

CONFIDENTIAL  
REGISTERED

OIL & NATURAL GAS COMMISSION  
BOMBAY OFF SHORE PROJECT  
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No:BOP/Geol/CG/Ops/Tech/

Dated: 28th Feb. 1986

To

THE CHIEF GEOLOGIST (Ops)

O.N.G.Commission.....

...VASUDHARA BHAVAN...

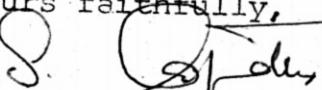
....BANDRA(E).....

Sir,

Please find enclosed herewith one copy of the well completion report of Well No. KD-2 for your kind perusal and record.

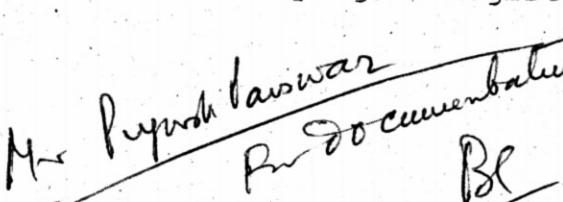
Thanking you,

Yours faithfully,

  
S. Gopal

Suptdg. Geologist 28.2.86

Encl: As above

  
Mr. Piyush Tawar  
For Documentation  
BL  
13.3.86

**CHIEF GEOLOGIST (Ops.)**

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PLATES

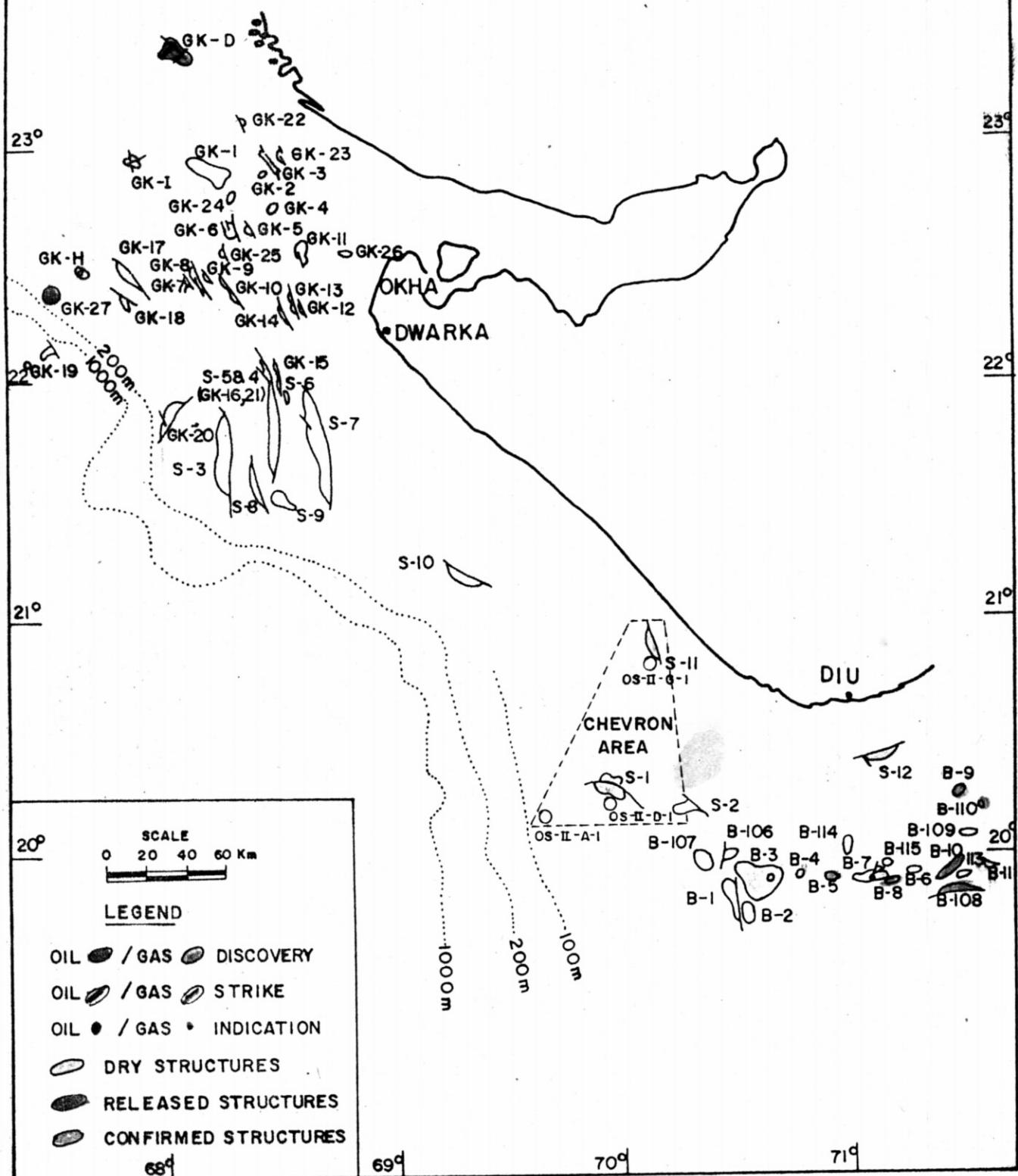
1. Location map of Kutch & Saurashtra area
2. Well Construction
3. Composite log
4. Core Reports
5. Geopressure log
6. Correlation Chart
7. Master log
8. Time Contour Map

