

GL02173

DE BRAGA #2

SCHLUMBERGER LOGGING DATA

<u>DATE</u>	<u>TYPE OF LOG RUN</u>	<u>LOGGED INTERVAL</u>	<u>TOTAL DEPTH</u>
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'
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.



SECURITY DIVISION  
Dresser Industries, Inc.

OILFIELD PRODUCTS GROUP  
P. O. BOX 6504 HOUSTON, TEXAS 77005 (713) 784-6011

FILE NO. **BIT RECORD** FORM NO. FM-683B

CONTRACTOR <b>COASTAL DRILLING</b>	RIG NO. <b>2</b>	RIG MAKE <b>OILWELL 52T</b>	DC. OD X ID X LENGTH (HOLE SIZE) <b>7 x x 30</b>	MO./ DAY/ YEAR <b>4 / 6 / 79</b>	PAGE <b>1</b> OF <b>1</b>
COMPANY <b>UNION OIL Co. of CAL.</b>	FIELD <b>STILLWATER</b>	RIG SIZE <b>96' BENDER</b>	<b>6 x x 30</b>	SPUD: _____	SALESMAN _____
LEASE <b>De Braga</b>	WELL NO. <b>2</b>	PUMP NO. 1 <b>6X16</b>	<b>x x</b>	U.S.I. _____	BUYER _____
STATE <b>NEVADA</b>	COUNTY <b>CHURCHILL</b>	PUMP NO. 2 <b>6X14</b>	<b>4 1/2 "X" HOLE</b>	INTER: _____	RIG PERSONNEL _____
SEC. / Y' SHIP/RANGE	MUD COMPANY <b>MAGCOBAR</b>	D.P. SIZE/T.J.	TD: <b>6946</b>	TOTAL DAYS: <b>32</b>	TOTAL ROT. HRS: _____
				FUEL SOURCE <b>DIESEL</b>	WATER SOURCE _____

RUN NO.	SIZE	TYPE	SERIAL NO.	JETS - 32 NOS REG. R OR RO			DEPTH OUT	FEET	HOURS	FEET PER HOUR	CUM. HRS.	WT. 1000 LBS.	R.P.M.	PUMP PRESS.	PUMP NO. 1		PUMP NO. 2		MUD PROPERTIES						VER. DEV.	DULL COND 1/4-1/8					REMARKS	DATE	DEPTH
				LNHR	SPM	LNHR									SPM	WT.	W.L.	F.V.	P.V.	VP	SOI.	T	B	G		RG							
1	17 1/2	STC	DSTJ 432NS	16	16	16	312	312	7 3/4	40.3	7 3/4	10	120	400	6	40	/	68	40					0 1/2	2	2	I						
2	12 1/4	STC	DSTJ AC4784	16	16	16	1205	893	11 3/4	76.0	19 1/2	12	120	1000	6	50	/	68	40	3/9				0 1/2	2	4	I	ALSO DRILLED CEMENT					
3	8 3/4	REED HTC 412	130924	14	14	14	1309	104	6 1/2	16.0	26	18	125	1000	6	50	/	66	40	4/4				1 1/4	4	2	I						
4	8 3/4	HTC OSC16	NA472	16	16	16	1355	46	1/2	92.0	26 1/2	15	125	600	6	50	/	68	40	6/3				1 1/2	4	4	I	ALSO DRILLED CEMENT					
5	8 3/4	HTC OSC16	PJ117	16	16	16	1450	95	1 1/2	63.3	28	15	125	600	6	50	/	67	40	3/3				1 1/2	8	4	I						
6	8 3/4	REED HTC Y11J	129354	16	16	16	2214	764	15	50.9	43	18	125	600	6	50	/	68	40	3/2				1 1/2	4	4	I	ALSO DRILLED CEMENT					
7	8 3/4	STC DSTJ	AA1359	16	16	16	2721	507	18	28.2	61	18	125	600	6	50	/	68	40	5/3				1 1/2	4	4	I						
8	8 3/4	STC DSTJ	AB6299	12	12	12	3721	1000	20 1/4	49.4	81 1/4	25	125	900	6	50	/	67	40	4/2				3 1/2	6	6	I						
9	8 3/4	REED HTC Y13	120572	11	11	11	4088	367	16 1/2	22.2	97 3/4	15	125	1000	6	50	/	68	35	7/4				3 1/2	4	6	I						
10	8 3/4	REED HTC Y11	129348	11	11	11	4401	313	15	20.9	112 3/4	10	125	1000	6	50	/	67	34	6/3				3 1/2	3	3	I						
11	8 3/4	STC DSTJ	AB6332	11	11	11	4772	371	23	16.1	135 3/4	20	125	1000	6	50	/	67	35	7/3				2 1/2	5	6	I						
12	8 3/4	HTC 03630	RT453	11	11	11	5124	352	19 3/4	17.8	153 1/2	18	125	1000	6	50	/	68	34	9/5				3 1/2	5	6	1/8						
13	8 3/4	HTC OSC16	Mx857	14	14	14	5430	30 1/2	23 3/4	12.9	171 1/4	18	125	1000	6	45	/	68	35	7/3				3 1/2	4	6	I						
14	8 3/4	REED HTC S11J	609222	12	12	12	5900	470	25 3/4	18.3	205	25	125	900	6	45	/	68	35	7/4				3 1/2	8	2	I						
15	8 3/4	REED HTC S11J	329071	12	12	12	6403	503	30 3/4	16.4	235 3/4	25	125	900	6	45	/	68	35	6/2				4 1/2	8	8	1/8						
16	8 3/4	STC DSTJ	01875	14	14	14	6701	298	17 3/4	16.8	253 1/2	25	125	900	6	45	/	68	33	6/3				4 1/2	5	2	I						
17	8 3/4	STC DSTJ	AB0185	14	14	14	6946	245	18 3/4	13.1	272 1/2	20	125	900	6	45	/	68	33	6/3				4 1/2	4	4	I						
18	6	REED HTC Y13J	DSTJ AA1359	16	16	16	CIRCULATION																										

