestone is gray
2650	do.	do.	do.	-	Limestone, no mudstone	-	do.
2655	do.	do.	do.	-	Limestone, some mudstone	-	15% of the limestone is gray
2660	do.	Pink & gray	do.	-	do.	-	50% of the limestone is gray
2665	do.	Med. gray to white, some pink	do.	-	do.	-	-
70	do.	do.	do.	-	do.	-	Some pink chert
2675	do.	do.	do.	-	Limestone, no mudstone	-	30% pink limestone
2680-2690	do.	Pale red and medium gray to white	do.	-	do.	-	50% pale red silty argillaceous limestone
2675-2700	do.	do.	do.	-	Limestone	-	70% pale red and pink limestone. 30% gray limestone

No permit

Waddell-Duncan-Murray

Depth	Rock name	Color	Texture Angularity size, shape	COMPOSITION Minor constituents	COMPOSITION Major constituents	Cement	Remarks
2705-2710	Limestone	Pale red & med. gray to white	Angular & subangular, fine grained some aphanitic	-	Limestone	-	20% fine grained argillaceous light gray limestone; 50% pink limestone 30% med. gray limestone
2715	do.	do.	do.	-	do.	-	50% fine grained argillaceous light gray limestone 35% pink limestone 15% med. gray limestone
2720	do.	Light gray some pale red and white	do.	-	do.	-	80% fine grained argillaceous limestone. Some chert
2725-2730	do.	do.	do.	-	do.	-	90% fine grained argillaceous limestone, light gray N7
2740	do.	Variegated pale red, med. gray & med. dark gray	do.	-	do.	-	50% do.
2745	do.	Med. gray & med. dark gray	do.	-	85% limestone 15% dark reddish brown felsite	-	do.
2750	do.	do.	do.	-	85% limestone 15% dark reddish brown felside(?) and mudstone	-	Some pale red sandstone cemented with calcite
2755	do.	do. some pale red & pink	do.	-	55% argillaceous limestone 30% sandstone 15% felsite (?) & mudstone		

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Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2765-2780	Limestone & sandstone	Variegated med. dark gray to white pale red and pink	Angular and subangular. Fine grained Some aphanitic	-	50% gray argillaceous limestone 50% pale red sandstone	-	Sandstone is impure and is cemented with magnesium, limestone. Sand grains are angular and very fine.
2770	do.	do.	do.	-	do.	-	-
2775	do.	do.	do.	-	do.	-	-
2780	do.	do.	do.	-	do.	-	-
2785	do.	do.	do.	-	55% sandstone 30% argillaceous limestone 10% mudstone	-	Some chert and dolomite
2790-2805	do.	do.	do.	-	48% sandstone 48% argillaceous limestone	-	do.
2810	do.	do.	do.	-	do.	-	Some volcanics and pale red quartzite
2815	Sandstone limestone quartzite	Variegated pale red & pink, some gray & white	Angular and subangular. Fine and very fine grained. Some coarse	-	50% sandstone 30% argillaceous limestone 10% pale red purple quartzite	-	Some dolomite and mudstone. Quartzite is coarse grained
2820	do.	do.	do.	-	35% sandstone 20% argillaceous limestone 15% quartzite 10% gray limestone 15% sandstone	-	Some dolomite

No permit

Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2825	Sandstone, limestone, quartzite	Variegated pale red & pink, some gray, and white	Angular and subangular. Fine and very fine grained, some coarse	-	60% pink and pale red sandstone 20% quartzite 15% gray limestone	-	Some mudstone. Quartzite contains granules
2830	do.	Pink and light gray, some pale red, purple and white	do.	-	80% sandstone 15% quartzite 5% mudstone	-	Sandstone cemented by dolomite. Grains are very fine and angular. Gradational, may be considered a quartzite
2835	Sandstone	do.	-	-	85% sandstone 10% mudstone 5% quartzite		
2840-2850	do.	do.	-	-	sandstone	-	Some mudstone and quartzite
2855	do.	do.	-	-	do.	-	do. More calcite cement in sandstone
2860	do.	do.	-	-	do.	-	do.
2865	do.	do.	-	-	do.	-	do.
2870-2875	do.	Pale red and med. gray to light gray	Angular and subangular, fine	-	Fine sandstone cemented by calcite	-	Some mudstone
2880	do.	do.	do.	-	-	-	Some gray dolomite
2885-2890	Sandstone & dolomite	do.	do.	-	50% gray dolomite 50% pale red sandstone	-	Dolomite is very sandy. Some mudstone

