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#### PREFACE

#### Organization of Report

This report presents the technical details of the drilling of Union Oil Company's De Braga #2 well, Churchill County, Nevada. The report consists of the ten chapters listed in the Index, as well as the well logs taken by Schlumberger. The content of each chapter is summarized in the following. All depths in the report refer to rotating kelly bushing (R.K.B.) unless otherwise indicated. R.K.B. is 11.5' above ground level (G.L.).

Chapter 1 presents a summary of the operations required to drill and complete De Braga #2. The results of a post-drilling flow test are presented. A listing of contractors used is also included.

Chapter 2 summarizes what was learned about the hydrothermal system encountered by De Braga #2. This includes data on formation lithologies, and other geological information.

Chapter 3 contains a well history describing the day to day operations during the drilling of De Braga #2. Also included is a detailed description of the casing strings, and a listing of deviation surveys with the corresponding maximum reading thermometer results. The one minor fishing operation engaged in while drilling this well is described in Chapter 4.

A time-depth progress graph is presented in Chapter 5. This graph also indicates the occurrence of events of major technical interest while drilling De Braga #2.

Chapter 6 lists the various kinds of logging data taken during the drilling of De Braga #2. Copies of each of the individual logs are supplied with the report. Maximum reading thermometer temperature surveys taken are also listed here.

Chapter 7 presents technical information about the drill bits used in De Braga #2.

Chapter 8 describes cementing operations carried out during casing jobs and to control lost circulation.

Chapter 9 is a technical summary of the drilling fluids used in drilling this well. This section was prepared in part by Magcobar, the sales, service and engineering company responsible for the drilling fluids program.

Chapter 10 includes analyses of formation water samples taken during the drilling operations.

## OUTLINE OF WELL SUMMARY

- I. General Information
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  - B. Preparation of Location and Setting of 20" Conductor to 94' (R.K.B.)
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    - 1. General Description of Hole Drilled
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         1328', 1355', and 1450' Required Cementing for
         Control
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    - 1. 12-1/4" Hole
    - 2. 8-3/4" Hole

G. Well Completion

# III. Post-Drilling Operations

Results of Flow Test on 5/22/79, Including Temperature and Pressure Surveys

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# I. GENERAL INFORMATION

# UNION OIL CO. OF CALIFORNIA GEOTHERMAL DIVISION

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# WELL RECORD

LEASE	De Braga			SPI	JD DATE 4/6/	79 COMP. DATE 5/	7/70				
WELL #			·····	CON	CONTRACTOR Coastal Drlg. Co.						
FIELD		er Prospec	t	RIG	RIG # 2						
LOCATI	ON S67°00'3	0"E 947.29	from the	NW ELE	ELEVATIONS: GROUND						
			19N, R31E,		K.B. TO GROUND 11'						
	(well is	located i	n NW% of Se	ec 6) P	C.B. TO LOWE	R CASING HEAD					
B. H. L.	30.8'5.	240.2' E O	f surface 1		PE WELL: EXP	L. XX DEV.					
DEPTH:	T.D. 6946	T.V.D. 69	40'E.T.D. 6	940'	STM HOT	WTR XX INJ					
			<u> </u>		RY HOLE	· · · · · · · · · · · · · · · · · · ·					
COMPAN	Y ENGINEER	Allen In	man	ÀPI	PROVED						
			CASING 1	RECORD							
SIZE	WEIGHT	GRADE	THREAD	TOP	BOTTOM	REMARKS					
20*	94#/ft	H40 ·	Buttress	.G. I	94' KB	cemented surf.	to 94				
	54.5#/ft	_K55	Buttress	11' КВ	310' KB	cemented surf to	<u></u> 310				
	40#/ft	K55	Buttress	11' КВ	1194' KR	cemented surf to					
7	26#/ft	_K55	8RD	<u>987' KB</u>	6940'_KB_	slotted & blan					
		ļ	+	<u> </u>	·	liner on Mid					
		<u> </u>	1	[	<u> </u>	fishing tool	hange:				
	· · · · · · · · · · · ·		WELL HEAD	ASSEMBI	Y						
			MAKE	TYPE	SIZE PR	ESSURE RATING					
CASING	HEAD SPOOL		WKM		-5/8"x10"	2000 psi					
EXPANS	SION FLANGE		WKM Flat	t x Studo	led 10"-600x	3"-300 2000 psi					
	VALVE (S)		WKM	Gate	10"	2000 psi					
	HEAD VALVE	ES	WKM	Gate	3"	2000 psi	7				
EXPANS	ION SPOOL V	ALVES				•					
SWAB V	ALVE		WKM	Gate	3"	2000 psi					
STEAM	ENTRIES:		DE	epth	LBS. IN	CREASE					
		<b></b>				•					
		Not App	licable			•					
			•			•	• •				
			SI	OTS		ANK					
SLOTTE	D LINER		FROM	TO	FROM	TO					
			2724	3241	987	2724					
7" 26	8RD LT&C	•	3408	3725	3241	3408					
			4220	5146	3725	4220					
			6303	6503	5146	6303					
			6625	6940	6503	6625					
TEST D	ATA				<u></u>	ORIFICE SIZE					
	TEST DATE		WHP	FLP	TEMP	POUNDS/HOUR					
				<u> </u>							
REMARK	S: Total c	ost of wel	1 = \$535,9	7 <b>0</b> . Cost	: per foot =	\$77.16.					
			- +00077								

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# B. <u>Contractors Used</u>

B&W Inc.

Bill's Casing Tong Service

Coastal Drilling Company

Dresser Industries

Diamond Transport

Dick Howell

Drilco

Driltrol

Halliburton

H&H Oil Tool

Hughes Tool Company

Jack Tedford, Inc.

Magcobar

Midway Fishing Tool

Northern Truck Service

Oilwell Supply

Powers Welding

Rodney A. Weishaupt

Schlumberger

Smith Tool Company

Tillett Tool and Service

West Coast Oil Tool

W-K-M Wellhead Systems

Lowell Emery Surveyors

#### **II. DRILLING OPERATIONS**

#### A. RIG INFORMATION:

Coastal Drilling Company Rig #2 is an Oilwell 52T with a 96' Bender Derrick, 11.5' substructure and a 52T Drawworks. The rig is rated to drill to a depth of 8000'. It is powered with two V8 GMC Diesel Engines rated at 600 INT. h.p.. The rotary table is a National 17-1/2". The rig is limited to a 350,000# casing capacity.

B. PREPARATION OF LOCATION AND SETTING OF 20" CONDUCTOR TO 94' (R.K.B.):

The location, sump and roads were built by Rodney A. Weishaupt. A 26" conductor hole was drilled to 83' G.L., 94' R.K.B. by Dick Howell. Twenty-inch (20") conductor pipe was run and cemented from the surface to 83' G.L. with Ready-Mix Concrete.

C. <u>17-1/2" HOLE: 94' to 312':</u> (13-3/8" Casing Set to 310')

Coastal Rig #2 moved in, rigged up, and was placed on day rate at 2400 hours, 4/6/79. The rat hole was drilled immediately thereafter. The well was spudded in at 0600 hours on 4/6/79, and 17-1/2" hole drilled to 312'.

310' of 13-3/8" 61#/ft K55 buttress casing was set and cemented to surface. The 20" casing was cut off to ground

C. Continued -

level. A 12"-900 well head, a 20" Hydril GK, and a Double Shaffer blowout preventer were installed and tested to 1000 psi.

D. <u>12-1/4" HOLE: 312' to 1205'</u>: (9-5/8" Casing Set to 1194')

1. General Description of Hole Drilled

The 12-1/4" hole was drilled from 132' to 1205' through a thick clay sequence, the Lahontan Valley Group. A single bit drilled the entire interval at an average rate of 76'/hour. No significant losses of circulation were observed during the drilling of this interval.

# 2. Water Flow Experienced While Logging

While logging tools were being prepared to run from 1205' the well commenced flowing. The mud weight was raised and mud was circulated to 727' and 1205' in sequence. A weight of  $70\#/ft^3$  stopped the flow, and logging was carried out.

E. <u>8-3/4" HOLE: 1205' to 6946' T.D.</u> (7" Liner Hung from 987' to 6940')

## 1. General Description of Hole Drilled

The 8-3/4" hole was drilled from 1205' to 6946' through a variety of sandstones, siltstones, and volcanics. The only major lost circulation occurred near the top of the interval.

## E. Continued -

- 2. Problems Encountered and Their Resolution
  - a. Partial loss of circulation or water flows, depending on mud weight, occurred several times in the interval 1300' to 1500'. Six lost circulation plugs (total cement volume 1835ft<sup>3</sup>) were set during the four days required to drill this section. Circulation was regained with the placement of cement plug
    #6. More detailed discussion of the cement used is contained in Chapter 8.
  - b. Parted Drill Collar Box at 6946':

A drill collar box twisted off while drilling at 6946'. The lost tools were recovered on the first run with an overshot fishing tool.

## F. LOGGING EFFORTS

Schlumberger logs were run as follows:

12-1/4" Hole Section - to 1205'

DIL-8 (1205'-312' Dual Induction Laterolog 8)

FDC and CNL (1205'-312' Formation Density Log - Compensated

Neutron Log)

Dipmeter (1205'-312')

Temperature Log = 222°F @ 950'

8-3/4" Hole Section - to 6946' T.D.

DIL-8 (6946'-1194' Dual Induction Laterolog 8)

#### F. Continued -

FDC and CNL (6946'-1194' Formation Density Log -Compensated Neutron Log) Temperature Log = 312°F @ 6946' Dipmeter (6944'-1196')

#### G. WELL COMPLETION

A combination blank and slotted liner production string, 7" 26# 8RD LT&C casing was run with a Midway liner hanger (7" x 9-5/8") on top and a cement guide shoe on bottom. The liner was hung with the top at 987' and the shoe at 6940'. The perforated section of liner extends from 2724' to 3241', 3408' to 3725', 4220' to 5146', 6303' to 6503' and 6625' to 6940'. Expanding baskets were run at 2040', 2090' and 2130'. The slot designation measure is 18-2-6-150, 150 mesh, 2" slots. A 10" W-K-M 2000# valve was installed on the 10" casing head with a 10"-600 x 3"-600 flat flange on the valve which reduces to a 3"-600 studded adapter and 3"-600 W-K-M full opening valve to facilitate wire line work.

An "A" frame to support the sheave for wire line operations and flow piping for testing purposes was installed.

All drill pipe and tools were laid down and loaded out. The Coastal Drilling Company Rig #2 was released at 2400 hours, 5/7/79.

#### III. POST DRILLING OPERATIONS

Current plans are to conduct extensive testing and to continue to monitor temperatures to make reservoir evaluations.

De Braga #2 was produced for 3 hours and 37 minutes on May 22, 1979. Mass produced to the pit during the test was 505,000# for an average rate of 140,000#/hour. Wellhead pressure and temperature were stable at 20 psig and 252°F throughout the test.

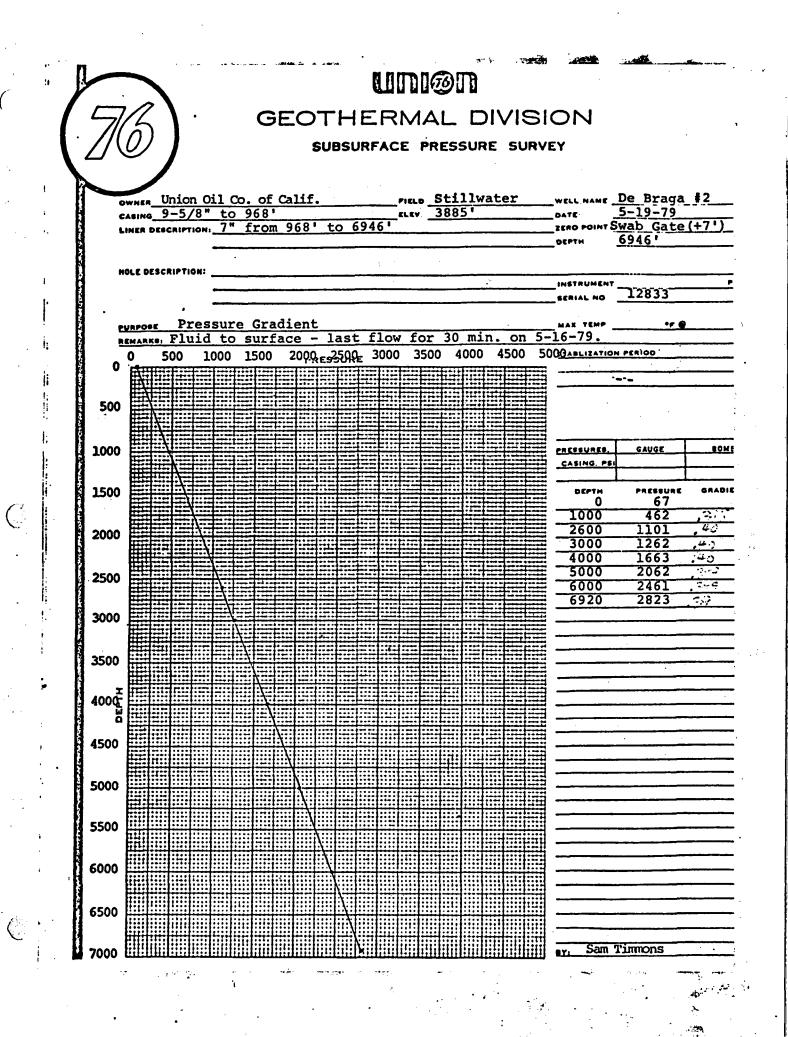
Maximum reservoir temperature of 336°F was recorded on the static survey the day before the test. The temperature and pressure survey reports follow this section.

Flash was 8%, based opon 336°F reservoir temperature and a pressure of 20 psig at the orifice.

The temperature survey shows a high gradient in the bottom 250' of the hole indicating that temperature may continue to rise rapidly with depth.

Pressure build-up data has not yet been evaluated. A formal report will be prepared of all the testing including analysis of the data. This report, and further temperature and pressure surveys following the buildup will be included in an addendum to this technical report when they are available.

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#### GEOLOGIC REPORT ON THE

## DE BRAGA #2 WELL

#### STILLWATER, CHURCHILL CO., NEVADA

De Braga #2 was drilled to a total depth of 6964'. The following is a description of the rock types encountered in the well to total depth. The descriptions are based on examination of the well cuttings by binocular microscope in the field. Except for the clays of the Lahontan Valley group, no attempt has been made to divide the lithologies into formal formational intervals.

#### LITHOLOGY

#### Lahontan Valley Group

De Braga #2 was spudded in Recent alluvium composed of sand, silts and clays. From 100' to 1280', the well penetrated the Lahontan Valley group. In the Stillwater area, this group is composed of light gray and light green-gray clays which are occasionally calcareous and range from clean to silty or sandy. A very high rate of penetration of the drill bit occurs in this formation - up to 250 to 300' per hour. This thick clay sequence may be the impermeable cap rock over the entire Stillwater area. It is Pleistocene in age.

# Pre-Lake Lahontan Sediments

From 1280' to 2400' a section of sandstones and siltstones were penetrated. These are typically very fine sandstones, largely composed of subangular quartz and feldspar with occasional varied and multi-colored lighic rock fragments. Quartz overgrowths on quartz grains is common as is a white Kaolinitic(?) matrix which gives the sandstone a low porosity. Pyrite and calcite are secondary minerals which are common in this interval. At the base is a thin 30' zone of light gray and light green, pyritiferous chert.

# Pre-Lake Lahontan Tertiary (?) Volcanics and Sediments

From 2400' to total depth a variable section was penetrated which was composed of volcanics, siltstones and sandstones. Complicating the determination of the stratigraphy which was drilled through in this interval was the inability of the hole to stay in gauge and washing-out of drilled hole was continually contaminating ditch samples with lighologies already drilled. The caliper log shows the hole was rarely in gauge and washouts in the 8-3/4" hole occasionally enlarged the hole to as much as 16".