\* DENOTE BY (N) - NO. (L) - LIGHT (M) - MEDIUM OR (H) - HEAVY ROUNDING OF GAGE

SUBJECT TO PROVISIONS ON REVERSE SIDE

## DE BRAGA #2

### 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 1143ft<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>®</sup>, were tried without notable success. This preflush is still under evaluation.

#### Casing Cementing Operations

The 20" surface conductor was cemented in place with ready-mixed 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

ADDITIVE	DESCRIPTION	FUNCTION OF ADDITIVE			REMARKS
		LIGHTEN SLURRY WEIGHT	ACCELERATE SETTING TIME	CONTROL LOST CIRCULATION	
Perlite (expanded)	treated volcanic material	X			absorbs water under high pressure
Silica Flour	finely powdered silicon dioxide				prevents loss of strength at high temperatures
Gel	Wyoming-type bentonite	X		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 naphthalene polymer		X		a cement dispersant to reduce viscosity and a friction loss reducer
Gilsonite	particulated naturally occurring asphaltite	X		X	inert - does not absorb water; high cement strength; resists corrosion; granular lost circulation additive
Nut-Plug (**)	walnut shells			X	granular lost circulation additive

(\*) Halliburton trademark

(\*\*) Magcoar trademark

**TABLE 3 - SUMMARY OF CASING CEMENTING OPERATIONS**

DATE	CASING SIZE INCHES	DEPTH OF OPEN HOLE FEET	CSG GUIDE SHOE AT FEET	INSERT FLOAT COLLAR AT, FT.	VOLUME FT <sup>3</sup>	MATERIAL	PERLITE BY WT. CEMENT	SILICA FLOUR BY WT. CEMENT	GEL BY WT. CEMENT	CFR-2 BY WT. CEMENT	CaCl <sub>2</sub> BY WT. CEMENT	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	--	--	--	--	--	Preflush
4/9/79	9-5/8	1205	1194	1115	50	water	--	--	--	--	--	Spacer
					611	Class "G" cement	1:1	40%	3%	0.5%	--	
					100	Class "G" cement	--	40%	--	0.5%	--	Good surface returns

## DE BRAGA #2

### 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<sup>3</sup>). 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 from 900' to 1500', where costs reached \$1000-\$4000/day due to lost circulation, water flows, and cement contamination.