ANNEXURES

- (i) Log Interpretation Data
- (ii) Laboratory Studies:
  - a. Fluid Saturation
  - b. Acidization Studies.

PROSPECT MAP

AREA : KUTCH - SAURASHTRA



SECTION - I1.1 General Well Data

Structure : 'D'  
 Well No. : KD - 2  
 Location : Kutch offshore  
 a) Latitude :  $23^{\circ} 21' 13.9''$  N  
 b) Longitude :  $68^{\circ} 08' 39.155''$  E  
 Area/Structure : Kutch Offshore  
 Country : India  
 Rig : Shenandoah  
 Projected Depth : 1350 m with provision to deepen to 1750m.  
 Drilled depth : 1765 m.  
 Well classification : Exploratory 'B' Category  
 Status : Oil Bearing

1.2 Elevation

KB Elevation : 33.9 M  
 Air Gap : 64' (19.50 Mt)  
 MLS  
 Water Depth : 48' (14.70 m)  
               (Logger)

1.3 Spud & Completion Dates

Spudded in at 16.00 Hrs on 2.10.85  
 Drilling completed on : 24.00 Hrs on 5-11-85  
 Drilling Time : 35  
 Production testing started on : 5-11-85  
 Production testing completed on : 14-12-85/40 day.  
 Well abandoned on : 16-12-85

1.4 Main Results:

As many as seven objects were tested with PCT tool. Objects No. I to 5 did not give any indications of presence of hydrocarbons. Testing data of objects 6 and 7 is tabulated below.

Object No.	Beam Size	Interval (mts)	Quantity of oil bbls/day	Quantity of gas M <sup>3</sup> /d	Formation water bbls	Remarks
OBJECT VI	1/2"	1100.5-1103.5 1107-1109.5	No flow 10 bbls on reverse out	-	-	Reverse out sample 10 bbls oil Api gravity 31.8

Re-Additioned perforation	1/2"	1110-1100.5	19bbls of crude oil on reverse out	Traces of gas	Reverse out sample 19bbls oil. Oil could be lifted to surface with navy pump.
OBJECT-VII	1/2"	1077-1069 1066-1058.5	-	Gas surfaced with navy pump	Reversed out sample consists oil emulsion. 15% crude & 85% Brine. With navy pump well fluids flowed 4-5 lts per min. which gradually stopped only gas surfaced. 27.05 API gravity.

## SECTION - II

### 2.1 Object of Drilling:

Well KD-1 was drilled in the 'D' structure in 1983 and on testing well flowed at the rate of 172 bbls/d of 29° API gravity oil and 21,700 Cu.ft of gas from Mid Eocene carbonates (1031-1043m) and siltstone (1070-1072m).

Time & depth contour maps prepared subsequently close to pay zone of KD-1 well on D structure, an areal extension of 80 Sq.Kms at the pay zone has been shown.

The well KD-2 was thus drilled with an objective to delineate reservoir at the pay zone.

The target depth 1200 mts was later extended to trap top to explore for expected hydrocarbon shows between 1270-1350 m, 1380-1385m, and 1680-1725m, below MSL.

### 2.2 Cuttings & Cores:

One set of cutting sample was collected at every 5 meters interval from 100 meters to 1765 meters.