The volcanics penetrated in this interval consisted of extrusive volcanics, finely crystalline to porphyritic and occasionally with zeolite or agate amygdules. In the finely crystalline basalts about 30% is composed of a bronze-colored(?) orthopyroxene (bronzite?) and about 70% light green, chloritized feldspar. In the prophyritic extrusives are micro-phenocrysts in an aphanitic matrix, occasionally with zeolite or agate amygdules.

The sandstones are largely volcanic, light green, poorly sorted with abundant green, chloritic clay matrix. Siltstones are

gray, brown and green and are also probably derived from volcanics. Calcite is very common through this volcanic-sedimentary sequence but pyrite appears to be present only down to about 5100'.

A major lost circulation zone was encountered near the top of this sequence in the interval, 1309' to 1370'. No other lost circulation occurred in this entire sequence.

A preliminary study of the field print of the dipmeter survey in this sequence suggests it is essentially flat.

#### TEMPERATURE

A Schlumberger temperature log was run upon reaching total depth. The running of this log was interrupted by the well starting to flow from artesian water zones just below the 9-5/8" casing. Heavier mud had to be mixed and circulated <u>within</u> the casing so as not to disturb the rebounding temperatures in the open hole below the casing. This tool was on bottom 37 hours after stopping circulation and recorded a maximum temperature of 327°F at total depth.

Below the casing at 1196' the temperature increased rapidly to about 290°F at about 1400' and remained there until about 4800'. From 4800' to total depth (6946') the temperature increased from about 290°F to 327°F (about 1.7°F per 100').

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				- <u></u>				· · · · ·					
ELEVATI	ON	820	-		OMP.	ABAND.		OTAL DEPTH	PLUG		REC	OMP.	
	VIATIC		4/6/	79	5/7/79			6946'					
	Str	aight	t Ho			B.H.L. 19	' Sou	th and 1	90' East	_			
SIZE	EBH:	DEP		SAX	CASING RECOR	D			ELEC. L		DA	<u>TA</u>	-,
20"	cem	0-94	1'	5vd <sup>3</sup>	се			urface	DIPMET			•• ••••••	••••••
13-3	/8"c	em 3.	L0'	430ft <sup>3</sup>	Ce	mented			CORERE	CORD	•••		
9-5/	8"ce	n 11	94'	430ft <sup>3</sup> 611ft <sup>3</sup>	се	emented	to s	urface	HISTOR Y				
7"		<u>5940</u>	/98	7' -0-	blank	and pe	erfor	ated lin			••••••	••••••••••••••••	
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4/6/7			Ri	gged u	p Coastal	Drilli	ing_C	0. Rig #	2. Rig	on d	ayı	cate	
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			-Ca	212	Bumped pl	ug with	<u>a 500</u>	psi.H	adgood	ceme	nt.		
••••••					to surfac					••••••			
4/7/7	7.9	•••••	W(	D.C. 2	hours. n a 12"-9	Cut off	E and	landed	13-3/8"	casi	ng.		
900 Double Shaffer and Hydril. Tested CSO to 1000#													
			-rai	ns and De at	hydril t 310'	.o1000	psi.	Drille	d-out-ce	ement	-ai	1d	
4/8/7	79					ole fro	m 31	21 +0 12	05' Wi	ped	hol	e.	
-/ 5/ /			Ci	cculat	12-1/4" h ed hole c an flowin	lean.	P.O.	H. Rigg	ed up Sc	hlun	bei	ger.	
			We.	ll beg	an flowin	g. R.I	I.H.	to 312'.	Built		ud		
			Ci	rculat	o 72 <b>#, co</b> ed 72 <b>#</b> /ft	3 mud.	Wel	l flowed	. R.I.H	, 121 I. to	12	205'.	
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		•	P.0	<b>).H.</b>	Ran Dipme 30 joints	ter and	l Tem	perature	log. F	ligge	đι	ıp	
			and	i ran	30 joints	(1196'	') of	9~5/8"	40# K55	butt	res	3S	

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Form 3358 (Rev 6/67)

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4/9/79 Continued -

casing. Cemented with shoe at 1194', insert float at 1115' with 611ft<sup>3</sup>, 105#/ft<sup>3</sup> slurry of "G" cement with 1:1 perlite, 40% SSA1, 3% gel, 0.5% CFR-2, followed by 100ft<sup>3</sup> "G" cement with 40% SSA1 and 0.5% CFR-2. Preceded cement with 200ft<sup>3</sup> water, 100ft<sup>3</sup> sepiolite, SSA1, flush, with 50ft<sup>3</sup> water. Had good cement returns to surface. C.I.P. at 2015 hours. W.O.C.

4/10/79 W.O.C. 2 hours. Removed cement head. Removed B.O.E. Cut off 13-3/8" and 9-5/8" casing. Welded on a 10"-600 series W-K-M casing head. Tested weld to 1000 psi. Installed B.O.E.'s. Tested CSO to 1000 psi. Laid down 7" drill collars. Picked up 6" drill collars.

4/11/79 R.I.H. Located top of cement at 1103'. Tested Hydril and pipe rams to 1000 psi. O.K. Drilled cement from 1103' to shoe at 1191' and cement to 1205'. Drilled 8-3/4" hole from 1205' to 1309'. Lost all mud returns. Pulled into casing. Mixed pit of lost circulation material and gel mud. R.I.H. to 1309'. Well started flowing. Closed Hydril. Had 70 psi on annulus. Opened choke. Pumped 200bbls mud. Well flowed. Closed well in. Mixed 70#/ft<sup>3</sup> mud. Pumped into hole. Killed well and stopped lost circulation. Pulled to 700'. Unable to circulate with 68#/ft<sup>3</sup> mud. Pulled to 520'. Well started flowing. Closed well in. Killed well with 68#/ft<sup>3</sup> mud. P.O.H. R.I.H. with bit and float sub on 4-1/2" drill pipe to 881', well started flowing. Closed well in and rigged up HOWCO.

4/12/79 Hung 4-1/2" O.E.D.P. at 881'. Closed Hydril. Mixed and pumped 200ft<sup>3</sup> "B" cement, 1:1 perlite, 40% SSA1, 3% gel and 0.5% CFR-2. C.I.P. at 0020 hours. Well went on vacuum after 4 hours. Pumped plug #2 through bit at 682'. Mixed and pumped 400ft<sup>3</sup> cement as before. C.I.P. at 0700 hours. W.O.C. 4 hours. Filled hole with 20 bbls mud. P.O.H. Picked up drilling assembly. R.I.H. to top of cement at 911'. Drilled cement to 1309'. Drilled 8-3/4" hole from 1309' to 1355'. Located obstruction at 1328'. Drilled on obstruction 30 minutes. P.O.H. Checked stabilizer and bit. R.I.H. Drilled on obstruction. Well started flowing. Closed well in.

4/13/79

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Mixed a pit of 72#/ft<sup>3</sup> mud. Killed well. P.O.H. R.I.H. with O.E.D.P. to 907'. Closed in well. Mixed and pumped 190ft<sup>3</sup> Versagel, mixed with 4# nut plug per gallon with 20ft<sup>3</sup> water, 100ft<sup>3</sup> "B" cement, 1:1 perlite, 40% SSA1, 3% gel and 0.5% CFR-2. C.I.P. at 0520 hours. Pulled 3 stands. Closed rams. W.O.C. 4 hours. R.I.H. to top of cement at 1126'. Drilled cement from 1126' to 1355'. Well started flowing. Closed well in. Mixed mud and killed well. P.O.H. Ran O.E.D.P. to 939'. Pumped 200ft<sup>3</sup> water, and 190ft<sup>3</sup> Versagel mixed with 5# walnut hulls/gallon, 4/13/79 Continued -

20ft<sup>3</sup> water and 200ft<sup>3</sup> "B" cement, premixed with 1:1 perlite, 40% SSA1, 3% gel and 0.5% CFR-2. Displaced with 15ft<sup>3</sup> water. Pressure built to 3000 psi. Pulled to 682'. Pumped out 100ft<sup>3</sup> cement to surface. P.O.H. W.O.C.

- 4/14/79 W.O.C. 4 hours. Ran drill pipe to top of cement at 1061'. P.O.H. R.I.H. with bit. Drilled cement from 1061' to 1326'. P.O.H. Made up HOWCO EZSV. Well started flowing. Killed well. R.I.H. Set EZSV at 1065'. Mixed and pumped 100ft<sup>3</sup> "B" cement premixed with 1:1 perlite, 40% SSA1, 3% gel, and 0.5% CFR-2, followed by 250 sacks cement, premixed with 0.75% CFR-2 and 25# gelsonite/sack. Displaced with 150ft<sup>3</sup> water. Reverse circulated and pulled 180'. W.O.C. 6 hours. Stabbed into EZSV. Pressured to 400 psi. Plug held O.K. P.O.H. Made up drilling assembly.
- 4/15/79 Drilled out EZSV at 1065' and stringers of cement from 1131' to 1220' and hard cement to 1355'. Drilled 8-3/4" hole from 1355' to 1450'. Lost 25% of returns after 1370'. P.O.H. Ran O.E.D.P. to 1159'. Closed rams. Mixed and pumped 420ft<sup>3</sup> "G" cement with 0.75% CFR-2. Displaced with 92ft<sup>3</sup> mud. P.O.H. W.O.C. 4 hours. Filled hole with 10bbls mud. R.I.H. Drilled out cement from 1155' to 1450'. Drilled 8-3/4" hole from 1450' to 1674'.
- 4/16/79 Drilled 8-3/4"hole from 1674' to 2494'.
- 4/17/79 Drilled 8-3/4" hole from 2494' to 3113'.
- 4/18/79 Drilled 8-3/4"hole from 3113' to 3837'.
- 4/19/79 Drilled 8-3/4" hole from 3837' to 4192'.
- 4/20/79 Drilled 8-3/4" hole from 4192' to 4401'. Plugged bit. P.O.H. Picked up 6" monel and drill collar. R.I.H. with bit #11. Drilled 8-3/4" hole from 4401' to 4433'.
- 4/21/79 Drilled 8-3/4" hole from 4433' to 4772'. Surveyed. Broke survey wire line. P.O.H.
- 4/22/79 R.I.H. with bit #12. Washed and reamed from 4750' to 4772'. Repaired drawworks rotary drive chain. Rig down from 0100 to 1930 hours. Drilled 8-3/4" hole from 4772' to 4800'.
- 4/23/79 Drilled 8-3/4" hole from 4880' to 5124'. P.O.H.
- 4/24/79 P.O.H. R.I.H. with bit #13. Drilled 8-3/4" hole from 5124' to 5328'.

Pg 3

- 4/25/79 Drilled 8-3/4" hole from 5328' to 5531'.
- 4/26/79 Drilled 8-3/4" hole from 5531' to 5878'.
- 4/27/79 Drilled 8-3/4" hole from 5878' to 6042'.
- 4/28/79 Drilled 8-3/4" hole from 6042' to 6209'.
- 4/29/79 Drilled 8-3/4" hole from 6209' to 6413'.
- 4/30/79 Drilled 8-3/4" hole from 6413' to 6701'.
- 5/1/79 Drilled 8-3/4" hole from 6701' to 6826'.
- 5/2/79 Drilled 8-3/4" hole from 6826' to 6946'. Twisted off. P.O.H. Left 290' of drilling assembly in hole. Top of fish at 6656'. Made up Midway 8-1/8" fishing tool, jars and bumper sub. R.I.H. Picked up fish. Circulated and conditioned mud.
- 5/3/79 Chained out of hole. Recovered all of fish. Rigged up and ran Schlumberger temperature log, DIL, Compensated Neutron:Formation Density Log and Continuous Dipmeter.
- 5/4/79 R.I.H. with drilling assembly to 2100'. Circulated and conditioned mud. P.O.H. and reran Temperature Log from the surface to 6946'. Ran 8-3/4" bit to 4000'. Circulated bottoms up. R.I.H. to 6946'. Conditioned mud. P.O.H. Laid down drill pipe.
- 5/5/79 Continued to P.O.H., laying down drill pipe and drill collars. Rigged and ran combination blank 7"26# K55, 8 round, LT&C production liner, hung liner on Midway 7" x 9-5/8" liner hanger at 987' with guide shoe at 6940'. Slotted casing intervals, from 2724' to 3241', 3408' to 3725', 4220' to 5146', 6303' to 6503' and 6940' to 6625'. Cement baskets placed at 2040', 2090' and 2130'. P.O.H. Laid down liner setting tool. R.I.H. with 9-5/8" HOWCO RTTS and set at 916'. Backed off lower kelly cock at 12'. Removed B.O.P.E.
- 5/6/79 Installed 10"-600 W-K-M master valve, 10"-600 x 12"-900 cross-over spool and 12"-900 Hydril. Stabbed into lower kelly cock at 12'. Released RTTS. Circulated to cool hole. P.O.H. R.I.H. with 8-3/4" bit with well flowing to 947'. Mixed and displaced 200 bbls 71#/ft<sup>3</sup> mud to kill well. P.O.H. R.I.H. picking up 3-1/2" drill pipe to 6900'. Dumped pits and refilled with fresh water.

Plugged bit. P.O.H.

5/7/79 Continued P.O.H. Laid down one joint plugged drill pipe. R.I.H. with well flowing two inch stream to 810'. Closed well in. Squeezed away 250 bbls water at 100 psi. R.I.H. 5/7/79

#### Continued -

with well flowing two inch stream to 3750'. Shut well in. Squeezed away 250 bbls through drill pipe and 100 bbls through kill line. R.I.H. with well flowing a two inch stream of water to 6940'. Pumped 700 bbls fresh water, dumping returns. Well dead after pumping 350 bbls and flowing two inch stream after pumping 700 bbls. P.O.H. laying down 4-1/2" and 3-1/2" drill pipe. Stopped at 4697', 2763' and 1535' to pump fresh water while dumping returns. Pumped a total of 2400 bbls fresh water. Well produced approximately 600 bbls additional fluid. Shut well in. Tightened all well head bolts. Tore out Hydril. Laid down Kelly. Released rig for move to Ruby Valley at 2400 hours.

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De Braga #2

#### CASING DETAIL

NO. JTS.	DESCRIPTION	LENGTH	TOP	BOTTOM
	13-3/8" 54.5# K55 BUTTRESS			
	13-3/8" B&W S.O.W. Guide Shoe 13-3/8" 54.5# K55 Buttress	1.85 16.80	308.15 291.35	310.00 308.15
1	Casing Cut-Off 13-3/8" 54# K55 Buttress Casing	40.65	250.70	291.35
6 '	13-3/8" 54# K55 Buttress Casing	252.70	+ 2.00	(Insert Float) 250.70
7	TOTAL: (KB = 11.00')	312.00	KB +2.00	, , , , , , , , , , , , , , , , , , ,
	9-5/8" 40# K55 BUTTRESS			
2 28	13-3/8" S.O.W. B&W Guide Shoe 13-3/8" 54.5# K55 Buttress Casi 13-3/8" 54.5# K55 Buttress Casing	1.30 ng 76.78 1117.92	1192.70 1115.92 + 2.00	1194.00 1192.70 1115.92 (Insert Float)
30	TOTAL: (KB = 11.00')	1196.00	KB +2.00'	
	7" 26# K55 8RD LT&C			
8	7" B&W Guide Shoe 7" 26# K55 8RD LT&C Slotted Casing	1.30 313.15	6938.80 6625.55	6940.00 6938.70
3 5	7" 26# K55 8RD LT&C Casing 7" 26# K55 8RD LT&C Casing	122.25 199.93	6503.30 6303.37	
28 23	7" 26# K55 8RD LT&C Casing 7" 26# K55 8RD LT&C Slotted Casing	1157.31 925.60	5146.06 4220.46	6303.37 5146.06
12 8	7" 26# K55 8RD LT&C Casing 7" 26# K55 8RD LT&C Slotted	495.30 316.98	3725.16 3408.18	4220.46 3725.16
4 13	7" 26# K55 8RD LT&C Slotted	166.39 516.99	3241.79 2724.80	3408.18 3241.79
42	Casing . 7" 26# K55 8RD LT&C Casing Midway 7"x9-5/8" Liner Hanger	1733.75 4.05	991.05 987.00	2724.80 991.05
151	TOTAL:	5953.00		

Top of liner @ 987', Below K.B. KB = 11.00'

## FISHING OPERATION

#### SUMMARY

Well Depth:	6946' (T.D.)
Date:	May 2, 1979
Top of Fish:	6656'
Length of Fish:	290'
Result:	Complete recovery on first attempt.