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TABLE 1 LOST CIRCULATION CONTROL EFFORTS

PLUG NUMBER	DEPTH OF OPEN HOLE FEET	DRILLED DEPTH FEET	CIRCULATION METHOD	PLUG VOLUME FT <sup>3</sup>	MATERIAL	PERLITE BY WT. CEMENT	SILICA FLOUR BY WT. CEMENT	GEL BY WT. CEMENT	CFR-2 BY WT. CEMENT	GILSONITE #/SK. CEMENT	MUT PLUG	TOP OF CEMENT FEET	TIME TO NEXT OPERATION HOURS	WELLHEAD SQUEEZE PRESSURE PSIG	THEORETICAL PLUG LOSS	REMARKS
79	1	1369	Bit @ 881'	200	Cl "B" cmt	1:1	40	3	0.5%	--	--	not located	4	70		
79	2	1309	Bit @ 682'	400	Cl "B" cmt	1:1	40	3	0.5%	--	--	911	4	--		
79	Preflush	1355	OEDP @ 907'	190	Versagel	--	--	--	--	--	50/gal	--	Continuous	--	--	Followed by 20ft <sup>3</sup> water spacer
79	3	1355	OEDP @ 907'	100	Cl "B" cmt	1:1	40	3	0.5%	--	--	1126	4	--	40	
79	Preflush	1355	OEDP @ 939'	190	Versagel	--	--	--	--	--	50/gal	--	Continuous	--	--	Followed by 20ft <sup>3</sup> water spacer
79	4	1355	OEDP @ 939'	200	Cl "G" cmt	1:1	40	3	0.5%	--	--	1061	4	300	0	Circulated excess cement out of drill pipe
79	{ 5a } { 5b }	1326	Bridge Plug at 1065'	{ 100 } { 415 }	cl "B" cmt ol "B" cmt (250 sks)	1:1 --	40 --	3 --	0.5% 0.75%	-- 25	-- --	-- 1220	Continuous 6	-- 80	-- 910	
79	6	1450	OEDP @ 1159'	420	ol "G" cmt	--	--	--	6.75%	--	--	1155	4	--	710	





**UNION 76**  
**GEO THERMAL DIVISION**

TECHNICAL REPORT ON  
DE BRAGA #2  
CHURCHILL COUNTY, NEVADA

DE BRAGA #2

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## DE BRAGA #2

### 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 Magco-bar, 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.



DE BRAGA #2

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
    - b. 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

DE BRAGA #2

I. GENERAL INFORMATION

**UNION OIL CO. OF CALIFORNIA  
GEOHERMAL DIVISION**

WELL RECORD

<b>LEASE</b> De Braga	<b>SPUD DATE</b> 4/6/79	<b>COMP. DATE</b> 5/7/79
<b>WELL #</b> 2	<b>CONTRACTOR</b> Coastal Drlg. Co.	
<b>FIELD</b> Stillwater Prospect	<b>RIG #</b> 2	
<b>LOCATIONS</b> S67°00'30"E 947.29' from the NW corner of Sec 6, T19N, R31E, MDM. (well is located in NW¼ of Sec 6)	<b>ELEVATIONS: GROUND</b>	
	K.B. TO GROUND 11'	
	K.B. TO LOWER CASING HEAD	
<b>B.H.L.</b> 30.8'S, 240.2' E of surface loc.	<b>TYPE WELL:</b> EXPL. <u>XX</u> DEV.	
<b>DEPTH:</b> T.D. 6946' T.V.D. 6940' E.T.D. 6940'	STM _____ HOT WTR <u>XX</u> INJ _____	
<b>COMPANY ENGINEER</b> Allen Inman	DRY HOLE _____	
	APPROVED _____	

CASING RECORD

SIZE	WEIGHT	GRADE	THREAD	TOP	BOTTOM	REMARKS
20"	94#/ft	H40	Buttress	G.L.	94' KB	cemented surf. to 94'
13-3/8"	54 5#/ft	K55	Buttress	11' KB	310' KB	cemented surf to 310'
9-5/8"	40#/ft	K55	Buttress	11' KB	1194' KB	cemented surf to 1194'
7"	26#/ft	K55	8RD	987' KB	6940' KB	slotted & blank liner on Midway fishing tool hanger

WELL HEAD ASSEMBLY

	MAKE	TYPE	SIZE	PRESSURE RATING
CASING HEAD SPOOL	WKM	SOW	9-5/8"x10"	2000 psi
EXPANSION FLANGE	WKM	Flat x Studed	10"-600x3"-300	2000 psi
MASTER VALVE (S)	WKM	Gate	10"	2000 psi
CASING HEAD VALVES	WKM	Gate	3"	2000 psi
EXPANSION SPOOL VALVES				
SWAB VALVE	WKM	Gate	3"	2000 psi

**STEAM ENTRIES:** \_\_\_\_\_ **DEPTH** \_\_\_\_\_ **LBS. INCREASE** \_\_\_\_\_

Not Applicable

SLOTTED LINER	SLOTS		BLANK	
	FROM	TO	FROM	TO
7" 26# 8RD LT&C	2724	3241	987	2724
	3408	3725	3241	3408
	4220	5146	3725	4220
	6303	6503	5146	6303
	6625	6940	6503	6625

TEST DATA				ORIFICE SIZE
RIG TEST DATE	WHP	FLP	TEMP	POUNDS/HOUR

**REMARKS:** Total cost of well = \$535,970. Cost per foot = \$77.16.

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.