A total 7 conventional cores were cut in this well.

A total of 74 side-wall cores were attempted and only 68 side-wall cores were recovered.

#### Conventional Cores:

CC#1, Int. 1019-1037m, Rec-100% ie 1800 cms.

Cutting time : 64, 58, 51, 49, 52, 30, 18, 16, 16, 18, 23, 15, 28, 39, 47, 37, 33 and 45 minutes per metre.

From top (In cms)	Lithological descriptions	Fluo	Cut.
0- 532	Shale: Grey, dk.gy. greenish grey, hd.compact, fissile, at places calcareous and occassionally pyritic.	-	-
532- 1800	Limestone: Grey, white, hard and compact, mainly packstone, occ. wackestone, highly fossiliferous, lot of nummulitic fossils noted. Occ. shale partings present, poor porosity.	N/F	N/C

CC#2 : Interval 1037 - 1055m, Recovery 92% ie 1659 cms.

Cutting time: 23, 28, 26, 27, 22, 15, 17, 37, 35, 47, 36, 33, 35, 37,  
38, 37 and 37 minutes per meter.

- - - - -
- 0-757 Limestone: Dirty white, light grey hard, compact, fossiliferous, poor porosity, at places re crystallised mostly packstone, at places wacke-  
stone. N/F N/C
- 757-1188 Shale: Bluish green, chloritic, mod. hard, compact, fissile, splintery. - -
- 1188-1281 Shale: Brownish grey, hard, compact, fissile, at places splintery. - -
- 1281-1659 Shale: Bluish green, chloritic, mod. hard, compact, fissile and splintery. - -

CC#3 : Interval 1055-1073m, Recovery 93.4% ie 1681 Cms.

Cutting time: 51, 37, 27, 35, 34, 41, 25, 37, 24, 45, 38, 38, 24, 32,  
37, 38, 33 & 20 minutes per meter.

- - - - -
- 0-138 Shale: Bluish green mod. hard to hard, compact, fissile. Occassionally splintery, Occ. chalky limestone is also observed. N/F N/C
- 138-213 Wackestone: Grey, dirty white, hard, compact, fossiliferous, few vugs and fossil casts noted, poor porosity. N/F N/C
- 213-223 Shale: Greenish grey, soft, friable, highly pyritic and calcareous. - -
- 223-111 Shale with limestone concretions: Shale is grey, bluish green, hard, compact, fissile with limestone concretions & calcareous in nature. Lime- stone is grey, dirty white, hard, compact, fossiliferous. Mostly, occurs as concretions and is wackestone. At places, limestone concretions become larger and shale partings very thin.
- 1111-1149 Shale: Bluish green, chloritic hard, compact. fissile, calcareous. N/F N/C
- 1149-1680 Shale with limestone concretions: Shale is grey, bluish green, hard, compact, fissile, fossiliferous, calcareous. Lime- stone is predominantly wackestone, grey dirty white, hard, compact, fossiliferous and occurs as concretions in shale. At places these concretions become bigger in size and shale occurs as partings around them.

CC#4 : Interval 1073-1091m, Recovery 96.28% ie 1733 cms.

Cutting time : 39, 41, 40, 42, 42, 47, 39, 40, 40, 42, 35, 42, 43, 44,  
45, 42, 40, 41.

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- 0-75 Shale with limestone concretions: Shale is bluish green, hd. to mod. hd. compact, fissile, calcareous. Limestone is grey, dirty white, hard, compact, fossiliferous, mostly in concretionary form in shale, ~~and~~ is wackestone. N/F N/C
- 75-375 Calcareous shale: Grey, dark gy, greenish gy, hard, compact, highly calcareous fossiliferous, pyrite modules observed. - -
- 375-634 Shale: Grey, dk gy, bluish green, hard, compact fissile, feebly calcareous.
- 719-835 Shale: Grey, bluish green, hard, compact, fissile fossiliferous.
- 835-992 Calcareous shale: Grey, dk gy, greenish gy, hard, compact, fissile, Highly calcareous, fossiliferous.
- 992-1733 Shale: Dark grey, highly fossiliferous, splintery.

CC#5 : Interval 1249-1267m, Recovery 38.89% ie 700 Cms.

Cutting time: 44, 36, 9, 8, 9.5, 14, 12, 26, 28, 41, 23, 23.5, 32, 15, 22, 55, 45 and 28 minutes per metre.