Only one minor fishing operation was required on De Braga #2, caused by the failure of a 6-1/16" drill collar box in the thread portion, three threads up from the Drilco relief area.

The fish was recovered with a Bowen spiral grapple 8-1/4" O.D. overshot with an 8-1/4" lip guide and a 6" basket grapple with mill control, run on a Bowen 6" bumper sun and hydraulic jar and run on six 6-1/4" drill collars. No problems were encountered in recovering the fish on the first attempt.

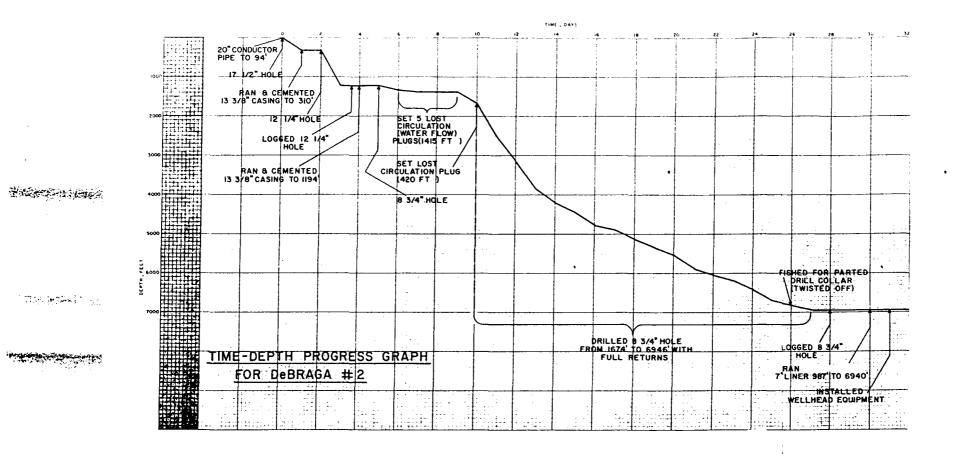
The total fish consisted of an 8-3/4" bit, an 8-3/4" stabilizer, 6-1/2" monel drill collar, 8-3/4" stabilizer, 6-1/4" drill collar, an 8-3/4" stabilizer and seven 6" to 6-1/2" drill collars.

# SCHLUMBERGER LOGGING DATA

DATE	TYPE OF LOG RUN	LOGGED INTERVAL	TOTAL DEPTH
9 April 79	Dual Induction-Laterolog	320' - 1207'	1205'
9 April 79	Compensated Neutron Log- Formation Density	90' - 1213'	1205'
9 April 79	Temperature Log	0' - 1205'	1205'
9 April 79	Dipmeter Log	320' - 1212'	1205'
3 May 79	Dual Induction-Laterolog	1192' - 6938'	6946 <b>'</b>
3 May 79	Compensated Neutron Log- Formation Density	1192' - 6944'	6946'
3 May 79	Temperature Log	0' - 6946'	6946'
3 May 79	Dipmeter Log	1196' - 6944'	6946'

Copies of these logs follow.

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SECURITY DIVISION Security Dresser in dustries, inc. PILE NO. ORESSER BIT RECORD FORM NO. PARALISE OILFIELD PRODUCTS GROUP P. O. BOX 6504 HOUSTON, TEXAS 77005 (713) 784-6011 COASTAL HAR MAKE DC. OD X ID X LENGTH [HOLE SIZE] 2 DRILLING OILWELL PAGE OF 527 30 SPUD STILLWATER 148 BIZE SALESMAN 96' RENDER UNION OIL CO. of CAL. 30 U.S. 6×16 LEASE WRLL HQ. DUYER De Braza INTERS STATE 6×14 RIG PERSONNEL CHURCHILL 41/2 NEVADA "X" HIE 6946 D.P. \$128/T. TD DIESEL TOTAL DAYS TOTAL ROT. HRS: WATER SOURCE MAGCOBAR JETS - 32NDS REG.R OR RO HOURS PUMP NO. I PUMP NO. MUD PROPERTIES DULL COND 1/4-1/8 WT. RUN SIZE TYPE CUM. 1000 SERIAL DEPTH FEET PUMP REMARKS DATE DEPTH R.P.M. PER NO. NO. OUT WT. тв G RG-8 1. 2. 3. HOUR HRS. LOS. PRESS. LINEN SPM LINE SPH w.s., F.V. DEV. ... .... 432 NIS 05 40 STC 16 16 317 734 40.3 734 640 68 2 2 312 10 1201 ЧЮ  $\mathcal{I}$ 16 DIJ 62 ALSO DUILLED CEMENT 2 68 2 122 STC 16 16 1205 893 1134 76.0 19% 120 6 50 40 3.6 14 II AC 4784 Ь 12.  $|\infty\rangle$ REED 10 3 834 44 1309 6/2 16.0 26 125 66 40  $|\mathcal{I}|$ 130924 14 14 15 1000 6 50 4 2 14 104 412 874 1244 4 HIC AISO DRILLA (EMENT 1/2 16 1355 46 192,0 26; 15 125 600 6 50 68 406/3 I NA472 16 lb 0810 1+ TC 1834 11/2 125 1°-8 T 5 PJIIT 16 1450 95 63.3 15 600 6 50 4 28 67 40 3⁄3 16 01 ALSO DRILLIS CEMENT REED YIIJ ର୍ତ୍ତ 10 81/4 403/2 18 125 600 68 4 4 6 16 2214 764 529 43 I 16 15 29394 6 BTJ 18 68 90 12 4 4 507 28.2 18 600 5/3 Ĩ 61 125 650 7 AA1355 //-16 272 16 <u>}</u> STC 2014 49.4 900 650 67 40 4 6 8 372 1000 814 25 6 IT た 12 12 125 AB6299 315 9 68 35 24 4 6 I 4088 367 22, 15 125 1000 6 50 205 N 11 16% YIS RED 25 3 129348 440 313 6 50 67 34 3 I 10 874 20.911234 11 25 100 11 11 15 10 DIJ 8% AB6332 4772 37 23 650 20 5 6 I 1000 67 // RS 35 20 6. HTC 03630 193 <u>3</u>2 5 6 1% 352 650 68 34 5724 18 125 RT 433 11 IS I 1000 HTC 8% 68 3° 4 I 30/ nyt 18 125 645 6 13 14 5430 1000 35 3 Mx 857 ]4 14 321 REFP 5900 8 8 470 252 183 900 68 35 2 25 35 14 609 227 17 12 205 125 6 14 ſ 12 REG 900 68 42 6 5 35 818 329071 30/4/16 125 8 6403 12 12 503 2352 25 12 FP7 42 5 2 I 16.8 900 645 68 33 84 670 りみ 6/3 298 125 16 DIRTS 14 253 25 ٧Y N STC. 336/3 44441 6946 1874 3.1 9006 ABOARS 245 8% 2725 °20 125 K/ST. 68 17 И 14 Μ 100 AAISTS 874 16 CIACULATION 16 16 57 REE 432558 CIRCULATION 18 OU 6 DENOTE BY (NJ - NO. (L) + LIGHT -(m)-MEDIUM HI-HEAVY BOUNDING OF GAGI SUBJECT TO PROVISIONS ON REVERSE SIDE

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# CEMENTING OPERATIONS

# Introduction

Two major kinds of cementing operations were carried out during the drilling of De Braga #2. The first type of operation involved the setting of cement plugs to seal off lost circulation zones in the 1300' to 1500' interval. The second type of operation was the cementing of the 13-3/8" and 9-5/8" casing string.

A total of 1835ft<sup>3</sup> of cement was mixed, pumped and set in six separate plugs to control lost circulation. These efforts occupied nearly four days of rig time and accounted for a total cost of approximately \$65,900. These efforts are discussed below.

The cementing of the 13-3/8" and 9-5/8" casing strings required an additional ll43ft<sup>3</sup> of cement. These efforts are described in a separate section below.

## Lost Circulation Control Efforts

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Lost circulation created problems drilling the 8-3/4" lower hole almost immediately after drilling out of the 9-5/8" casing shoe. Four plugs were set in drilling from 1309' to 1355'. While drilling out the fourth plug at 1326', circulation was lost again. The fifth plug was set by installing a Halliburton EZSV bridge plug in the 9-5/8" casing and squeeze cementing through it to 50 psi surface pressure. This was successful, and drilling out continued to 1450', where a sixth plug was needed.

Table 1 presents a description of the lost circulation cementing operations in De Braga #2. Table 2 describes the cement additives used.

Both API class "B" and class "G" cements were used, depending on availability. In two cases, preflushes containing lost circulation material and a viscous gel, Versagel<sup>®</sup>, were tried without notable success. This preflush is still under evaluation.

#### Casing Cementing Operations

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The 20" surface conductor was cemented in place with readymixed concrete poured between the casing and 26" hole prior to the start of drilling operations.

The 13-3/8" and 9-5/8" casing strings were cemented with slurries of class "G" cement using guide shoes and insert floats. Each string was cemented in a single stage. The slurry for the 9-5/8" string was mixed with perlite to reduce the hydrostatic head and consequent fluid loss to the formation. Table 3 shows a detailed description of the cementing operations for setting casing.

# TABLE 2

# SUMMARY AND DESCRIPTION OF CEMENT ADDITIVES USED ON DE BRAGA #2

		FU	JNCTION OF ADI	DITIVE		
ADDITIVE	DESCRIPTION	LIGHTEN SLURRY WEIGHT	ACCELERATE SETTING TIME	CONTROL LOST CIRCULATION	REMARKS	
Perlite (expanded)	treated volcanic material	. x			absorbs water under high pressure	
Silica Flour	finely powdered silicon dioxide				prevents loss of strength at high temperatures	•
Gęl	Wyoming-type bentonite	x		× -	increases suspension of particulate additives; maintains even distribution of other additives; reduces slurry weight	
CaCl <sub>2</sub>	in powder or flake form		x		accelerates early strength	:
CFR-2 (*)	a napthalene polymer		<b>x</b> ·		a cement dispersant to reduce viscosity and a friction loss reducer	·
Gilsonite	particulated naturally occurring asphaltite	x		х.	<pre>inert - does not absorb water; high cement strength; resists corrosion; granular lost circulation additive</pre>	
Nut-Plug (**)	walnut shells			x	granular lost circula- tion additive	•

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(\*) Halliburton trademark

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(\*\*) Magcobar trademark

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#### TABLE 3 SUMMARY OF CASING CEMENTING OPERATIONS

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DATE	CASING SIZE INCHES	DEPTH OF OPEN HOLE FEET	CSG GUIDE SHOE AT FEET	INSERT FLOAT COLLAR AT, FT.	VOLUME FT3	MATERIAL	PERLITE BY WT. CEMENT	SILICA FLOUR BY WT. CEMENT		BY WT.		REMARKS
	20	94		~-		ready mix concrete						By Dick Howell
4/6/79	13-3/8	312	310	242	432	Class "G" cement		40%		0.5%	18	Good surface returns
					(100	water					÷-	Spacer
		•			100	sepiolite suspensio			<b></b>			Preflush
4/9/79	9-5/8	1205	1194	1115	50	water						Spacer
					611	Class "G" cement	1:1	40%	38	0.5%		
			·		100	Class "G" cement		40%		0.5%		Good surface returns

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#### DRILLING FLUID SUMMARY

Attached are sheets which detail the mud properties, additions, and costs on a daily basis. The following summarizes our experiences with the drilling fluid, and highlights those operations which increased the drill fluid cost.

Numerous problems were experienced due to high permeability zones encountered between 900' and 1500', which resulted in higher costs in this interval. In fact, over 50% of the total drilling fluid costs were incurred in this interval. Before presenting a detailed account of these problems, let us dispense with the rest of the drill fluid operation with a short summary.

The drilling fluid used was a dispersed mud which utilized bentonite and attapulgite for viscosity, a tannin compound for fluid loss control and to maintain a dispersed mud system, and caustic soda to maintain the pH of the mud. This drilling fluid performed adequately and economically in the trouble free sections of the hole.

The problems with the drilling fluid were all related to pressure control. High permeability zones were encountered which acted as lost circulation zones when the mud weight exceeded the reservoir pressure, and which flowed formation water into the wellbore if the mud weight was less than the reservoir pressure. As outlined in detail below, a series of events was repeated several

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times in which the well would start the flow, the mud weight would be increased to stop the flow, and then circulation would be lost. When the weighted mud supply was exhausted the well would flow again. Making up a mud system, especially a weighted mud system, and then losing it is very costly, so these zones were plugged with cement. However, cement acts as a contaminant in the mud system and destroys its desirable properties. Consequently, the cement contamination had to be treated out of the mud, increasing the cost.

What follows is a detailed synopsis of the problems that occurred, and how they affected the mud system.

After the intermediate (12-1/4") hole was drilled to 1205', the hole was to be logged, but while preparations were underway, the hole started to flow. Eventually the well had to be killed by circulating a weighted mud  $(72\#/ft^3)$ . This section of hole was subsequently cased and cemented. 8-3/4" hole was then drilled to 1309', where a total loss of returns occurred. Mud containing lost circulation materials was spotted at the bottom of the hole, but the well started flowing. Weighted mud (70#/ft<sup>3</sup>) was pumped into the hole to stop the well from flowing, and the flow not only stopped, but all returns were lost. The mud weight was reduced to 68#/ft<sup>3</sup>, and the well started to flow again. Subsequently, cement was pumped into the well to seal off this problem zone. Five cement plugs were set before drilling could continue below 1355', and one more cement plug was placed around 1450'. Each time that cement was displaced into the well, the mud had to be reconditioned.

Pg 2

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To summarize, the mud system performed well and economically (\$400-600/day) except in the trouble area frrm 900' to 1500', where costs reached \$1000-\$4000/day due to lost circulation, water flows, and cement contamination.