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The Permit

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
2895	Sandstone & dolomite	Pale red and medium gray to light gray	Angular and subangular, fine.	-	60% gray dolomite 40% sandstone	-	Some dark gray impure dolomite
2905-2915	do.	Pale red and dark gray to light gray	do.	-	40% medium gray dolomite 40% dark gray dolomite 20% sandstone	-	-
2920-2925	do.	do.	do.	-	35% medium gray dolomite 35% dark gray dolomite 30% sandstone	-	Some soft pale green limestone
2930-2935	do.	do.	do.	-	40% medium gray dolomite 40% sandstone 20% dark gray dolomite	-	Considerable chert
2940-2950	Dolomite & sandstone	do.	do.	-	60% medium gray dolomite 25% sandstone 15% dark gray dolomite	-	Some chert. Sandstone is lighter colored and contains fewer sand grains
2955	do.	do.	do.	-	50% medium gray dolomite 30% dark gray dolomite 25% sandstone	-	Some volcanics, mudstone, and grayish orange pink dolomite

No permit

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	COMPOSITION Major constituents	Cement	Remarks
2960-2975	Dolomite	~~[illegible]~~ grayish orange pink, pale red & dark grey to light gray	angular and subangular, fine	-	80% medium gray to grayish orange pink dolomite 10% dark gray dolomite 10% sandstone	-	Pink dolomite contains very few sand grains. Considerable chert. Some mudstone
2980-2990	do.	do.	do.	do	do. but 70% medium gray and pink dolomite & 10% light gray quartzite	-	Considerable chert
2995	Dolomite & sandstone	do.	do.	-	80% pink and gray dolomite in equal proportions 10% sandstone 10% quartzite	-	Considerable chert. Some mudstone
3000-3015	do.	do.	do.	-	do.	-	Some mudstone and chert
3020	do.	do.	do.	-	70% dolomite 10% sandstone 10% quartzite 10% mudstone	-	Some chert & black bituminous shale
3025-3040	do.	do.	do.	-	do.	-	Some chert. Some sandstone contains glauconite (?)
3045	do.	do.	do.	-	75% dolomite 10% sandstone 10% quartzite 5% mudstone	-	Some medium grained red sandstone

No permit

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Waddell-Duncan-Murray (D-22-27)5

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3050	Sandstone & dolomite	Dark reddish brown, some gray, pink, and white	Angular and subangular. Fine and medium	-	60% sandstone 20% pink & gray dolomite 10% mudstone 5% quartzite	-	Reddish brown sandstone contains angular medium & fine quartz grain cemented by calcite, silica and some hematite. Considerable red tinted dog tooth calcite and clear calcite rhombs
3055	Sandstone	do.	do.	-	75% sandstone 10% clear calcite 15% dolomite, mudstone and quartzite	-	Much of the cement appears to be dog tooth calcite
3060	Sandstone and dolomite	do.	do.	-	45% sandstone 40% pink and gray dolomite 10% dark gray limestone	-	Some mudstone and clear caldite rhombs
3065	Dolomite & sandstone	Gray, pink & white, Some dark reddish brown	do.	-	20% sandstone 70% pink and gray dolomite 10% dark gray limestone & mudstone	-	Considerable chert. Some of the dolomite is sandy. Some grayish orange pink sandstone
3070	Sandstone & dolomite	Grayish orange pink Some gray, pink & white	Angular and subangular, fine	-	80% impure grayish orange pink sandstone 15% pink & gray dolomite	-	Some mudstone and chert. Dolomite seems to grade into the impure sandstone. Sandstone contains glauconite (?)

24.

See permit

Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3075	sandstone & dolomite	Grayish orange pink and medium gray, some pink and white	Angular and subangular, fine	-	70% grayish orange pink sandstone 25% dolomite 5% quartzite	-	Some calcite rhombs and mudstone
3080	do.	do.	do.	-	50% sandstone 50% dolomite	-	do.
3085	do.	do.	do.	-	75% dolomite 25% sandstone	-	Sandstone seems to grade into sandy dolomite and dolomite all are impure and usually contain glauconite?
3090	do.	do.	do.	-	do.	-	Some chert
3095-3100	Dolomite	do.	do.	-	80% dolomite 10% reddish brown sandstone 10% grayish orange pink sandstone	-	Reddish brown sandstone is probably from 3055
3105-3110	do.	do.	do.	-	do.	-	do. 25% gray dolomite
3115-3120	do.	do.	do.	-	do.	-	15% gray dolomite. Some chert. Reddish brown sandstone is probably from 3055
3125	do.	Grayish orange pink & medium light gray	Angular and subangular fine	-	80% pink dolomite 20% gray dolomite	-	Considerable chert. Dolomite seems to contain the same minerals but have a slightly different color. Limestones contain glauconite (?). Some sandstone.