Magcoar

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

DE BRAGA #2

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. 17-1/2" HOLE: 94' to 312': (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. 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<sup>3</sup> stopped the flow, and logging was carried out.

E. 8-3/4" HOLE: 1205' to 6946' T.D. (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.

DE BRAGA #2

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.

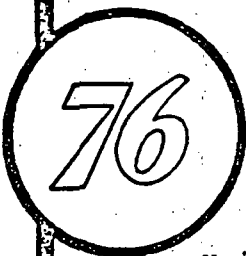
Maximum reservoir temperature of 336°F was recorded on the static survey the day before the test. The temperature and pressure survey reports follow this section.

Flash was 8%, based upon 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.



UNION

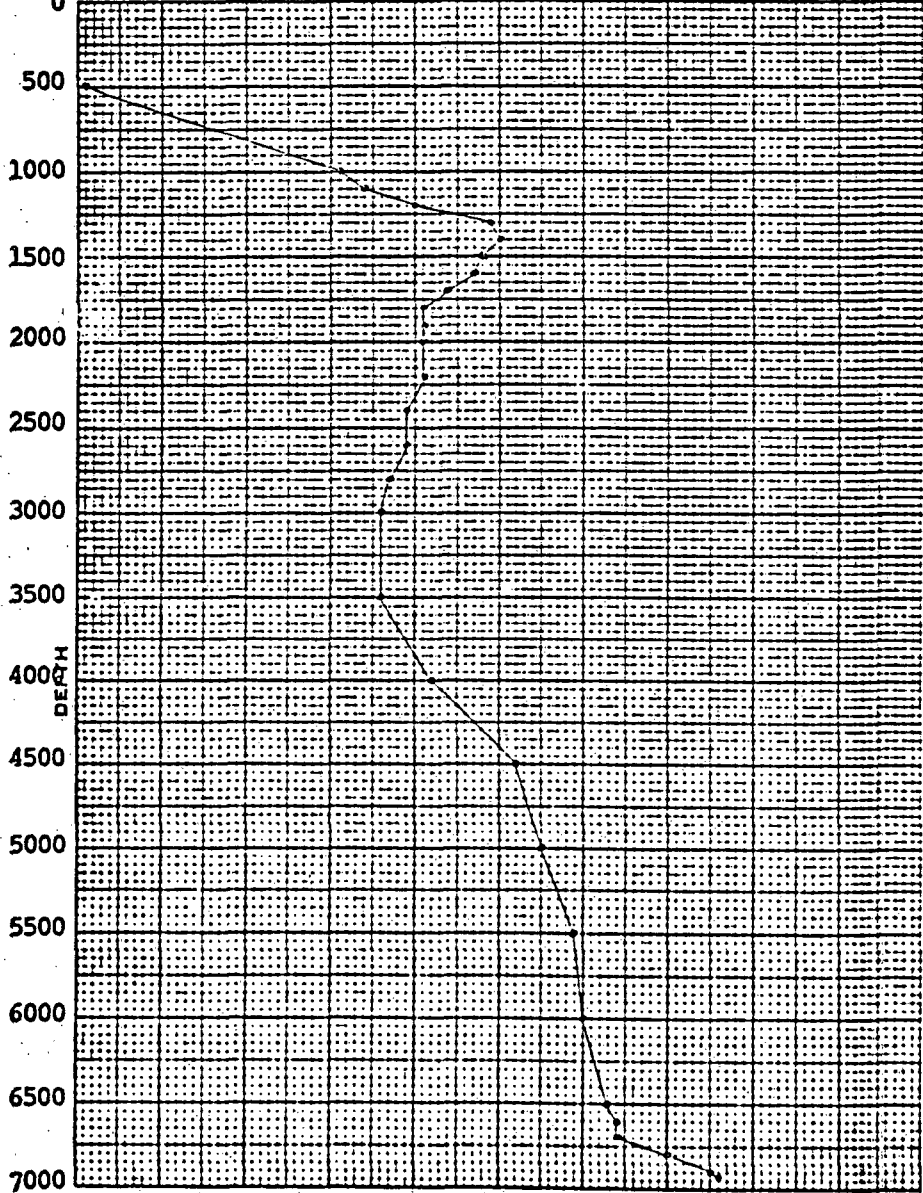
GEOTHERMAL DIVISION  
SUBSURFACE TEMPERATURE SURVEY