#### DE BRAGA 12

#### TABLE 1 LOST CIRCULATION CONTROL EPPORTS

n	PLOG FURGER	DEPTH OP OPEN HOLE FLET	DRILLED DEPTH FLET	CINCULATION NETHOD	PLUG VOLUME	MATERIAL	PERLITE By WT. CEMENT				GILSOWITE \$/SR.	NUT	TOP OF CENENT	NEXT OPERATION	WELLHEAD SQUEEIE PRZSSURE	THEORETICAL	· · ·
	PURCER	7161	1101	- ALTHOU	11-	MILAIND	CONDIA	CERENT	CERENT	Consit	Concar	PLUG	1551	HOURS	P516	PLUG LOSS	AEPUARKS
12/79	1	1309	1309	Bit ( 001'	200	Cl "B" cm	nt lil	40	3	0.51	-		not located	1 4	70 y		
2/79	2	1309	1309	BIL 8 682'	409	Cl "3" cs	it 111	40	3	0.5%			911	4	- }	728	•
3/79	Prefluch	1355	1355	OEDP ( 907'	190	Versagel				**		58/ga)	1	Continuous			Followed by 10ft <sup>3</sup> water spacer
3/79	3	1355	1355	OZDP 8 907*	100	C1 *B* cm	t 1,1	. 40	3	0.5%			1126	4		45	-
3/79	Preflush	1355	1355	OEDP \$ 939"	190	Versagel						51/ga	1	Continuous			Followed by 20ft <sup>3</sup> water spacer
3/79	4	1355	1355	OEDP 8 939"	200	Cl "G" cm	at 1:1	40	3	0.51		-	1061	4	300	٠	Circulated excess coment out of drill pipe
4/79	{ 54 56 }	1326	1355	Bridge Plug at 1065'	{ 100 415	cl "B" cm cl "B" cm (250 sks)	at 1:1	40	3	0.5% 0.75%	25		1220	Continuous 6	30 }	914	
15/79	6	1450	1450	OEDP @ 1159'	420	el "G" ca	st			6.75%			1155	4		710	

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	UNION OIL CO.	6	19N	31E	Liggi	te		INTERMEDIATE	13 3/8		175		17 3					+-
Mancohar	DE BRAGA #2	STIL	WATER		4-5-74			LINEA ( 5 )	9 5/8	1196	125	1	11 3	Y4			<u> </u>	+
Triagoobal	COASTAL #2	CHUR	CHHILL,	NEV.	5-2-7			PRODUCTION	<u> </u>	6940	8 3/4	15	252	8/4		L	L	↓
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4-7 300 67	41 1 1 1 1 1 1 1 1								· .	2	TT		Ξ.	I. I		11.		57.
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Well started flowin 120058 70	g, mis mud and build weight.		1.1	.2 .5	1200	0_1	3 75	115	13					1-1-	1 T T			1 0
Circand condition m	ud, p.o.h., rig up and run 1 34 137 130 5 5 0 /2 5	logs, h	ole flow	ing, ri	h, buil		nut wt. 3   .50			·		1		1-1				1.0 2,0
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1200 .73 72   Hot water flow @ 98	' (degrees)	.5 <u>  NC  </u>			1150	،ل ف	4			i								3.4
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-11 1265 .58 66	32 110 4 4 1 /5	1.0 228		1.4 1.1	1150		3	1 70			0 202							3.2
-12 1309 .68 72	nt. lost circ. @1.309'. mix 35 147 12:8 2/12	2.1.24	12,3	3.3.4.2	1000	0 _I	4 1 14	10	15	5	_i8i4	. L	1	1Ľ			TT	707
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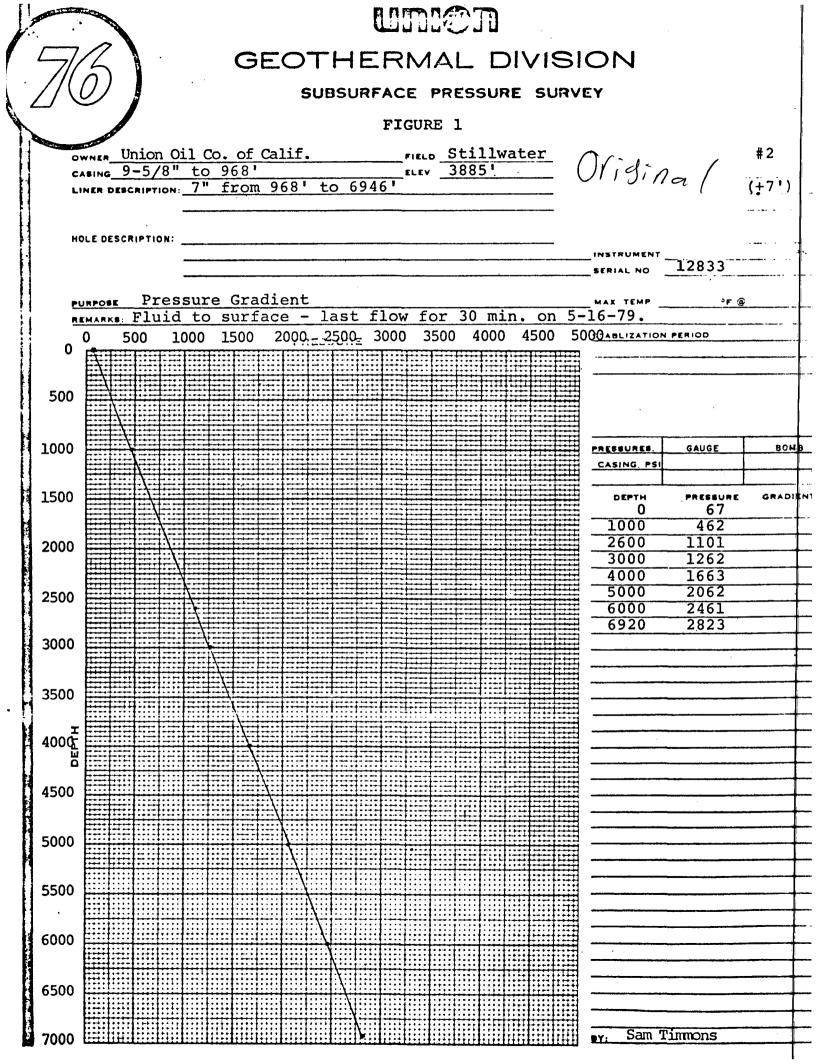
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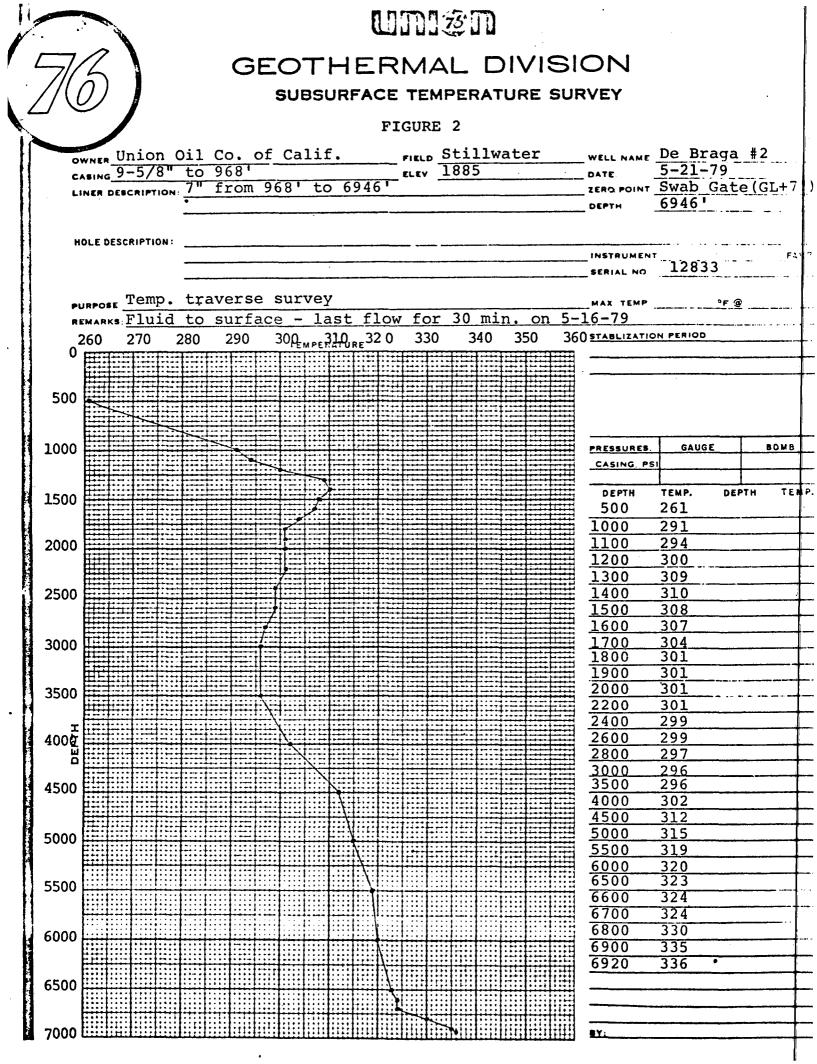
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## FLUID ANALYSIS

Water samples were collected during the drilling of De Braga #2 and sent to Union Oil Company's Science and Technology Division laboratories at Brea, California for analysis. The results of those analyses are not yet available for inclusion in this report. When the analyses are finished, an addendum will be furnished to complete this section.





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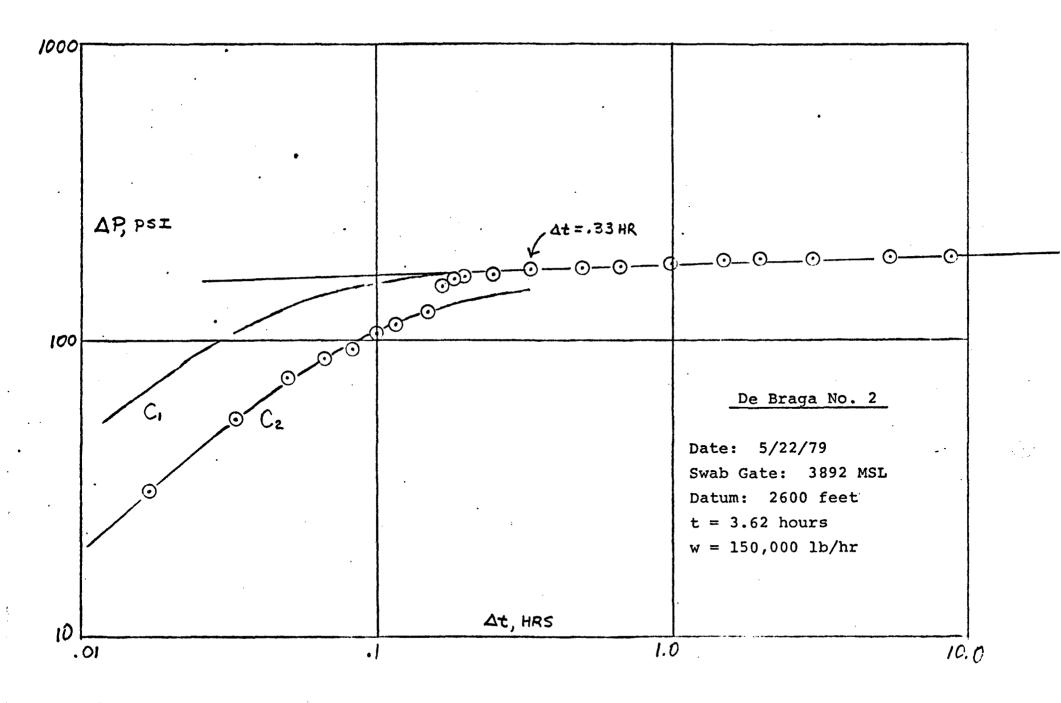
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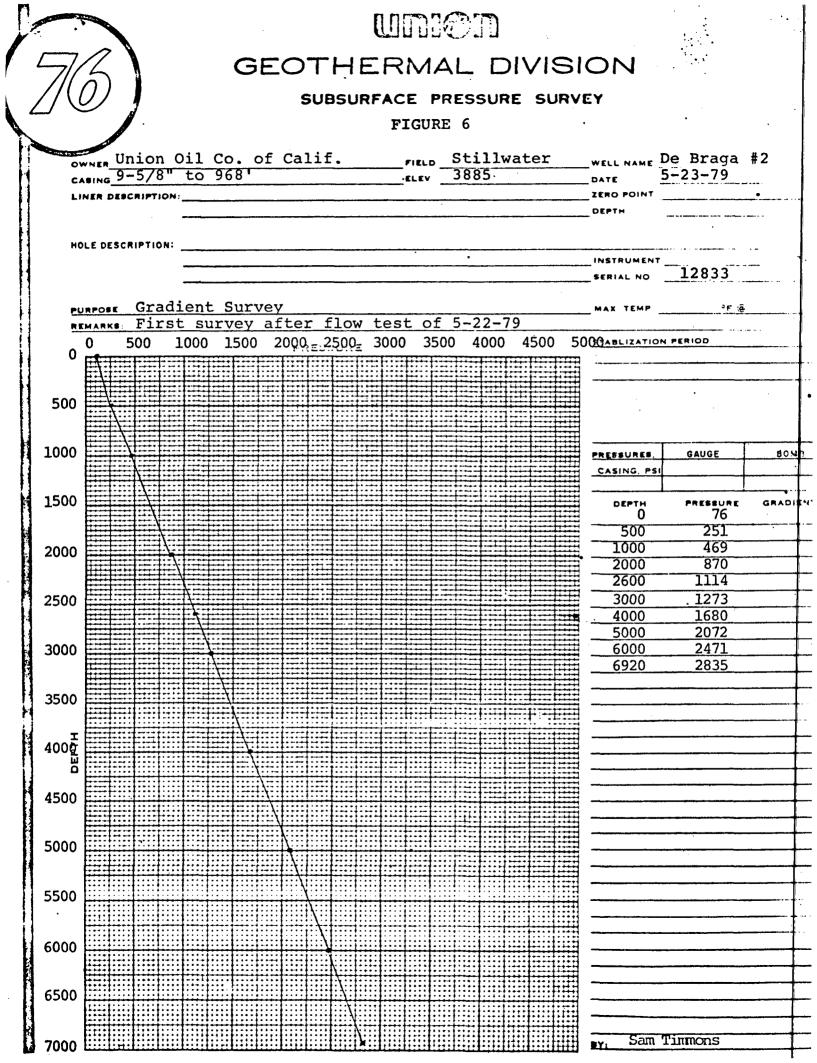
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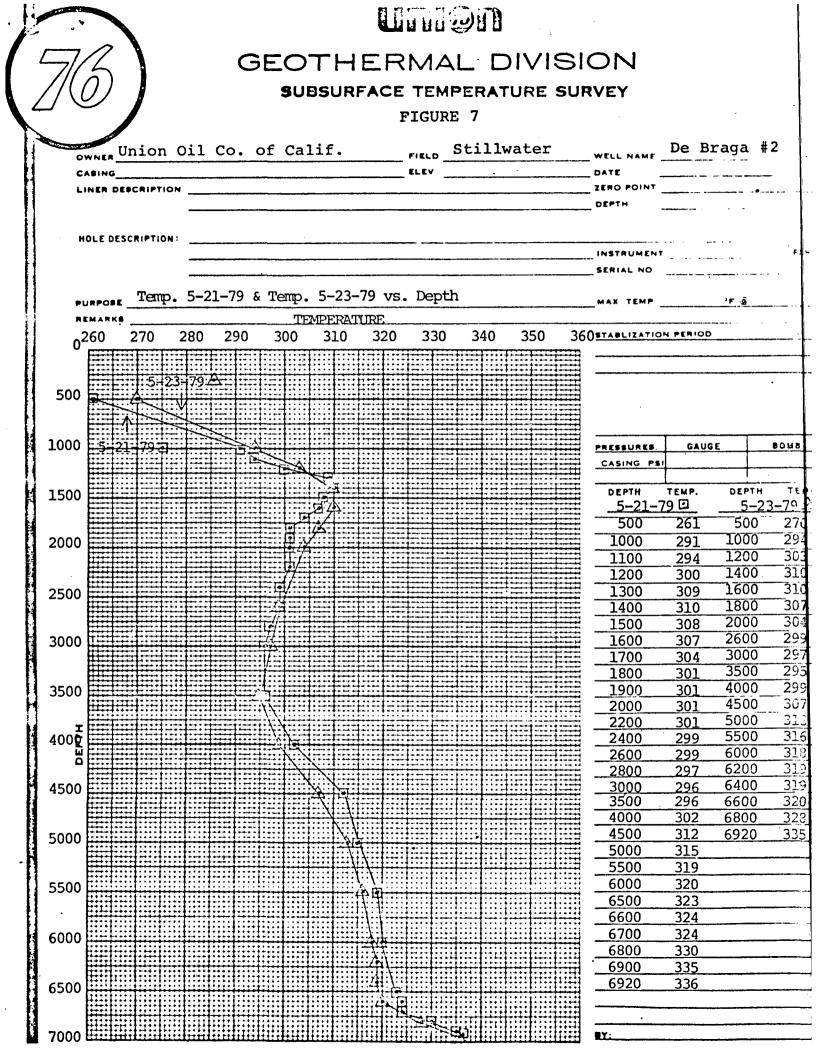
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## INDEX

Preface:

## Organization of Report

- Chapter 1: Well Summary
- Chapter 2: Geologic Report
- Chapter 3: Well History
- Chapter 4: Fishing Operations
- Chapter 5: Time Depth Progress Graph
- Chapter 6: Logging Data
- Chapter 7: Bit Record
- Chapter 8: Cementing
- Chapter 9: Drilling Fluid Summary (Magcobar)
- Chapter 10: Fluid Analysis

Origina/

#### PREFACE

### Organization of Report

This report presents the technical details of the drilling of Union Oil Company's De Braga #2 well, Churchill County, Nevada. The report consists of the ten chapters listed in the Index, as well as the well logs taken by Schlumberger. The content of each chapter is summarized in the following. All depths in the report refer to rotating kelly bushing (R.K.B.) unless otherwise indicated. R.K.B. is 11.5' above ground level (G.L.).