No permit

25.

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3190	Dolomite	Grayish orange pink, medium light and dark gray Some dark reddish brown	Angular and Subangular Fine and some medium	-	50% gray dolomite 20% pink dolomite 20% reddish brown sandstone 10% dark gray quartzite	-	Sandstone same as at 3055
3195-3200	do.	do.	do.	-	60% gray dolomite 20% pink dolomite 15% gray and white quartzite. 5% sandstone		
3205-3210	do.	do. but no dark reddish brown	do.	-	65% gray dolomite 20% pink dolomite 15% gray and white quartzite	-	No reddish brown sandstone
3215	do.	do.	do.	-	do.	-	Some reddish brown sandstone
3220	do.	do.	do.	-	do.	-	-
3225-3235	Dolomite & sandstone	Grayish orange pink & medium to light gray. Dark reddish brown sandstone	do.	-	50% sandstone 45% dolomite	-	Sandstone is same as at 3055. Some quartzite & very light sandstone. Glauconite (?) in most of the fragments.
3240	do.	do.	do.	-	85% dolomite 10% sandstone		
3245	do.	do.	do.	-	90% dolomite 5% sandstone	-	-

No permit

Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3130	Dolomite	Grayish orange pink & medium light gray	Angular and subangular fine	-	70% pink dolomite 20% gray dolomite 10% sandstone	-	Sandstone is probably from 3055
3135	do.	do.	do.	-	80% pink dolomite 20% gray dolomite	-	-
3140-3145	do.	do.	do.	-	70% pink dolomite 30% gray dolomite	-	-
3150	do.	do.	do.	-	60% pink dolomite 40% gray dolomite	-	-
3155	do.	do.	do.	-	60% gray dolomite 40% pink dolomite	-	-
3160	do.	do. and light gray	do. some medium	-	70% gray dolomite 30% pink dolomite	-	Some of the light gray dolomite contains medium sized quartz grains
3165	do.	do.	do.	-	60% gray dolomite 40% pink dolomite	-	do. Some white quartzite
3170-3175	do.	do.	do.	-	do.	-	do. more quartz grains in dolomite
3180	do.	do.	do.	-	70% gray dolomite 20% pink dolomite ~~10% dark gray quartzite~~	-	Some white quartzite. Considerably more quartz grains particularly in the darker dolomite
3185	do.	do. Some medium dark gray	do.	-	70% gray dolomite 20% pink dolomite 10% dark gray quartzite	-	-

No permit

26.

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3250-3260	Dolomite	Grayish orange pink and medium to light gray	Angular and subangular, fine and medium	do.	-	-	-
3270-3275	do.	do.	do.	-	-	-	Some mudstone and chert
[illegible]0	do.	do.	do.	-	-	-	do. Also some pure light gray and white limestone
3285	do.	do.	do.	-	-	-	Dolomite seems to grade into sandy dolomite and quartzite
3290-3295	Dolomite, some quartzite and sandstone	do.	do.	-	-	-	Some green and dark red mudstone. Nearly all fragments contain glauconite (?)
3300-3310	do.	do. some medium dark gray	do.	-	-	-	Most of the medium dark gray rock is a partly dolomitic quartzite containing a considerable amount of glauconite (?)
3315	do.	Grayish orange & medium gray to light gray	do.	-	-	-	-
3320	do.	do.	do.	-	-	-	Some pale red sandstone and green mudstone
3325-3340	do.	do.	do.	-	-	-	Some pale red sandstone & purple mudstone

No permit

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Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3340-3350	Dolomite, some quartzite and sandstone	Grayish orange pink and dark gray to light gray	Angular and subangular Fine and Medium	-	-	-	Some dark gray micaceous mudstone and reddish brown mudstone. Also small amounts of quartzite and sandstone.
3355-3360	do.	do.	do. some aphanitic	-	-	-	5% dark gray micaceous mudstone. Some pure limestone
3365-3375	do. and mudstone	do.	do.	-	-	-	10% micaceous mudstone. Some pure limestone
3380	do.	do.	do.	-	85% dolomite 13% mudstone	-	Some pure limestone. Micaceous mudstone appears to occur as thin layers in a grayish orange pink and light gray, fine-grained glauconitic (?) sandstone.
3385-3390	do.	do.	do.	-	do.	-	do. Much of the micaceous mudstone is very fissil
3395	Dolomite, limestone, & mudstone	Variegated grayish orange pink, dark reddish brown and dark gray to very light gray	do.	-	85% dolomite and limestone 13% red and gray mudstone	-	Much of the red mudstone is also micaceous. Some sandstone.
3400-3405	do.	do.	do.	-	80% dolomite and limestone 20% mudstone	-	Some olive green and tan micaceous mudstone. Also small amounts of quartzite and sandstone.
3410-3420	do.	do.	do.	-	75% dolomite and limestone 25% mudstone	-	Dolomite and glauconite not as prevalent.