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- 0-206 Limestone: Mainly wackestone recrystallised white, grey, hard, compact, fossiliferous, few vugs seen. Moderate porosity. Few oil blots seen, at places chalky. In places it occurs as concretions in shale partings. Patchy GYF Cut
- 206-281 Shale/Silty shale: Grey, dk. gy, hard, compact, splintery, pyritic, silty at places, in places the siltstone contains greenish ferro magnesium minerals(?) - -
- 281-530 Limestone: Mainly packstone/Wackestone. Grey, dirty white, highly fossiliferous, pyritic, moderate porosity occ. oil blots seen, thin shale partings are seen. Patchy Fluo Faint cut
- 530-700 Limestone: Grey, white, very hard, poor visual porosity, occ. soft and chalky, fossiliferous at places oil blots observed Patchy GYF +ve Cut.

CC# 6 : Interval 1267-1277m; Recovery 98%, i.e. 980 cms

Cutting Time : 26, 15, 13, 15, 10, 13, 24, 27, 15 and 15 minutes per metre.

0-531	Limestone:(Recrystallised type) Dirty white, hard, compact, vuggy porosity at places shale partings present, in places highly fossiliferous occ.chalky	N/F	N/C
531-628	Limestone: Dirty white,hard,compact, vuggy porosity fossiliferous, fractured.	N/F	N/C
628-894	Limestone: (Recrystallised type) dirty white,hard,compact,vuggy porosity, at places filled with secondary calcite	N/F	N/C
894-980	Limestone:(Recrystallised type)dirty white,hard,compact,at places calcareous, shale partings present.		

CC# 7 : Interval 1520-1528; Recovery 97.3%. i.e. 17.51 cms.

Cuttings time: 14, 46, 40, 41, 46, 42, 46, 42, 41, 41, 34, 36, 53, 75, 50, 43, 42, 40, 38 and 41.

0-35	Sandstone:Light grey to dark grey,mod sorted,compact to mod.hard,grains are angular to sub-angular.	Specky flu.	Strong +ve
35-41	Carbonaceous shale:Grey,dark brown,mod. hard,fissile,fossiliferous, dead oil clots observed	flu.	Mild cut
41-48	Sandstone:Light grey to dark grey,mod. sorted angular to sub angular grain	specky	Strong +ve
48-60	Carbonaceous shale:Grey to dark brown, mod.hard fissile,fossiliferous dead oil clots.	Flu.	Mild cut
60-80	Sandstone:Light grey to dark grey,mod. sorted,compact to mod.hard,grains are angular to sub angular,some clay cementing material is seen.	Specky flu.	+ve
80-209	Carbonaceous shale:Grey to dark brown,mod. hard,fissile, non-calcareous,fossiliferous,Dead oil clots impart fluo; and cut to the rock.	-	-
209-745	Carbonaceous shale:Brown to dark brown snuff coloured)compact,fissile,highly fossiliferous, non calcareous,in few places, white material very soft nature (?)showing fluorescence and cut,developed along fracture planes l-to lamination has been observed.	N/F	N/C
745-823	Packstone:Light grey,hard to very hard, fossiliferous, poor porosity.	N/F	N/C
823-841	Shale:Dark grey,compact to mod.hard, fissile,feeble calcareous	N/F	N/C
841-851	Packstone:Light grey,hard to very hard, fossiliferous,poor porosity	N/F	N/C