Chapter 1 presents a summary of the operations required to drill and complete De Braga #2. The results of a post-drilling flow test are presented. A listing of contractors used is also included.

Chapter 2 summarizes what was learned about the hydrothermal system encountered by De Braga #2. This includes data on formation lithologies, and other geological information.

Chapter 3 contains a well history describing the day to day operations during the drilling of De Braga #2. Also included is a detailed description of the casing strings, and a listing of deviation surveys with the corresponding maximum reading thermometer results. The one minor fishing operation engaged in while drilling this well is described in Chapter 4.

A time-depth progress graph is presented in Chapter 5. This graph also indicates the occurrence of events of major technical interest while drilling De Braga #2.

Chapter 6 lists the various kinds of logging data taken during the drilling of De Braga #2. Copies of each of the individual logs are supplied with the report. Maximum reading thermometer temperature surveys taken are also listed here.

Chapter 7 presents technical information about the drill bits used in De Braga #2.

Chapter 8 describes cementing operations carried out during casing jobs and to control lost circulation.

Chapter 9 is a technical summary of the drilling fluids used in drilling this well. This section was prepared in part by Magcobar, the sales, service and engineering company responsible for the drilling fluids program.

Chapter 10 includes analyses of formation water samples taken during the drilling operations.

## OUTLINE OF WELL SUMMARY

- I. General Information
  - A. Well Record
  - B. Contractors Used
- II. Drilling Operations
  - A. Rig Information
  - B. Preparation of Location and Setting of 20" Conductor to 94' (R.K.B.)
  - C. 17-1/2" Hole: 94' to 312' (13-3/8" Casing Set to 310')
  - D. 12-1/4" Hole: 312' to 1205' (9-5/8" Casing Set to 1194')
    - 1. General Description of Hole Drilled
    - 2. Water Flow Experienced at 1205' While Logging
  - E. 8-3/4" Hole: 1205' to 6946' (7" Liner Hung from 987' to 6940')
    - 1. General Description of Hole Drilled
    - 2. Problems Encountered and Their Resolution
      - a. Loss of Returns and/or Water Flows at 1309',
         1328', 1355', and 1450' Required Cementing for
         Control
      - Drill Collar Box Parted at 6946' and Required
         Fishing
  - F. Logging Efforts: Schlumberger
    - 1. 12-1/4" Hole
    - 2. 8-3/4" Hole

G. Well Completion

**III.** Post-Drilling Operations

Results of Flow Test on 5/22/79, Including Temperature and Pressure Surveys

# I. GENERAL INFORMATION

# UNION OIL CO. OF CALIFORNIA GEOTHERMAL DIVISION

## WELL RECORD

LEASE	De Braga			1	SPUD DATE 4/6/79 COMP. DATE 5/7/79						
WELL #					CON	TRACTOR COA	istal Drlo	r. Co.			
FIELD	Stillwate	er Prospect	t		RIG # 2						
LOCATĪ	ON 567°00'3	O"E 947.29	from the	NW	ELEV	VATIONS: G	ROUND				
	corner of	E Sec 6, T	19N, R31E,	MDM.	K	UND 11'					
			n NWZ of Se		K	.B. TO LOW	ER CASINO	HEAD			
B.H.L.	30.8'S,	240.2' E of	E surface 1		TYP	E WELL: EX	PL. XX	DEV.			
DEPTH:	T.D. 6946	T.V.D. 694	10'E.T.D. 6	940		ГМ НО	T WTR XX	INJ			
		· · · ·			D	RY HOLE					
COMPAN	Y ENGINEER	Allen Inn	nan	1	APPI	ROVED		<u></u>	• ·		
			CASING I	RECORD	)						
SIZE	WEIGHT	GRADE	THREAD	TC	P	BOTTOM	REMARK	s			
20"	94#/ft	H40	Buttress	G.T.		94' KB	cemente	d surf.	to 94		
	54.5#/ft	K55	Buttress		KB	310' KB	Icemente				
	40#/ft	K55	Buttress	111		1194' KB	cemente				
	26#/ft	K55	8RD	9871		6940' KB	slotted				
/				1	-00-			on Mi			
								ng tool			
						-					
			WELL HEAL								
			MAKE	TYPE	-		RESSURE F	the second s			
	HEAD SPOOL		WKM	SOW	<u>9</u> .	-5/8"x10"	2	000 psi	L		
	SION FLANGE		WKM Fla	t x St	udd	ed 10"-600	<u>x3"-300_2</u>	<u>000 psi</u>	· · · · · · · · · · · · · · · · · · ·		
	VALVE(S)		WKM	Gate		10"		000 psi			
	HEAD VALVI		WKM	Gate		3"	2	<u>000 psi</u>			
	ION SPOOL V	ALVES		Cata			•				
SWAB V	ALVE		WKM	Gate	<u>.</u>	3"	2	000 psi	<u> </u>		
STEAM	ENTRIES:		DI	EPTH		LBS. I	NCREASE				
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7" 26	# 8RD LT&C	•	3408		725	3241	3408				
			4220		L46	3725	4220				
			6303 6625		503 940	5146 6503	6303 6625				
			0025	0	140						
TEST D	DATA				•		ORIFICE	SIZE			
RIG	TEST DATE		WHP	FLF	<u>}</u>	TEMP	POUNDS/H	IOUR			
			· · · · · · · · · · · · · · · · · · ·								
REMARK	S: Total c	ost of wel	<u>1 = \$535,9</u>	7 <b>0.</b> (	Cost	per foot	= \$77.16.				
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## B. Contractors Used

B&W Inc.

Bill's Casing Tong Service

Coastal Drilling Company

Dresser Industries

Diamond Transport

Dick Howell

Drilco

Driltrol

Halliburton

H&H Oil Tool

Hughes Tool Company

Jack Tedford, Inc.

Magcobar

Midway Fishing Tool

Northern Truck Service

Oilwell Supply

Powers Welding

Rodney A. Weishaupt

Schlumberger

Smith Tool Company

Tillett Tool and Service

West Coast Oil Tool

W-K-M Wellhead Systems

Lowell Emery Surveyors

#### **II.** DRILLING OPERATIONS

## A. RIG INFORMATION:

Coastal Drilling Company Rig #2 is an Oilwell 52T with a 96' Bender Derrick, 11.5' substructure and a 52T Drawworks. The rig is rated to drill to a depth of 8000'. It is powered with two V8 GMC Diesel Engines rated at 600 INT. h.p.. The rotary table is a National 17-1/2". The rig is limited to a 350,000# casing capacity.

B. PREPARATION OF LOCATION AND SETTING OF 20" CONDUCTOR TO 94' (R.K.B.):

The location, sump and roads were built by Rodney A. Weishaupt. A 26" conductor hole was drilled to 83' G.L., 94' R.K.B. by Dick Howell. Twenty-inch (20") conductor pipe was run and cemented from the surface to 83' G.L. with Ready-Mix Concrete.

C. <u>17-1/2" HOLE: 94' to 312':</u> (13-3/8" Casing Set to 310')

Coastal Rig #2 moved in, rigged up, and was placed on day rate at 2400 hours, 4/6/79. The rat hole was drilled immediately thereafter. The well was spudded in at 0600 hours on 4/6/79, and 17-1/2" hole drilled to 312'.

310' of 13-3/8" 61#/ft K55 buttress casing was set and cemented to surface. The 20" casing was cut off to ground

C. Continued -

level. A 12"-900 well head, a 20" Hydril GK, and a Double Shaffer blowout preventer were installed and tested to 1000 psi.

- D. 12-1/4" HOLE: 312' to 1205': (9-5/8" Casing Set to 1194')
  - 1. <u>General Description of Hole Drilled</u> The 12-1/4" hole was drilled from 132' to 1205' through a thick clay sequence, the Lahontan Valley Group. A single bit drilled the entire interval at an average rate of 76'/hour. No significant losses of circulation were observed during the drilling of this interval.

2. Water Flow Experienced While Logging

While logging tools were being prepared to run from 1205' the well commenced flowing. The mud weight was raised and mud was circulated to 727' and 1205' in sequence. A weight of  $70\#/ft^3$  stopped the flow, and logging was carried out.

- E. <u>8-3/4" HOLE: 1205' to 6946' T.D.</u> (7" Liner Hung from 987' to 6940')
  - 1. General Description of Hole Drilled

The 8-3/4" hole was drilled from 1205' to 6946' through a variety of sandstones, siltstones, and volcanics. The only major lost circulation occurred near the top of the interval.

- E. Continued -
  - 2. Problems Encountered and Their Resolution
    - a. Partial loss of circulation or water flows, depending on mud weight, occurred several times in the interval 1300' to 1500'. Six lost circulation plugs (total cement volume 1835ft<sup>3</sup>) were set during the four days required to drill this section. Circulation was regained with the placement of cement plug
      #6. More detailed discussion of the cement used is contained in Chapter 8.
    - b. Parted Drill Collar Box at 6946':

A drill collar box twisted off while drilling at 6946'. The lost tools were recovered on the first run with an overshot fishing tool.

## F. LOGGING EFFORTS

Schlumberger logs were run as follows:

12-1/4" Hole Section - to 1205'

DIL-8 (1205'-312' Dual Induction Laterolog 8)

FDC and CNL (1205'-312' Formation Density Log - Compensated

Neutron Log)

Dipmeter (1205'-312')

Temperature Log = 222°F @ 950'

8-3/4" Hole Section - to 6946' T.D.

DIL-8 (6946'-1194' Dual Induction Laterolog 8)

## F. Continued -

FDC and CNL (6946'-1194' Formation Density Log -Compensated Neutron Log) Temperature Log = 312°F @ 6946' Dipmeter (6944'-1196')

## G. WELL COMPLETION

A combination blank and slotted liner production string, 7" 26# 8RD LT&C casing was run with a Midway liner hanger (7" x 9-5/8") on top and a cement guide shoe on bottom. The liner was hung with the top at 987' and the shoe at 6940'. The perforated section of liner extends from 2724' to 3241', 3408' to 3725', 4220' to 5146', 6303' to 6503' and 6625' to 6940'. Expanding baskets were run at 2040', 2090' and 2130'. The slot designation measure is 18-2-6-150, 150 mesh, 2" slots. A 10" W-K-M 2000# valve was installed on the 10" casing head with a 10"-600 x 3"-600 flat flange on the valve which reduces to a 3"-600 studded adapter and 3"-600 W-K-M full opening valve to facilitate wire line work.

An "A" frame to support the sheave for wire line operations and flow piping for testing purposes was installed.

All drill pipe and tools were laid down and loaded out. The Coastal Drilling Company Rig #2 was released at 2400 hours, 5/7/79.

## III. POST DRILLING OPERATIONS

Current plans are to conduct extensive testing and to continue to monitor temperatures to make reservoir evaluations.

De Braga #2 was produced for 3 hours and 37 minutes on May 22, 1979. Mass produced to the pit during the test was 505,000# for an average rate of 140,000#/hour. Wellhead pressure and temperature were stable at 20 psig and 252°F throughout the test.

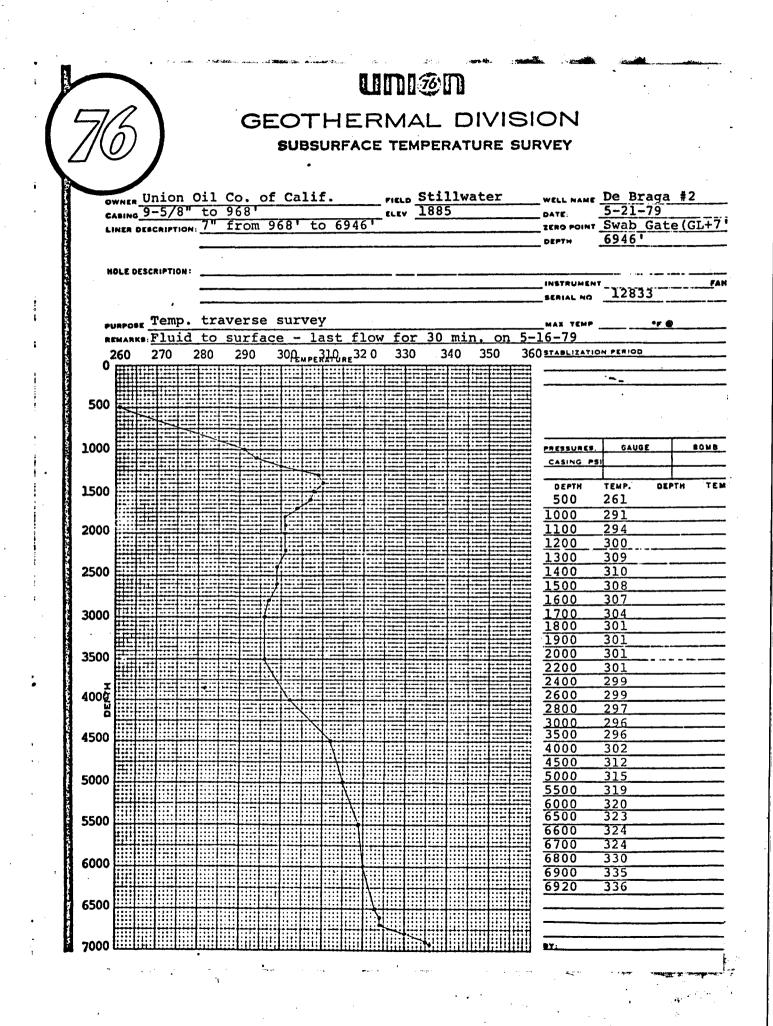
Maximum reservoir temperature of 336°F was recorded on the static survey the day before the test. The temperature and pressure survey reports follow this section.

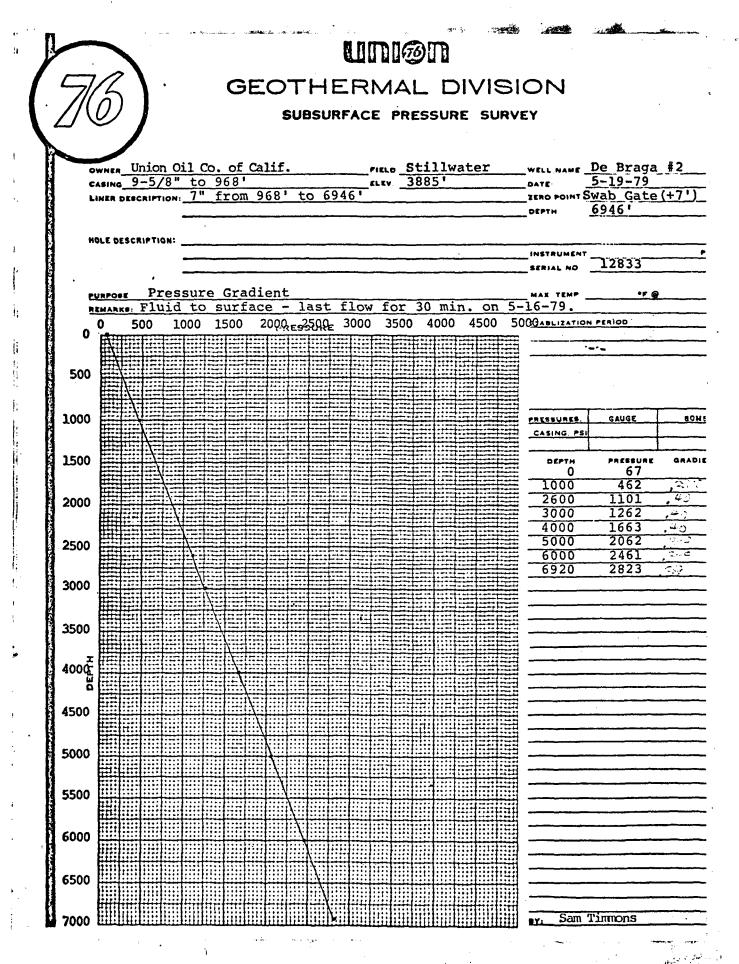
Flash was 8%, based opon 336°F reservoir temperature and a pressure of 20 psig at the orifice.

The temperature survey shows a high gradient in the bottom 250' of the hole indicating that temperature may continue to rise rapidly with depth.