No permit

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Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3425	Dolomite, limestone, & mudstone	Variegated grayish orange pink, dark reddish brown and dark gray to very light gray	Angular and subangular Fine and aphanitic. Some medium	-	90% dolomite and limestone 10% mudstone	-	20% medium gray dolomite
3430	do.	do.	do.	-	50% dolomite and limestone 50% mudstone	-	50% medium gray micaceous mudstone
3435	do.	do.	do.	-	-	-	Considerable dolomite and volcanics. Probably a contaminated sample.
3440	Limestone & mudstone, very little dolomite	Medium dark gray, some light gray	Do. but no medium	-	-	-	Most of the sample is medium gray limestone and mudstone. Limestone contains finely striated shell fragments.
3445	Limestone & mudstone	Medium gray some lighter gray	do.	-	80% limestone 20% mudstone	-	Micaceous mudstone appears to grade into the limestone
3450	do.	do.	do.	-	do.	-	-
3455	do.	do. some grayish orange pink	do.	-	do.	-	Some grayish orange pink limestone
3460-3465	do.	do. some dark reddish brown	do.	-	do.	-	Do. some dark reddish brown mudstone

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Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3470	Limestone & mudstone	Medium to light gray, grayish orange pink, some dark reddish brown	Angular and subangular. Fine and aphanitic	-	80% limestone 20% mudstone	-	Some small brachiopods average 1 mm in diameter
3475-3485	Limestone some mudstone	Variegated medium gray to white, grayish orange pink, dark reddish brown and grayish green	do.	-	95% limestone 5% mudstone	-	Some green limestone
3490-3500	do.	do.	do.	-	do.	-	50% very light gray limestone
3505-3510	Limestone, volcanics & mudstone	Dark gray to very light gray, grayish orange pink	do.	-	60% limestone 35% volcanics 5% mudstone	-	Volcanic material is similar to that between 540 feet and 1750 feet. Probably a contaminated sample.
3515-3520	do.	do.	do.	-	60% volcanics 35% limestone 5% mudstone	-	do.
3525	do.	do.	do.	-	65% limestone 25% volcanics 10% mudstone	-	do.
3530	do.	do.	do.	-	80% limestone 10% volcanics 10% mudstone	-	do.

No permit

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3535-3540	Limestone & mudstone	Dark gray to very light gray, little grayish orange pink	Angular and subangular. Fine and aphanitic	-	90% limestone 10% mudstone	-	Very little siltstone. Most of the mudstone is dark greenish gray
3545-3550	do.	do.	do.	-	do.	-	Most of the mudstone is also a slightly micaceous claystone
3555	do.	do.	do.	-	85% limestone 15% mudstone	-	-
3560	do.	do.	do.	-	do.	-	Some reddish brown mudstone
3565-3570	do.	Dark gray to very light gray	do.	-	80% limestone 20% mudstone	-	20% greenish gray mudstone
3575	do.	do.	do.	-	60% limestone 40% mudstone	-	-
3580	do.	do.	do.	-	90% limestone 10% mudstone	-	Some shell fragments in a light gray limestone
3585-3625	do.	do.	do.	-	Contaminated	-	Approximately 80% limestone and 20% mudstone
3630	do.	do.	do.	-	80% limestone 20% mudstone	-	Some sandy dolomitic limestone
3635-3650	do.	do.	do.	-	do.	-	do. Much of the limestone contains silt.
3655	do.	do.	do.	-	Contaminated	-	-