2.	889.0	1 1/4	Wackestone: As above	F	N/C
3.	906.0	1	Wackestone: Dirty white mod. hard mod por sh intercalations observed	F	N/F
4	908.0	1	Wackestone: Dirty white to white mod. hd. to comp. mod. por. F		N/B
5	917.0	B	- EMPTY		
6	920.0	B	EMPTY		
7	1101.5	2	Packstone: Dirty white, mod. hd. Specky mod por. calcareous, shale part-flu. cuttings observed.	Mild	
8	1103.0	2	Siltstone: Gy greenish <sup>to</sup> gy in colour; soft; good porosity GYF		Strong +ve
9	1104.5	2 1/2	Packstone & Siltstone: The packstone is brownish hd. mod porosity siltst. is light gr. to greenish; calcareous; soft	GYF	Strong +ve
10	1107.5	2 1/2	Siltstone; Gr; fine grained; qz grains & dk ferromagnesian minerals present; feebly calcareous; soft; friable; few xls of calcite present	GYF	Strong +ve
11	1108.0	2 1/2	Siltstone: Gy, fine grained glassy <del>zqqz</del> & dk ferromagnesian minerals present; feebly calc shows lamination, compact, mod porosity.	GYF	Strong +ve
12	1110.0	2 1/2	Siltstone: Ltgr, greenish brown <del>mix</del> in color. fine grained, soft, Specky grains angular to sub angular fluo <del>mix</del> mod porosity.		
13	1114.0	2	Siltstone: Lt gy to greenish brown, fine grained, soft, grains angular to sub angular, moderate porosity. Intercalated shale band is gy, soft, fissile	GYF	Strong +ve
14	1115.5	2	Siltshale: Dk gr, mod. hd, silty in nature	N F	N C
15	1125.5	1 1/2"	Shale: Brownish black, soft to compact, fissile, carbonaceous	N F	N C
16	1130.5	1 1/2	Shale: Brownish black, fissile soft to compact, feebly calcareous	N F	N C
17	1134.5	1 1/2	Packstone; Dirty white to gr, white, mod hd, to hd; mod por shaly intercalations.	Mineral fls.	N F

18	1140.5	1"	Wackestone: Dirty white to gy. white, mod hd, to compact, intercalated with shale.	Miner fluo	N/C
19	1143.0	C <i>crumbled</i>	Wackestone: Gy, mod.hd, hd, mod porosity	N/F	Very faint R
200	1146.0	1"	Wackestone: Dirty white to grayish white, at places shaly, mod.hd to hd, mod poro;	Miner fluo	Mild
21	1149.0	I"	Wackestone: Dirty white to gr.white, shaly intercalations, compact to mod hd. poro.	Miner- al fluo	Mild cut
22	1168.0	I"	Wackestone: Grayish white, mod.hd. to hd. mod. poro;	N/F	N/C
23	1178.5	I"	Wackestone: Grayish white, mod.hd. to hd, mod, porosity.	N/F	N/C
24	1187.0	3/4"	Wackestone: Gr.white, soft to mod.hd., xline calcite is present.	N/F	N/C -
25	1194.0	3/4"	Wackestone: Dk gy. to gy., mod.hd. to hd. mod.poro., pyritic at places.	N/F	N/C -
26	1199.5	3/4"	Shale: Gr to dk gy; compact, fissile; calcareous; Lst concretions present.	N/F	N/C -
27	1228.5	E	EMPTY	-	-
28	1228.5 (2nd run )	3/4"	Wackestone; white to dirty white, mod.hd, mod.poro.;	Patchy fluo.	Mild Cut
29	1230.5	1/2"	Wackestone: Dirty white, mod.hd., pyritic at places, mod. poro., xline calcite present.	N/F	N/C
30	1232.0	C <i>crumbled</i>	As above	N/F	N/C --
31	1237.0	1 1/2"	Shale: Grayish brown, at places greenish, mod.hd; fissile, fossil impressions(?) calcareous	N/F	N/C -
32	1238.0	C	Wackestone: Dirty white, mod.hd. mod.poro	N/F	N/C R
33	1239.0	1 1/2"	Shale: Brownish, mod.hd; fissile, along the planes, calcite xls developed; calcareous, at places limestone concretions.	N/F	N/C -
34	1243.0	1/2"	Wackestone: Dirty white to white, mod.hd; compact, good porosity.	GYF	+ve cut -
35	1244.0	C	Wackestone: Dirty white to white, mod.hd., good poro.	GYF	Fai- nt -