OWNER Union Oil Co. of Calif. FIELD Stillwater WELL NAME De Braga #2  
CASING 9-5/8" to 968' ELEV 1885 DATE: 5-21-79  
LINER DESCRIPTION: 7" from 968' to 6946' ZERO POINT Swab Gate (GL+7')  
DEPTH 6946'

MOLE DESCRIPTION: \_\_\_\_\_  
INSTRUMENT \_\_\_\_\_ FAN \_\_\_\_\_  
SERIAL NO 12833

PURPOSE Temp. traverse survey MAX TEMP \_\_\_\_\_ °F @ \_\_\_\_\_  
REMARKS: Fluid to surface - last flow for 30 min. on 5-16-79

260 270 280 290 300 310 320 330 340 350 360 STABILIZATION PERIOD



DEPTH	TEMP.	DEPTH	TEM
500	261		
1000	291		
1100	294		
1200	300		
1300	309		
1400	310		
1500	308		
1600	307		
1700	304		
1800	301		
1900	301		
2000	301		
2200	301		
2400	299		
2600	299		
2800	297		
3000	296		
3500	296		
4000	302		
4500	312		
5000	315		
5500	319		
6000	320		
6500	323		
6600	324		
6700	324		
6800	330		
6900	335		
6920	336		

BY: \_\_\_\_\_

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UNION

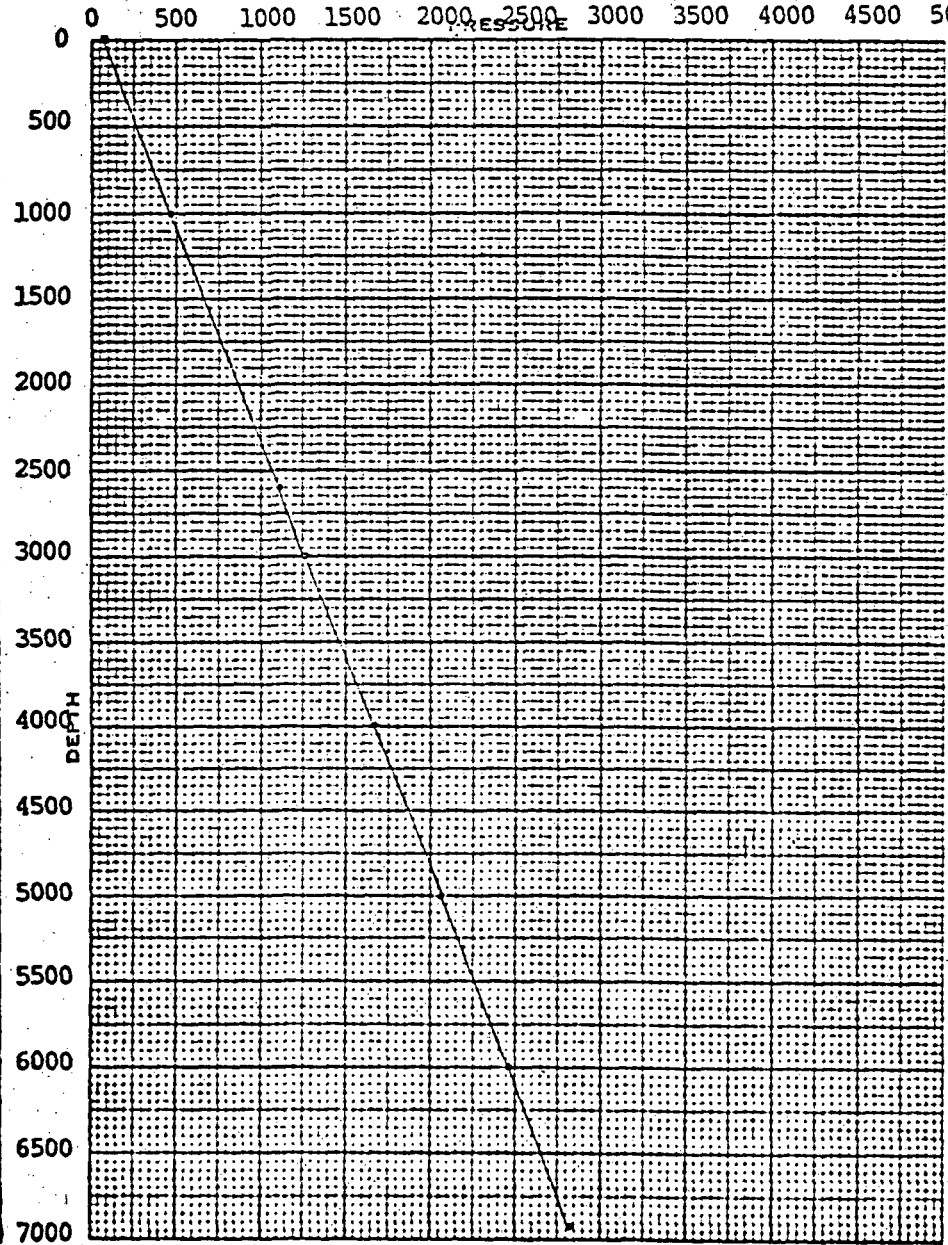
GEO THERMAL DIVISION

SUBSURFACE PRESSURE SURVEY

OWNER Union Oil Co. of Calif. FIELD Stillwater WELL NAME De Braga #2  
 CASING 9-5/8" to 968' ELEV. 3885' DATE 5-19-79  
 LINER DESCRIPTION: 7" from 968' to 6946' ZERO POINT Swab Gate (+7')  
 DEPTH 6946'

HOLE DESCRIPTION: \_\_\_\_\_  
 INSTRUMENT \_\_\_\_\_  
 SERIAL NO 12833

PURPOSE Pressure Gradient MAX TEMP \_\_\_\_\_ °F @ \_\_\_\_\_  
 REMARKS: Fluid to surface - last flow for 30 min. on 5-16-79.



ABLIZATION PERIOD \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PRESSURES	GAUGE	BOME
CASING PSI		

DEPTH	PRESSURE	GRADIE
0	67	
1000	462	
2000	1101	
3000	1262	
4000	1663	
5000	2062	
6000	2461	
6920	2823	

BY: Sam Timmons