No permit

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Waddell-Duncan-Murray

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	COMPOSITION Major constituents	Cement	Remarks
3660-3670	Limestone & mudstone	Dark gray to very light gray	Angular and subangular. Fine and aphanitic	-	80% limestone 20% mudstone	-	Some purple mudstone
3675	do.	do.	do.	-	75% limestone 25% mudstone	-	Some dark sandstone containing pyrite
3680	do.	do.	do.	-	80% limestone 15% mudstone	-	Considerable sandstone
3685-3700	Sandstone, limestone, & mudstone	do.	do.	-	60% sandstone 25% limestone 15% mudstone	-	Most of the sample is medium gray and medium dark gray impure sandstone containing clay, mica, calcite and some glauconite Some of the sandstone is siliceous
3705-3725	do.	do.	do.	-	75% sandstone 15% limestone 10% mudstone	-	Considerable silt in the sandstone
3730-3750	do.	do.	do.	-	80% sandstone 15% limestone 5% mudstone	-	Sandstone same as that at 3705 feet Some white and pink quartzite.
3755-3765	do.	do.	do.	-	70% sandstone 10% limestone 20% mudstone	-	Most of the mudstone is still a greenish gray claystone
3770	do.	do.	do.	-	-	-	Partly contaminated but approximately 40% claystone
3775	do.	do.	do.	-	-	-	Some white quartzite
3780-3795	do.	do.	do.	~~65% sandstone~~	65% sandstone 15% limestone 20% mudstone	-	do. Contaminated

No permit

Waddell-Duncan-Murray (D-22-27)5

Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3805-3820	Quartzite, sandstone, limestone and some mudstone	Dark gray to white	Angular and subangular. Coarse, fine and aphanitic	-	40% coarse grained white quartzite	-	Contaminate.
3825	do.	do. some grayish orange pink 10R 8/2	do.	-	70% quartzite 30% sandstone, limestone and mudstone	-	Some pink quartzite containing calcite. Sandstone same as at 3685 feet.
3830	do.	do.	do.	-	-	-	Some pink sandstone
3835	do.	do.	do.	-	30% coarse grained quartzite 25% sericite (?)	-	Considerable amount of a pale green stoney rock - possibly sericite. Contaminated
3840-3845	do.	do.	do.	-	25% quartzite 30% sericite (?)	-	Contaminated
3850-3855	Quartzite	Moderate orange pink, some dark gray to white	Angular coarse	-	70% quartzite 10% sericite (?)	-	Most of the quartzite is moderate orange pink
3860	do.	do.	do.	-	do.	More grayish orange pink quartzite	
3865-3870	do.	do.	do.	-	85% quartzite	-	Very little green
3875	do.	do.	do.	-	Contaminated	-	Considerable white quartzite
3880	do.	do.	do.	-	do.	-	do. Some medium gray fine grained quartzite. Contaminated

Mr. Dermot

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Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3885	Quartzite & sandstone	Medium gray some pink and white	Angular and subangular. Coarse and fine	-	50% fine grained partly siliceous sandstone. 15% coarse grained white and pink quartz Contaminated	-	Some gray coarse grained quartzite. Sandstone similar to that at 3685 ft. Contaminated.
90	do.	do.	do.	-	90% sandstone similar to that at 3685 feet	-	Very little coarse grained quartzite. Contaminated.
3895	do.	do.	do.	-	90% sandstone similar to that at 3685 feet	-	Very little coarse grained quartzite. Samples 3885-3895 may have been incorrectly labeled.
3905	do.	Grayish orange pink, white and medium gray	do.	-	40% coarse grained pink and white quartzite	-	Contaminated
3910-3915	Quartzite	do. but very little gray	Angular, some subangular. Coarse medium and fine	-	55% do.	-	Most of the quartzite is coarse grained but some is fine and medium grained. Quartzite contains some feldspar
3920-3935	Quartzite and arkose	do.	do.	-	80% quartzite 20% arkose	-	Arkose composed of quartz, feldspar, specular hematite and chlorite, pink orthoclase is the dominant feldspar
3940-3955	Arkose & quartzite	do.	do.	-	30% arkose 10% quartzite	-	Contaminated

No permit

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Depth	Rock name	Color	Texture angularity size, shape	COMPOSITION Minor constituents	Major constituents	Cement	Remarks
3960-3990	Arkose and quartzite	Grayish orange pink 10R8/2 and white	Angular, some subangular. Coarse, medium and fine.	-	35% arkose 25% quartzite	-	Contaminated
3995-4015	Granite(?)	Grayish Orange pink 10R8/2, light red and white	do.	-	-	-	Red orthoclase very noticeable. Contaminated.
4020-4105	Granite	do. plus pale yellowish green	do.	-	-	-	Many fragments contain sericite
4110-4210	do.	Moderate orange pink and white, Some green and purple	Angular coarse	-	-	-	Purple and green sericite increase with depth.

No permit