36	1245.5	$\frac{1}{2}"$	Wackestone: Dirty white to white, mod.hd., good porosity.	GYF	Strong Cut	-
37	1248.0	C Crumpled	As above	GYF	Strong +ve Cut	-
38	1249.5	C Crumpled	Wackestone: Dirty white to white, mod.hd., mod. porosity.	GYF	+ve cut	-
39	1253.5	$\frac{1}{2}"$	Wackestone: As above	GYF	+ve cut	-
40	1255.0	$\frac{3}{4}"$	Wackestone: Dirty white to white mod.hd., mod. porosity.	GYF	+ve cut	-
41	1256.0	$\frac{3}{4}"$	Wackestone: Dirty white to white mod.hd., good porosity.	Strong GYF	Strong +ve cut	-
42	1258.5	$\frac{1}{2}"$	Wackestone: White to dirty white, mod.hd. mod. porosity xlline	GYF	+ve cut	-
43	1260.5	E	EMPTY	-	-	-
44	1263.0	C Crumpled	Wackestone: White to dirty white mod.hd., mod. porosity.	GYF	+ve cut	-
45	1264.5	$2\frac{1}{2}"$	Wackestone: White to dirty white mod.hd., mod. porosity.	GYF	+ve cut	-
46	1269.5	$1\frac{1}{2}"$	Wackestone: White to dirty white mod.hd., mod. porosity	GYF	+ve cut	-
47	1276.5	$\frac{1}{2}"$	Wackestone: White to dirty white mod.hd., mod.porosity.	Specky fluo.	Faint cut	-
48	1280.5	$\frac{1}{2}"$	Wackestone: White to buff colour, mod.hd., mod.porosity.	GYF (mild)	Faint Cut	-
49	1287.5	$\frac{1}{2}"$	Wackestone: Dirty white to white mod.hd., mod. porosity	GYF	N/C	-
50	1297.0	$\frac{3}{4}"$	Wackestone: Dirty white to white compact to mod.hd., xlline at places, mod.poro.,	F	N/C	-
51	1307.0	I"	Wackestone: Dirty white to white, compact to mod,hd., mod. porosity	Specky fluo.	N/C	-
52	1315.5	C Crumpled	As above	-do-	N/C	R
53	1318.0	$\frac{3}{4}"$	Wackestone: White to dirty white mod.hd., mod. porosity.	GYF	Mild	-
54	1322.0	$\frac{1}{2}"$	Wackestone: Dirty white to white, mod.hd., mod. porosity.	Specky	N/C	-
55	1328.0	$\frac{3}{4}"$	Wackestone: Dirty white to white mod.hd., mod. porosity.	Strong GYF	Strong golden yellow cut	-

56	1330.5	C crumbled	Wackestone: As above	Faint fluo.	N/C	-
57	1332.7	1/4"	Wackestone: White to dirty white mod.hd., mod. porosity.	F	Mild Cut	-
58	1334.7	C crumbled	Wackestone: White to dirty white mod.hd., mod. porosity.	Patchy Fluo.	Mild Cut	R
59	1338.5	1/4"	Wackestone: White to dirty white mod.hd., mod. porosity.	Fluo.	Mild Cut	-
60	1344.0	E	EMPTY -	-	-	-

!-----  
1. S.W.C.'s carried out on 29.10.85

2. Interval : 1732.5 to 1472.5 m
3. Cores requested : 14
4. Cores recovered : 13
5. Cores lost : 1
6. Cores rejected : Nil

Sl No.	Depth(m) (in)	Recores	Lithology	Fluo	Cut
1.	1472.5	1 1/4"	Wackestone: Dirty white, buff colored, mod. compact, bottom portion shaly, poor porosity.	Mineral fluo.	feeble
2.	1477.5	3/4"	Wackestone: As above	-do-	-do-
3.	1485.0	3/4"	Grainstone: Dull white, buff white, soft mod. compact, moderate porosity.	-do-	-
4.	1508.5	1 3/4"	Grainstone: As above	-	-
5.	1516.0	1 1/2"	Shale: Gray, dk. gray, soft, mod. compact, fissile non-calcareous	-	-
6.	1517.5	2"	Silty shale; Dk. gray, black, mod. compact	-	-
7.	1520.0	1 3/4"	Carbonaceous shale: Dk. gray, black, hard and compact, laminated with thin streaks of coal, non-calcareous.	Specky	Mild
8.	1566.5	-	Not recovered.		
9.	1619.5	1 1/2"	Sandstone: White, colourless, glassy, mod. compact, loose, medium grained, angular to sub-angular, calcareous poorly sorted, moderate porosity.	-	-
10.	1646.5	1"	Sandstone: As above	-	Feeble

11.	1701.5	1½"	Sandstone: As above	-	Feeble
12.	1703.5	1½"	Sandstone: As above	-	-
13.	1727.5	1½"	Grainstone: Dull white, buff white, mod. compact, fair porosity.	-	Feeble
14.	1732.5	1½"	Grainstone: As above	-	Feeble

2.3 Oil & Gas shows - KD - 2

No hydrocarbon gas was recorded while drilling this well. GYF) cut generally  
Specky/faint was observed at the following depths.