Pressure build-up data has not yet been evaluated. A formal report will be prepared of all the testing including analysis of the data.

This report, and further temperature and pressure surveys following the buildup will be included in an addendum to this technical report when they are available.





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## GEOLOGIC REPORT ON THE

## DE BRAGA #2 WELL

## STILLWATER, CHURCHILL CO., NEVADA

De Braga #2 was drilled to a total depth of 6964'. The following is a description of the rock types encountered in the well to total depth. The descriptions are based on examination of the well cuttings by binocular microscope in the field. Except for the clays of the Lahontan Valley group, no attempt has been made to divide the lithologies into formal formational intervals.

## LITHOLOGY

## Lahontan Valley Group

De Braga #2 was spudded in Recent alluvium composed of sand, silts and clays. From 100' to 1280', the well penetrated the Lahontan Valley group. In the Stillwater area, this group is composed of light gray and light green-gray clays which are occasionally calcareous and range from clean to silty or sandy. A very high rate of penetration of the drill bit occurs in this formation - up to 250 to 300' per hour. This thick clay sequence may be the impermeable cap rock over the entire Stillwater area. It is Pleistocene in age.

## Pre-Lake Lahontan Sediments

From 1280' to 2400' a section of sandstones and siltstones were penetrated. These are typically very fine sandstones, largely composed of subangular quartz and feldspar with occasional É.

varied and multi-colored lighic rock fragments. Quartz overgrowths on quartz grains is common as is a white Kaolinitic(?) matrix which gives the sandstone a low porosity. Pyrite and calcite are secondary minerals which are common in this interval. At the base is a thin 30' zone of light gray and light green, pyritiferous chert.

## Pre-Lake Lahontan Tertiary (?) Volcanics and Sediments

From 2400' to total depth a variable section was penetrated which was composed of volcanics, siltstones and sandstones. Complicating the determination of the stratigraphy which was drilled through in this interval was the inability of the hole to stay in gauge and washing-out of drilled hole was continually contaminating ditch samples with lighologies already drilled. The caliper log shows the hole was rarely in gauge and washouts in the 8-3/4" hole occasionally enlarged the hole to as much as 16".

The volcanics penetrated in this interval consisted of extrusive volcanics, finely crystalline to porphyritic and occasionally with zeolite or agate amygdules. In the finely crystalline basalts about 30% is composed of a bronze-colored(?) orthopyroxene (bronzite?) and about 70% light green, chloritized feldspar. In the prophyritic extrusives are micro-phenocrysts in an aphanitic matrix, occasionally with zeolite or agate amygdules.

The sandstones are largely volcanic, light green, poorly sorted with abundant green, chloritic clay matrix. Siltstones are

Pg 2

gray, brown and green and are also probably derived from volcanics. Calcite is very common through this volcanic-sedimentary sequence but pyrite appears to be present only down to about 5100'.

A major lost circulation zone was encountered near the top of this sequence in the interval, 1309' to 1370'. No other lost circulation occurred in this entire sequence.

A preliminary study of the field print of the dipmeter survey in this sequence suggests it is essentially flat.

## TEMPERATURE

A Schlumberger temperature log was run upon reaching total depth. The running of this log was interrupted by the well starting to flow from artesian water zones just below the 9-5/8" casing. Heavier mud had to be mixed and circulated within the casing so as not to disturb the rebounding temperatures in the open hole below the casing. This tool was on bottom 37 hours after stopping circulation and recorded a maximum temperature of 327°F at total depth.

Below the casing at 1196' the temperature increased rapidly to about 290°F at about 1400' and remained there until about 4800'. From 4800' to total depth (6946') the temperature increased from about 290°F to 327°F (about 1.7°F per 100').

Pg 3

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Well History

Form 3358 (Rev 6/67)

4/9/79 Continued -

casing. Cemented with shoe at 1194', insert float at 1115' with 611ft<sup>3</sup>, 105#/ft<sup>3</sup> slurry of "G" cement with 1:1 perlite, 40% SSA1, 3% gel, 0.5% CFR-2, followed by 100ft<sup>3</sup> "G" cement with 40% SSA1 and 0.5% CFR-2. Preceded cement with 200ft<sup>3</sup> water, 100ft<sup>3</sup> sepiolite, SSA1, flush, with 50ft<sup>3</sup> water. Had good cement returns to surface. C.I.P. at 2015 hours. W.O.C.

4/10/79 W.O.C. 2 hours. Removed cement head. Removed B.O.E. Cut off 13-3/8" and 9-5/8" casing. Welded on a 10"-600 series W-K-M casing head. Tested weld to 1000 psi. Installed B.O.E.'s. Tested CSO to 1000 psi. Laid down 7" drill collars. Picked up 6" drill collars.

4/11/79 R.I.H. Located top of cement at 1103'. Tested Hydril and pipe rams to 1000 psi. O.K. Drilled cement from 1103' to shoe at 1191' and cement to 1205'. Drilled 8-3/4" hole from 1205' to 1309'. Lost all mud returns. Pulled into casing. Mixed pit of lost circulation material and gel mud. R.I.H. to 1309'. Well started flowing. Closed Hydril. Had 70 psi on annulus. Opened choke. Pumped 200bbls mud. Well flowed. Closed well in. Mixed 70#/ft<sup>3</sup> mud. Pumped into hole. Killed well and stopped lost circulation. Pulled to 700'. Unable to circulate with 68#/ft<sup>3</sup> mud. Pulled to 520'. Well started flowing. Closed well in. Killed well with 68#/ft<sup>3</sup> mud. P.O.H. R.I.H. with bit and float sub on 4-1/2" drill pipe to 881', well started flowing. Closed well in and rigged up HOWCO.

4/12/79 Hung 4-1/2" O.E.D.P. at 881'. Closed Hydril. Mixed and pumped 200ft<sup>3</sup> "B" cement, 1:1 perlite, 40% SSA1, 3% gel and 0.5% CFR-2. C.I.P. at 0020 hours. Well went on vacuum after 4 hours. Pumped plug #2 through bit at 682'. Mixed and pumped 400ft<sup>3</sup> cement as before. C.I.P. at 0700 hours. W.O.C. 4 hours. Filled hole with 20 bbls mud. P.O.H. Picked up drilling assembly. R.I.H. to top of cement at 911'. Drilled cement to 1309'. Drilled 8-3/4" hole from 1309' to 1355'. Located obstruction at 1328'. Drilled on obstruction 30 minutes. P.O.H. Checked stabilizer and bit. R.I.H. Drilled on obstruction. Well started flowing. Closed well in.

4/13/79 Mixed a pit of 72#/ft<sup>3</sup> mud. Killed well. P.O.H. R.I.H. with O.E.D.P. to 907'. Closed in well. Mixed and pumped 190ft<sup>3</sup> Versagel, mixed with 4# nut plug per gallon with 20ft<sup>3</sup> water, 100ft<sup>3</sup> "B" cement, 1:1 perlite, 40% SSA1, 3% gel and 0.5% CFR-2. C.I.P. at 0520 hours. Pulled 3 stands. Closed rams. W.O.C. 4 hours. R.I.H. to top of cement at 1126'. Drilled cement from 1126' to 1355'. Well started flowing. Closed well in. Mixed mud and killed well. P.O.H. Ran O.E.D.P. to 939'. Pumped 200ft<sup>3</sup> water, and 190ft<sup>3</sup> Versagel mixed with 5# walnut hulls/gallon.

2

4/13/79 Continued -

20ft<sup>3</sup> water and 200ft<sup>3</sup> "B" cement, premixed with 1:1 perlite, 40% SSA1, 3% gel and 0.5% CFR-2. Displaced with 15ft<sup>3</sup> water. Pressure built to 3000 psi. Pulled to 682'. Pumped out 100ft<sup>3</sup> cement to surface. P.O.H. W.O.C.

- 4/14/79 W.O.C. 4 hours. Ran drill pipe to top of cement at 1061'. P.O.H. R.I.H. with bit. Drilled cement from 1061' to 1326'. P.O.H. Made up HOWCO EZSV. Well started flowing. Killed well. R.I.H. Set EZSV at 1065'. Mixed and pumped 100ft<sup>3</sup> "B" cement premixed with 1:1 perlite, 40% SSA1, 3% gel, and 0.5% CFR-2, followed by 250 sacks cement, premixed with 0.75% CFR-2 and 25# gelsonite/sack. Displaced with 150ft<sup>3</sup> water. Reverse circulated and pulled 180'. W.O.C. 6 hours. Stabbed into EZSV. Pressured to 400 psi. Plug held O.K. P.O.H. Made up drilling assembly.
- 4/15/79 Drilled out EZSV at 1065' and stringers of cement from 1131' to 1220' and hard cement to 1355'. Drilled 8-3/4" hole from 1355' to 1450'. Lost 25% of returns after 1370'. P.O.H. Ran O.E.D.P. to 1159'. Closed rams. Mixed and pumped 420ft<sup>3</sup> "G" cement with 0.75% CFR-2. Displaced with 92ft<sup>3</sup> mud. P.O.H. W.O.C. 4 hours. Filled hole with 10bbls mud. R.I.H. Drilled out cement from 1155' to 1450'. Drilled 8-3/4" hole from 1450' to 1674'.
- 4/16/79 Drilled 8-3/4"hole from 1674' to 2494'.
- 4/17/79 Drilled 8-3/4" hole from 2494' to 3113'.
- 4/18/79 Drilled 8-3/4"hole from 3113' to 3837'.
- 4/19/79 Drilled 8-3/4" hole from 3837' to 4192'.
- 4/20/79 Drilled 8-3/4" hole from 4192' to 4401'. Plugged bit. P.O.H. Picked up 6" monel and drill collar. R.I.H. with bit #11. Drilled 8-3/4" hole from 4401' to 4433'.
- 4/21/79 Drilled 8-3/4" hole from 4433' to 4772'. Surveyed. Broke survey wire line. P.O.H.
- 4/22/79 R.I.H. with bit #12. Washed and reamed from 4750' to 4772'. Repaired drawworks rotary drive chain. Rig down from 0100 to 1930 hours. Drilled 8-3/4" hole from 4772' to 4800'.
- 4/23/79 Drilled 8-3/4" hole from 4880' to 5124'. P.O.H.
- 4/24/79 P.O.H. R.I.H. with bit #13. Drilled 8-3/4" hole from 5124' to 5328'.

De Braga #2

- 4/25/79 Drilled 8-3/4" hole from 5328' to 5531'.
- 4/26/79 Drilled 8-3/4" hole from 5531' to 5878'.
- 4/27/79 Drilled 8-3/4" hole from 5878' to 6042'.
- 4/28/79 Drilled 8-3/4" hole from 6042' to 6209'.
- 4/29/79 Drilled 8-3/4" hole from 6209' to 6413'.
- 4/30/79 Drilled 8-3/4" hole from 6413' to 6701'.
- 5/1/79 Drilled 8-3/4" hole from 6701' to 6826'.
- 5/2/79 Drilled 8-3/4" hole from 6826' to 6946'. Twisted off. P.O.H. Left 290' of drilling assembly in hole. Top of fish at 6656'. Made up Midway 8-1/8" fishing tool, jars and bumper sub. R.I.H. Picked up fish. Circulated and conditioned mud.
- 5/3/79 Chained out of hole. Recovered all of fish. Rigged up and ran Schlumberger temperature log, DIL, Compensated Neutron Formation Density Log and Continuous Dipmeter.
- 5/4/79 R.I.H. with drilling assembly to 2100'. Circulated and conditioned mud. P.O.H. and reran Temperature Log from the surface to 6946'. Ran 8-3/4" bit to 4000'. Circulated bottoms up. R.I.H. to 6946'. Conditioned mud. P.O.H. Laid down drill pipe.
- 5/5/79 Continued to P.O.H., laying down drill pipe and drill collars. Rigged and ran combination blank 7"26# K55, 8 round, LT&C production liner, hung liner on Midway 7" x 9-5/8" liner hanger at 987' with guide shoe at 6940'. Slotted casing intervals, from 2724' to 3241', 3408' to 3725', 4220' to 5146', 6303' to 6503' and 6940' to 6625'. Cement baskets placed at 2040', 2090' and 2130'. P.O.H. Laid down liner setting tool. R.I.H. with 9-5/8" HOWCO RTTS and set at 916'. Backed off lower kelly cock at 12'. Removed B.O.P.E.
- 5/6/79 Installed 10"-600 W-K-M master valve, 10"-600 x 12"-900 cross-over spool and 12"-900 Hydril. Stabbed into lower kelly cock at 12'. Released RTTS. Circulated to cool hole. P.O.H. R.I.H. with 8-3/4" bit with well flowing to 947'. Mixed and displaced 200 bbls 71#/ft<sup>3</sup> mud to kill well. P.O.H. R.I.H. picking up 3-1/2" drill pipe to 6900'. Dumped pits and refilled with fresh water. Plugged bit. P.O.H.
- 5/7/79 Continued P.O.H. Laid down one joint plugged drill pipe. R.I.H. with well flowing two inch stream to 810'. Closed well in. Squeezed away 250 bbls water at 100 psi. R.I.H.

5/7/79

#### Continued -

with well flowing two inch stream to 3750'. Shut well in. Squeezed away 250 bbls through drill pipe and 100 bbls through kill line. R.I.H. with well flowing a two inch stream of water to 6940'. Pumped 700 bbls fresh water, dumping returns. Well dead after pumping 350 bbls and flowing two inch stream after pumping 700 bbls. P.O.H. laying down 4-1/2" and 3-1/2" drill pipe. Stopped at 4697', 2763' and 1535' to pump fresh water while dumping returns. Pumped a total of 2400 bbls fresh water. Well produced approximately 600 bbls additional fluid. Shut well in. Tightened all well head bolts. Tore out Hydril. Laid down Kelly. Released rig for move to Ruby Valley at 2400 hours. De Braga #2

## CASING DETAIL

NO. JTS.	DESCRIPTION	LENGTH	TOP	BOTTOM
	13-3/8" 54.5# K55 BUTTRESS			
	13-3/8" B&W S.O.W. Guide Shoe 13-3/8" 54.5# K55 Buttress Casing Cut-Off		308.15 291.35	310.00 308.15
1	13-3/8" 54# K55 Buttress Casing	40.65	250.70	291.35 (Insert Float)
6 <sup>′</sup>	13-3/8" 54# K55 Buttress Casing	252.70	+ 2.00	250.70
7	TOTAL: (KB = 11.00')	312.00	KB +2.00'	
	9-5/8" 40# K55 BUTTRESS			
2 28	13-3/8" S.O.W. B&W Guide Shoe 13-3/8" 54.5# K55 Buttress Casin 13-3/8" 54.5# K55 Buttress Casing	1.30 g 76.78 1117.92	1192.70 1115.92 + 2.00	1194.00 1192.70 1115.92 (Insert Float)
30	TOTAL: (KB = 11.00')	1196.00	KB +2.00'	
	7"_26# K55_8RD LT&C			
8	7" B&W Guide Shoe 7" 26# K55 8RD LT&C Slotted Casing	1.30 313.15	6938.80 6625.55	6940.00 6938.70
3	7" 26# K55 8RD LT&C Casing	122.25	6503.30	6625.55
5	7" 26# K55 8RD LT&C Casing	99.93	6303.37	6503.30
28	7" 26# K55 8RD LT&C Casing	1157.31	5146.06	6303.37
23	7" 26# K55 8RD LT&C Slotted Casing	925.60	4220.46	5146.06
12	7" 26# K55 8RD LT&C Casing	495.30	3725.16	4220.46
8	7" 26# K55 8RD LT&C Casing 7" 26# K55 8RD LT&C Slotted	316.98	3408.18	3725.16
_	Casing			
4 13	7" 26# K55 8RD LT&C Casing 7" 26# K55 8RD LT&C Slotted	166.39	3241.79	3408.18
τs	Casing	210.33	2724.80	3241.79
42	7" 26# K55 8RD LT&C Casing Midway 7"x9-5/8" Liner Hanger	1733.75	991.05	2724.80
	Midway 7"x9-5/8" Liner Hanger	4.05	987.00	991.05
151	TOTAL:	5953.00		

Top of liner @ 987', Below K.B. KB = 11.00'

#### FISHING OPERATION

#### SUMMARY

Well Depth:	6946' (T.D.)
Date:	May 2, 1979
Top of Fish:	6656'
Length of Fish:	290'
Result:	Complete recovery on first attempt.