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 lithic 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 lithologies already drilled. The caliper log shows the hole was rarely in gauge and wash-outs 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 porphyritic 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 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').





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,

- 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'.

- 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

<u>NO.</u> <u>JTS.</u>	<u>DESCRIPTION</u>	<u>LENGTH</u>	<u>TOP</u>	<u>BOTTOM</u>
	<u>13-3/8" 54.5# K55 BUTTRESS</u>			
	13-3/8" B&W S.O.W. Guide Shoe	1.85	308.15	310.00
	13-3/8" 54.5# K55 Buttress	16.80	291.35	308.15
	Casing Cut-Off			
1	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	250.70
7	TOTAL: (KB = 11.00')	312.00	KB +2.00'	
	<u>9-5/8" 40# K55 BUTTRESS</u>			
	13-3/8" S.O.W. B&W Guide Shoe	1.30	1192.70	1194.00
2	13-3/8" 54.5# K55 Buttress Casing	76.78	1115.92	1192.70
28	13-3/8" 54.5# K55 Buttress Casing	1117.92	+ 2.00	1115.92
				(Insert Float)
30	TOTAL: (KB = 11.00')	1196.00	KB +2.00'	
	<u>7" 26# K55 8RD LT&amp;C</u>			
	7" B&W Guide Shoe	1.30	6938.80	6940.00
8	7" 26# K55 8RD LT&C Slotted Casing	313.15	6625.55	6938.70
3	7" 26# K55 8RD LT&C Casing	122.25	6503.30	6625.55
5	7" 26# K55 8RD LT&C Casing	199.93	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 Slotted Casing	316.98	3408.18	3725.16
4	7" 26# K55 8RD LT&C Casing	166.39	3241.79	3408.18
13	7" 26# K55 8RD LT&C Slotted Casing	516.99	2724.80	3241.79
42	7" 26# K55 8RD LT&C Casing	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'

DE BRAGA #2

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.

DE BRAGA #2

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.