Only one minor fishing operation was required on De Braga #2, caused by the failure of a 6-1/16" drill collar box in the thread portion, three threads up from the Drilco relief area.

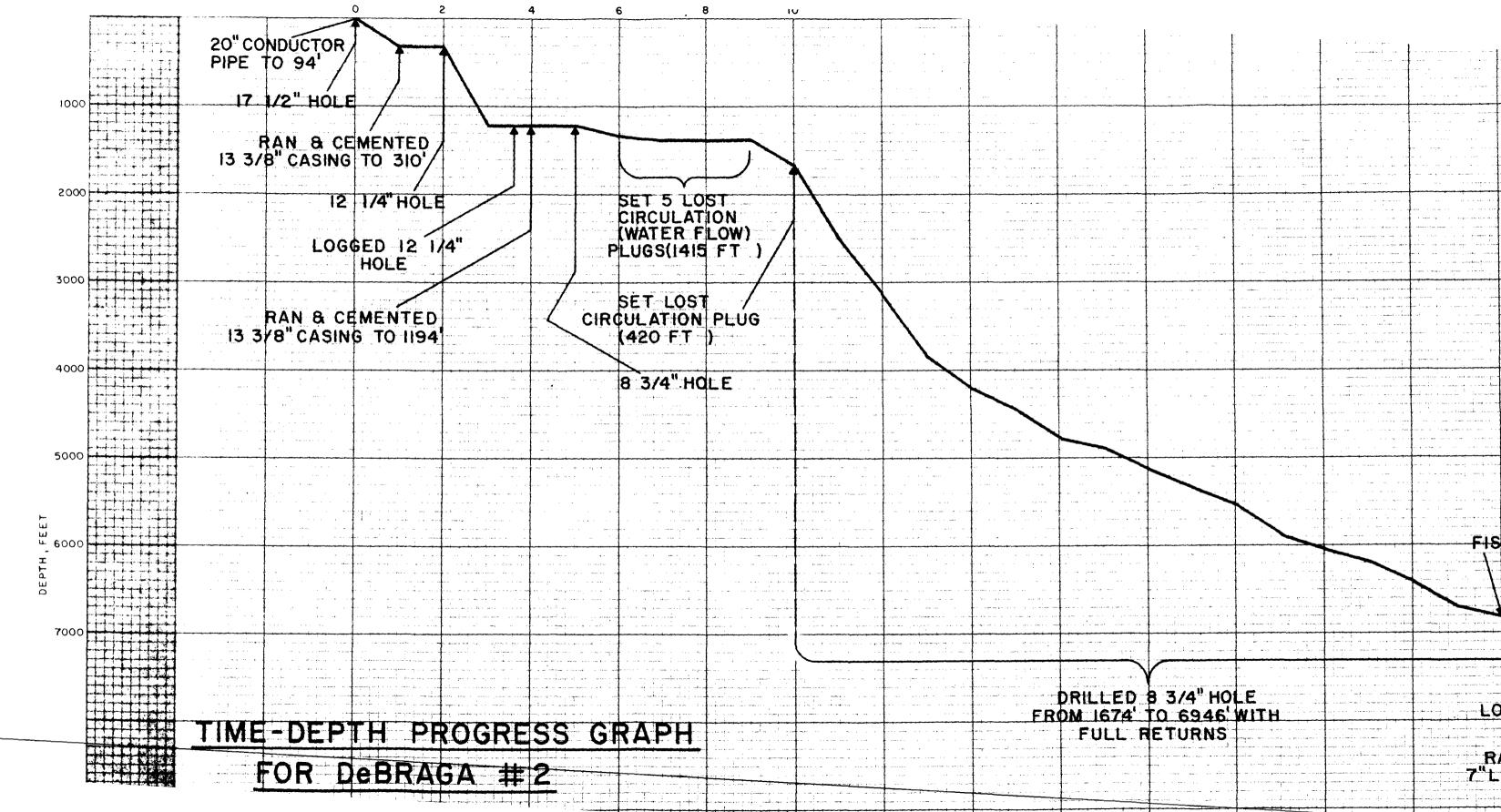
The fish was recovered with a Bowen spiral grapple 8-1/4" O.D. overshot with an 8-1/4" lip guide and a 6" basket grapple with mill control, run on a Bowen 6" bumper sun and hydraulic jar and run on six 6-1/4" drill collars. No problems were encountered in recovering the fish on the first attempt.

The total fish consisted of an 8-3/4" bit, an 8-3/4" stabilizer, 6-1/2" monel drill collar, 8-3/4" stabilizer, 6-1/4" drill collar, an 8-3/4" stabilizer and seven 6" to 6-1/2" drill collars.

## SCHLUMBERGER LOGGING DATA

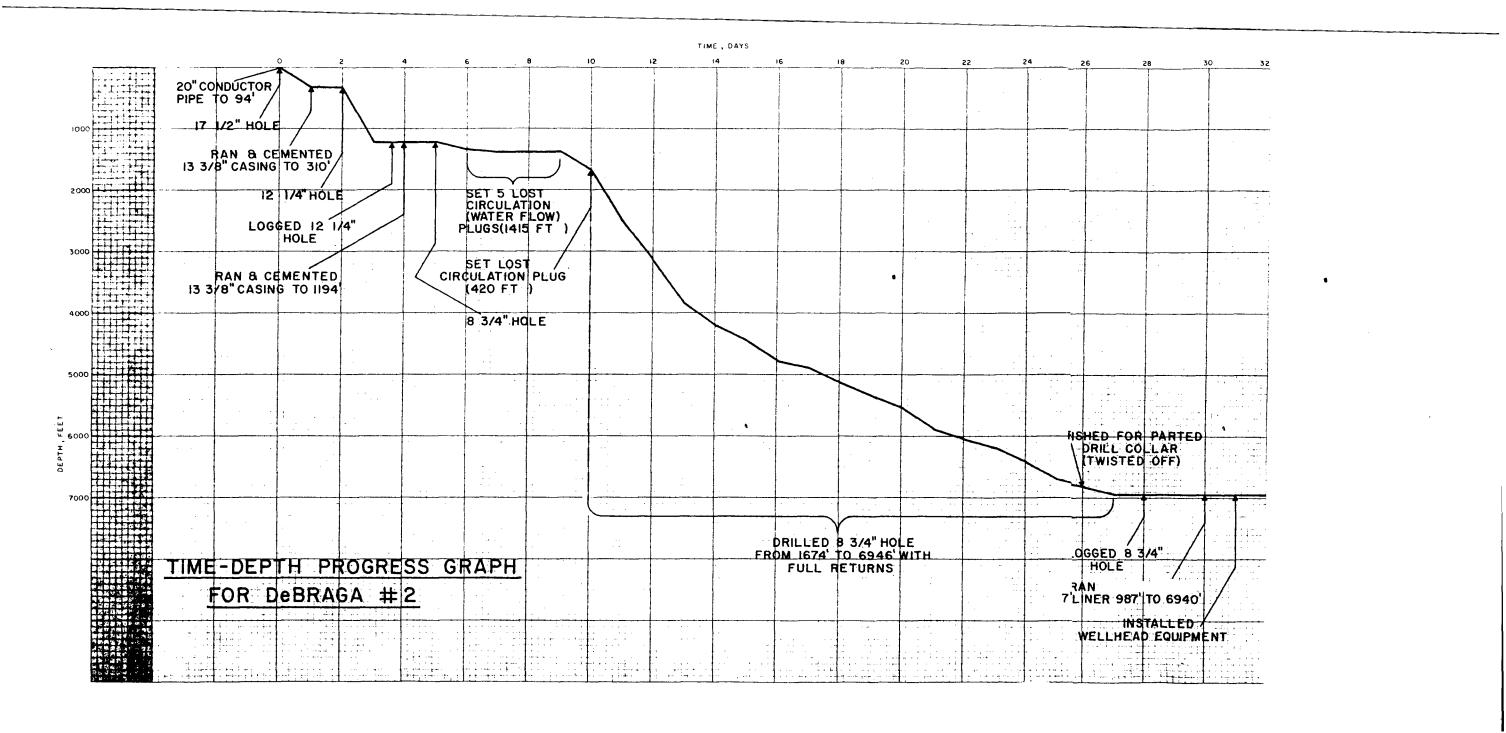
DATE	TYPE OF LOG RUN	LOGGED INTERVAL	TOTAL DEPTH
9 April 79	Dual Induction-Laterolog	320' - 1207'	1205'
<b>9 A</b> pril 79	Compensated Neutron Log- Formation Density	90' - 1213'	1205'
<b>9</b> April 79	Temperature Log	0' - 1205'	1205'
<b>9</b> April 79	Dipmeter Log	320' - 1212'	1205'
3 May 79	Dual Induction-Laterolog	1192' - 6938'	6946 <b>'</b>
3 May 79	Compensated Neutron Log- Formation Density	1192' - 6944'	6946'
3 May 79	Temperature Log	0' - 6946'	6946 <b>'</b>
3 May 79	Dipmeter Log	1196' - 6944'	6946 <b>'</b>

Copies of these logs follow.



p. . .. .g • .5-..... . . . . -----. . . . . . . د أساد . بيستني التنصابين سؤا بدوم مراسمه ام and the second tur tur er ..... nin men minime مديدية موداد والمعتد المتداورات and the second سلابية الإستادا والت الما المرأية د - بحد ، مأسيق FISHED FOR PARTED DRILL COLLAR (TWISTED OFF) سيسا وأستطار الها الاستؤسير والمستجد العنا ب بالمنظم بهم ويوجد LOGGED 8 3/4" HOLE RAN 7"LINER 987'TO 6940'

INSTALL FI



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	TATE	VAD.	-			COUNT	URCI	11.1	11-	6X1				×	4	1/2_		"Hyc	.) INTI	694	6		/	<u>_</u>	RIG	PERSONNEL			
ŀ	TVC.	RANGE	<u>,</u>				CHURCHILL			OMPAN	BA	<u>.</u>	D.F	, SIZE/T.	J:	/	2_ "X" Hae,			AL DAYS	· T	OTA	LROT	. HRS:		FUEL SOURCE WATER			
ŀ				JETS	- 32N R OR	DS	T		HOURS			wт.			PUMP P	10. I PU	( IMP NO. 2	2	<u>ан</u>	PERTIES		ER.		ND 1/4-1			DATE	DEPTH	
	NO.	TYPE	SERIAL NO.	1.			РТН   UT	FEET			CUM. HRS.	1000	R.P.M.	PUMP PRESS.	LINER			wT.	W.L. F.	v	1		тв	G R		REMARKS		DEFIN	
ŀ	1 17:	STC	432NS	16			12	312	73/4	40.3	734	10	120	400	6	10	17	68	4				22	I					
╞	$\frac{1}{2}$ $\frac{1}{2}$	STC	432103 DFJ AC4784			6 120		893		76.0		12.	120	1000		2		68	<b></b>	-	1 . M		24			ALSO DEILLED CEMENT			
ł	3 834	RED		14		4 130			6/2		· · · · ·	18	125	1000		10	+>	66		044	t-fi	<u>د</u>	12	$\mathbf{I}$			<u>†</u> −−†		
┢	4 834	HIC	NA472	tt		6 13		46		92,0	1	15	125	600	+ · · · +	50	1/	68		06/3	+	2	44	Ī		AISO DRILLO CEMENT	<u>↓</u>		
┢	5 83/4	H TC	PJ117	tt			150	95		63,3		15	125	600	<u>+≚.</u> +	50		67	<del> +</del> -	03/3	<u>†</u> −†,		84	T		CCTENT	<u>†</u> †		
h	6 81/4	оци Ræd YIIJ	129354	<b>}</b> +'		6 22		764		50.9	43	18	125	600	<u>+ −</u> +	50		68		103/2	1		44	++	-	ALSO TRILLES CEMENT			
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### CEMENTING OPERATIONS

#### Introduction

Two major kinds of cementing operations were carried out during the drilling of De Braga #2. The first type of operation involved the setting of cement plugs to seal off lost circulation zones in the 1300' to 1500' interval. The second type of operation was the cementing of the 13-3/8" and 9-5/8" casing string.

A total of 1835ft<sup>3</sup> of cement was mixed, pumped and set in six separate plugs to control lost circulation. These efforts occupied nearly four days of rig time and accounted for a total cost of approximately \$65,900. These efforts are discussed below.

The cementing of the 13-3/8" and 9-5/8" casing strings required an additional ll43ft<sup>3</sup> of cement. These efforts are described in a separate section below.

## Lost Circulation Control Efforts

Lost circulation created problems drilling the 8-3/4" lower hole almost immediately after drilling out of the 9-5/8" casing shoe. Four plugs were set in drilling from 1309' to 1355'. While drilling out the fourth plug at 1326', circulation was lost again. The fifth plug was set by installing a Halliburton EZSV bridge plug in the 9-5/8" casing and squeeze cementing through it to 50 psi surface pressure. This was successful, and drilling out continued to 1450', where a sixth plug was needed.

Table 1 presents a description of the lost circulation cementing operations in De Braga #2. Table 2 describes the cement additives used.

Both API class "B" and class "G" cements were used, depending on availability. In two cases, preflushes containing lost circulation material and a viscous gel, Versagel<sup>R</sup>, were tried without notable success. This preflush is still under evaluation.

#### Casing Cementing Operations

The 20" surface conductor was cemented in place with readymixed concrete poured between the casing and 26" hole prior to the start of drilling operations.

The 13-3/8" and 9-5/8" casing strings were cemented with slurries of class "G" cement using guide shoes and insert floats. Each string was cemented in a single stage. The slurry for the 9-5/8" string was mixed with perlite to reduce the hydrostatic head and consequent fluid loss to the formation. Table 3 shows a detailed description of the cementing operations for setting casing.

## TABLE 2

# SUMMARY AND DESCRIPTION OF CEMENT ADDITIVES USED ON DE BRAGA #2

		FU	JNCTION OF ADI	DITIVE	
ADDITIVE	DESCRIPTION	LIGHTEN SLURRY WEIGHT	ACCELERATE SETTING TIME	CONTROL LOST CIRCULATION	REMARKS
Perlite (expanded)	treated volcanic material	x •			absorbs water under high pressure
Silica Flour	finely powdered silicon dioxide				prevents loss of strength at high temperatures
Gęl	Wyoming-type bentonite	x		× · _	increases suspension of particulate additives; maintains even distribution of other additives; reduces slurry weight
CaCl <sub>2</sub>	in powder or flake form		x		accelerates early strengt
CFR-2 (*)	a napthalene polymer		х.		a cement dispersant to reduce viscosity and a friction loss reducer
Gilsonite	particulated naturally occurring asphaltite	x		X	<pre>inert - does not absorb water; high cement strength; resists corrosion; granular lost circulation additive</pre>
Nut-Plug (**)	walnut shells			х	granular lost circula- tion additive

(\*) Halliburton\_trademark\_

(\*\*) Magcobar trademark

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#### TABLE 3 SUMMARY OF CASING CEMENTING OPERATIONS

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DATE	CASING SIZE INCHES	DEPTH OF OPEN HOLE FEET	CSG GUIDE SHOE AT FEET	INSERT FLOAT COLLAR AT, FT.	VOLUME FT3	MATERIAL	PERLITE BY WT. CEMENT	SILICA FLOUR BY WT. CEMENT		CFR-2 BY WT. CEMENT	BY WT.	REMARKS
	20	94				ready mix concrete						By Dick Howell
4/6/79	13-3/8	312	310	242	432	Class "G" cement		40%		0.5%	1%	Good surface returns
					(100	water					÷-	Spacer
		,			100	sepiolite suspension	 n					Preflush
4/9/79	9-5/8	1205	1194	1115	50	water		-				Spacer
					611	Class "G" cement	1:1	40%	38	0.5%		
			·		100	Class "G" cement		408		0.5%		Good surface returns

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#### DRILLING FLUID SUMMARY

Attached are sheets which detail the mud properties, additions, and costs on a daily basis. The following summarizes our experiences with the drilling fluid, and highlights those operations which increased the drill fluid cost.

Numerous problems were experienced due to high permeability zones encountered between 900' and 1500', which resulted in higher costs in this interval. In fact, over 50% of the total drilling fluid costs were incurred in this interval. Before presenting a detailed account of these problems, let us dispense with the rest of the drill fluid operation with a short summary.

The drilling fluid used was a dispersed mud which utilized bentonite and attapulgite for viscosity, a tannin compound for fluid loss control and to maintain a dispersed mud system, and caustic soda to maintain the pH of the mud. This drilling fluid performed adequately and economically in the trouble free sections of the hole.

The problems with the drilling fluid were all related to pressure control. High permeability zones were encountered which acted as lost circulation zones when the mud weight exceeded the reservoir pressure, and which flowed formation water into the wellbore if the mud weight was less than the reservoir pressure. As outlined in detail below, a series of events was repeated several times in which the well would start the flow, the mud weight would be increased to stop the flow, and then circulation would be lost. When the weighted mud supply was exhausted the well would flow again. Making up a mud system, especially a weighted mud system, and then losing it is very costly, so these zones were plugged with cement. However, cement acts as a contaminant in the mud system and destroys its desirable properties. Consequently, the cement contamination had to be treated out of the mud, increasing the cost.

What follows is a detailed synopsis of the problems that occurred, and how they affected the mud system.

After the intermediate (12-1/4") hole was drilled to 1205', the hole was to be logged, but while preparations were underway, the hole started to flow. Eventually the well had to be killed by circulating a weighted mud  $(72\#/ft^3)$ . This section of hole was subsequently cased and cemented. 8-3/4" hole was then drilled to 1309', where a total loss of returns occurred. Mud containing lost circulation materials was spotted at the bottom of the hole, but the well started flowing. Weighted mud (70#/ft<sup>3</sup>) was pumped into the hole to stop the well from flowing, and the flow not only stopped, but all returns were lost. The mud weight was reduced to 68#/ft<sup>3</sup>, and the well started to flow again. Subsequently, cement was pumped into the well to seal off this problem zone. Five cement plugs were set before drilling could continue below 1355', and one more cement plug was placed around 1450'. Each time that cement was displaced into the well, the mud had to be reconditioned.

To summarize, the mud system performed well and economically (\$400-600/day) except in the trouble area frrm 900' to 1500', where costs reached \$1000-\$4000/day due to lost circulation, water flows, and cement contamination.

ATE	FLUG WUNDER	DEPTN OF OPEN BOLE FIET	DR ILLED DEPTH FECT	CIRCULATION METHOD	PLUG VOLUME FT3	MATERIA	PERLITE By WT. L CEMENT	SILICA PLOUR BY WT. CEMENT	GEL BY WT. CEMENT	CPR-2 BY WT. CEMENT	gilson <b>ite</b> {/sk. <u>Cement</u>	NUT		TIME TO NEXT OPERATION HOURS	WELLHEAD SQUEEIE PRESSURE PSIG	THEORETICAL PLUG LOSS	REMARKS
/12/79	1	1369 1309	1309	Bit @ 301* Dit @ 682*	200		cmt 1:1 cmt 1:1	40	3	0.5% 0.5%	**		not located 911	4	70 }	724	
/13/79	Freflush		1355	OEDP \$ 907"	190	Versage	1				~-	5ŧ/g:	1	Continuous			Pollowed by 20ft <sup>3</sup> water spacer
/13/79	3	1355	1355	OEDP @ 907*	100	C1 "B"	ent lil	. 40	3	0.5%	**		1126	4		45	
/13/79	Freflush	1355	1355	OEDP \$ 939'	190	Versage	1		~~			5ŧ/gi		Continuous			Followed by 20ft <sup>3</sup> water spacer
1/13/79	4	1355	1355	OEDP ( 939'	200	Cl "G"	cat 1:1	40	3	0.5%			1061	4	300	•	Circulated excess cement out of drill pipe
/14/79	{54 56}	1326	1355	Bridge Plug at 1065'	${100 \\ 415}$	cl "B" cl "B" (250 ska		40	3	0.5% 0.75%	23		1220	Continuous 6	50 }	918	••
/15/79	6	1450	1450	OEDP @ 1159'	420	cl *G*	cat		**	6.75%	~~		1155	4		710	
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DE BRAGA #2 TABLE 1 LOST CIRCULATION CONTROL EFFORTS

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#### FLUID ANALYSIS

Water samples were collected during the drilling of De Braga #2 and sent to Union Oil Company's Science and Technology Division laboratories at Brea, California for analysis. The results of those analyses are not yet available for inclusion in this report. When the analyses are finished, an addendum will be furnished to complete this section.

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			PAGE OF	
			CONDUCTOR SIZE DEFTH DIT SIZE N DITSHOFATING DEGASSER DESANDER DESILTER CENTRIFUGESHARER	R N <b>5</b>
	WELL HISTORY UNION OIL CO.	SECTION TOWNSHIP PANGE MUD TYPE 6 19N 31E Lignin FIELD SPUD DATE	te 13 3/8 312 17 <sup>1</sup> / <sub>2</sub> 1 17 3/4	
	Manchan de Braga #2	STILLWATER 4-6-75	INTERMEDIATE 9 5/8 1196 121 1 11 3/4	
	COASTAL #2	CHURCHHILL, NEV. 5-2-7	7 6940 8 3/4 15252 3/4	
	DRILLING FLUID SERVICES RON HUBBS	NEVADA 26	PRODUCTION	
	DATE         MEAS- URED DEPTH         ¥ ¥,8, N         MUD WT.         VIS SEC.         ANGLE AND DIREC. TION         FLOW RATE (gpm)         FLOW LINE DIREC. TION         GELS           4 - 6         229         66         38         92         92	API FLUID LOSS     H T H P FLUID LOSS     Pf     Mf     Pm     SALT OR CHIORIDE       Image: Construction     Pf     Mf     Pm     □ ppm       □ mg/l     □     □     □	$\begin{array}{c cccc} & & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & \\ & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ $	
i.		drlng. cement from 15' to 9'		
	Cut and weld 13 3/8", install Hy-dril, nipple up,           4-8         1124 32         69         35         834         403         132         3         9         2         /129.0	test @1,000 psi for 30 min.	drlng. cmt.     993.0	00
	Use         Use <thuse< th=""> <thuse< th=""> <thuse< th=""></thuse<></thuse<></thuse<>	. Wait on loggers. Start	t of hole. 120 4 4 4	 
	120068         70         33         37         3         2         0         /1         9.5           Circand condition mud, p.o.h., rig up and run E         1         1         1         1         1         1         1         1         1         1         1         1         9.5         1         9.5         1         1         1         1         1         1         9.5         1	ogs, hole flowing, rih, buil	0 3 .75 15 3 110 1,022 ing_mut_wt. 2,014	1.00
	4-9         1200         .58         71         34         137         130         5         5         0         2         9.2           p.o.h., rig up and r E         logs, run 9         5/8" and cemen           1200         .73         72         35         48         6         8         0         /1         9.5	k k k k k k k k k k k k k k k k k k k	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	7.00 1.00
	Hot water flow @ 98' (degrees) 4-10 1200 .73 72 35 48 6 3 0 /1 9.5	NC1 .3 .4 1150	<u>0 4 5                                  </u>	
	<pre>W.O.C., test @ 1,000 psi for 20 min., rig for dri 4-11 1265 .58 66 32 110 4 4 1 /5 11. R.I.H., drilng.cement, lost circ. @1,309', mix lo 4-12 1309 .68 72 35 147 128 2 /1212. CMT pull to 692 woc, bleed of pressure. cmt, woc, 4-13 1326 .73 66 34 49 135 6 3 1 /5 11. Build weight, cmt, woc, clean out cmt, 1126 to 11 1323 .58 66 32 82 3 3 0 /2 9.6 WOC, rih tag cmt @ 1061', dring cmt., kill well</pre>	0 228 .9 1.4 1.1 1150 cm, regain circ., now well f 1 24 2.3 3.3 4.2 1000 dring cement, dring, to 13 8 23 1.8 2.3 4.2 1000 92, torque @ 1326, well flo 5 24 .4 .4 2.0 950	0       3       .5       70       5       10       3       110       2025       25       3.243         wing. kill well, then no circ, w/o Haliburton       6.664         0       4       10       15       5       84       10       207.0         0       4       10       15       5       84       10       707.0         0       3       1       15       10       10 200       170       4.837         0       3       1       15       10       10 200       170       12,21         0       3       1       50       10       10 120       45       30       2,476         9. cement, drill well again and cement.       14,690       14,690       14,690       14,690	4.00 00 7.00 7.00 14.00 6.00
<b>.</b>	4-14       1440       .73       68       35       48       .417       117       6       3       0       /2       10.         4-15       1580       .68       66       34       37       3       2       0       /2       11.         RIH       cond.       mud.       cmt.       at 1031'       drlng       out       cmt.       por         4-16       2056       .58       64       35       110       4       4       .1       /6       10.	.9       19       .5       1,1       1.3       1950         .6       21       1.7       2.1       5.2       1950         .7       re-cement at 1150' woc, d         .9       24       .4       .7       2.6       950		9.00
	2456       ,7       63       31       52       5       3       0       /2       9.5         Drlng, hole taking fluid.       4-17       2737       .64       68       33       85       403       5       4       1       5       9.6		0 3 .75 60 16 10 20 1,296 0 3 .25 17,705	6.00 5.00
	2864       .73       68       31       32       4       2       .0       /3       10         Drlng sand and clay       4       12       .0       /3       10         4-18       3622       .75       .70       36       .76       .138       11       5       .1       .5       .9       .5		0     3     .25     20     12     2     30     585.0       0     3     .25     .25     .25     .25	0000
	3741.71.68.33.67       1       7.3.1/4.9.2         Drilling       4.194028.71.69.33.85       135.9.5.1.69.3		0     3     .25     70     10     4     80     1,28       0     3     .25     19,57	5.00
	4102       .73       67       31       41       130       6       3       0       , 3       9         Drlng., note       11       of       16       cones       were       on       D=San         4-20       4339       .69       68       34       90       8       5       .0       4       9	4 18 .1 .2 .3 450 der, dischared 3/4 of pit in 7 18 .2 .4 .4 450	0       3       .25       60       10.8       50       1.11         sump, bebuild volume       20,68         0       3       .25       1	2.00
	4370 .76 67 2 45 7 3 1 5 10 Dring.	2 18 1 .3 4 450	0 3 55 1 <sup>-</sup> 10 25 1 <sup>-</sup> 1,05 21,73	
		- · · · · · · · · · · · · · · · · · · ·		

	. <b>*•</b>			<i>,</i> •,						PAGE .	OF
1	<b>,</b>			·	CONDUCTOR	SIZE DEPTH	BIT SIZE	N BITS ROTATING	DEGASSER DESAND	ER DESILTER	CENTRIFUGE SHAKER SCREENS
4	WELL HISTORY	OPERATOR	SECTION TOWNSHIP RANGE MUD TYPE		BURFACE			+			
	MAG-464-C	Union Oil Co.	6 19N 31E								
	Manenhan	DE BRAGA #2	STILLWATER	E	INTERMEDIATE						
		CONTRACTOR	COUNTY/PARISH		LINER(S)						
		ENGINEERS	STATE DAYS TO	T,	PRODUCTION					_	
	DAILLING FLUID SERVICES	RON HUBBS	NEYADA		+	7.27			1/10/7		
	DATE WEAS- URED DEPTH N WT. S	ANGUEX FLOW LINE GELS	APi     H.T.H.P.     SALT       PH     FLUID     FLUID       PG     FLUID     Pf       Mf     Pm     CI ppm			TANNA- THINA- CAUSTTC SODA SODA BICA	ARL SFE	K. SEAL SALIK SALIK GEL	CCA PLUG IME		/ / MUD COST
	DEPTH N S	/IS 2010 C C C C C C C C C C C C C C C C C C			gEl	A H H S CO	BAR CRO	× × ×			
	4-21 4521 .73 68 3	3 65 13.8 8 4 0 / 4	9.9 18 1 .2 .3 450	3 0 .5							
	4708 .71 67 34	4 67 150 7 4 0 / 4	10.118 .1 .2 .4 450	30 0 tro	60	8 10					22,738.0
	Build volume, gate 1 4-22 4775 .73 67 3	eft open on sand trap. 5 48 6 3 0/3	9.7 18 .1 .2 .3 450	3 0 1	T   1	<u> </u>				· · ·	
						3 16 1	······································		010		882
	4805 .7 69 3 Water left on in pit,	4 52 5 3 0/3 , flooded location, buildin	9.5 18 .1 .2 .3 450 g vis		50	2 6	I				23,620.
		4 104 142 10 6 1/5	9.5 17 .1 .3 .3 450	3 0 1							
	5100 .71 71 3	5 85 142 9 5 1/5	9.6 17 .1 .3 .3 450	3 0 1	48	6					24,228.
	0rilling, rotary driv 4-24 5160 .76 69 3	e break, bit plugged 5 58 130 9 4 0/2	9.4 17 .2 .4 .4 450	3 0 .25			<u> </u>				
	Gate left open on sa	nd trap, lost 100 bbls.					1				688.00
	5280 .76 68 3 Water left on in pit		9.6 17 .2 .4 .4 450	3 0 .2		4				iii	24,916
	4-25 5440 .73 68 3		9.4 16	20 3 0 .2	68	i			6	<u>    i    l     l     l</u>	518.0 25,434
	Drlng. and survey 4-26 5723 .71 65 3	1 85 9 5 0/2	9.1 16	20 3 6 .2	5						
	5864 8 68 3	2 38 7 4 0 1	9.2 16 2 4 7 450	20 3 0 .2	5 40				3		301.00
	Drilling and survey										25,73
	4-27 5913 .83 69 3		9.2 16 .1 .2 .2 450	3 0 .2		L I I		······			389.00
	5973 .79 69 3 Drlling and survey	2 41 152 8 3 0/1	9.3 16 .1 .2 .3 450	3 0 .2	5 50						25,124
	4-28 6165 .8 69 3	2 28 6 2 0/1	9.2 16 .1 .2 .2 450	3 0 .2	5 35	1			2		26.535
	Drilling and work on 4-29 6351 .76 69 3	rig 2 45 153 7 3 0/1	9.3 16 .1 .2 .2 450	3 0 .2	5						
						3	T		3 10		416.0
	6395 .73 68 3 Drilling						<i></i>	└─── <sup>↓</sup> ─── <sup>↓</sup> ─── <sup>↓</sup>	·····	<del></del>	26,951
	4-30 6530 .76 69 3	3 45 153 7 3 0 / 1	9.2 16 .1 .3 .3 450	3 0 .2	5		1 1				
	6655 .8 68 3	2 28 155 6 2 0 / 1	9.3 16 .2 .3 .3 450	3 0 .2	5 30	3	15				27,482
	Drilling and survey 5-1 6750 .77 68 3	1 30 168 5 2 0/1	9.2 16 .2 .3 .4 450	3 0 .2	5 6		15				167.0
	Drilling 5-2 6944 .73 68 3					2					27,649
	Twisted off, 7 colla	rs, one monel in hole, rig	up over shot, retrieve fish			······		· · · · · · · · · · · · · · · · · · ·	· · · · · · ·	·····	27,808
	5-3 6946 .68 68 3 P.O.H. W/fish, run 1	4 74 6 4 0 / 1	9.3,16 .1 .2 .3 450	3 0 tr	c		15		····	L	28,000
	5-4 6946 .7 61 3	7 142 168 18 8 1 4	9.5 16 .2 .4 .5 450	4 0 tr	c 10	2 2	30				420.0
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	log water flow @1450' 2 12 7 0/1	9.4 16 .2 .4 .4 450	4 0 tr	c						
	Lay down tools, run 5-6				20	1 2 1	70	3			905.0
		dril, nipple up, circ. thru	RTTS CIT Well, well hlowing	ill well, c	hange ove	r to wate	r		1.1.1 <u>.</u> 1.	۰. ۱ .l	29,325
· -			and the second								

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