Depth	Lithology	Fluorescence	Cut
390-395	Sand/Sand stone	-	Faint white cut
475-490	Lime stone	-	Faint white cut
555-565	Lime stone	-	Whitish cut
910-915	Limestone		White cut
1114	Siltstone	-	Faint
1110-1135	Siltstone	-	Faint +ve cut
1200-1230	Limestone	-	Faint +ve cut
1240-1249	Limestone	GYF	+ve cut
1285-1295	Limestone	Specky fluo.	Faint +ve cut
1315-1325	Limestone	Specky fluo.	Faint +ve cut
1340-1350	Limestone	-	Faint +ve cut
1440-1445	Silty shale	Specky fluo	+ve cut
1515-1520	Siltstone/sandstone	Specky fluo	Strong +ve cut

2.4 Mud Loss & Other complications:

No mud loss encountered while drilling KD-2, nor there was any drilling complication observed, except that, the formations caved a lot, which made hole diameter exceptionally large.

2.5 Mud Parameters of Well KD-2

Sl. No.	Depth (m)	Mud Wt. (ppg)	Visc. (sec)	Water Loss(Ml)	pH	Oil (ppm)	CL (ppm)	Sand	Solid
1.	0-490	9.5/10.2	35-40		No control				
2.	490-700	9.7	37	10	10	4	19500	<1	10
3.	700-855	9.7	39.40	7	10	6-5		<1	11
4.	855-1019	9.7	40	6.5	10.5	6		<1	11
5.	1019-1084	9.7	37	6.2	10.5	6	18815	<1	11
6.	1084-1262	9.7	36	6.2	10.5	6	21300	<1	11

7.	1262-1313	9.7	37	6.0	10.5	6	16320	<1	11
8.	1313-1360	9.7	37	6.0	11	6	15620	<1	11
9.	1360-1440	9.7	37	5.5	11	7	17040	<1	11
10.	1440-1453	9.7	38	6.0	11	5	18815	<8	12
11.	1453-1520	9.7	39	5.6	11	5	17040	<1	12
12.	1520-1547	9.8	37	5.6	11	5	17040	<1	12
13.	1547-1660	9.7	39	5.0	10.5	5	18460	<1	10
14.	1660-1733	9.7	39	5.0	10.5	5	18815	<1	10
15.	1733-1749	9.7	37	5.0	10.5	5	18815	<1	10
16.	1749-1760	9.7	37	5.2	10.5	5	18815	<1	10
17.	1760-1765	9.9	37	5.0	10.5	5	18815	<1	10

## 2.6 Mud Chemical Consumption

Chemicals	Rate Rs./MT	Qty in tons	Total Cost(Rs.)
Barytes	500	129.00	64,500.00
Bentonite	636	36.75	23,373.00
CMC	11330	12.05	1,36,526.50
Cutch	-	-	-
Caustic soda	6536	5.85	38,235.60
Soda Ash	4500	6.225	28,012.50
Al.stearate	34500	0.125	4,312.50
Mica	-	-	-
Walnut	-	-	-
FCLS	5415	4.05	21,930.75
Resinex	15180	2.500	37,950.00
Sandopac DLA	1060/Dr	10 Dr	10,600.00
Diesel Oil	3000/M <sup>3</sup>	390 bbl	1,86305.73
Lime	1000	0.925	925.00
Geltex	24000	0.400	9,600.00
Salt	400	53.475	21,390.00
Sod.Dichromate	17000	0.700	11,900.00
Attopulgite	400	2.500	1,000.00

2.7

StratigraphyKD - 2

KB = 33.9m Depths from MSL are given in Brackets

Age	Interval (m)	Thickness	
Recent to upp: middle	48.7 -457	408.3	<u>Clay, claystone, sand, sandstone, siltstone</u> Top part is mainly clay, claystone, grey, greenish in colour, soft, sticky calcareous, sticky with shell fragments. At places silty in nature. At about 200m(KB) sand sandstone bands are encountered. Grey, greyish white, with sub angular to angular, sub-rounded quartz grains moderately rounded. From 275m (KB) to 450m siltstone with sand/sandstone bands is encountered along with clay/claystone.
Miocene	(48.7-423)		
Lower	457-752	295 m	<u>Alternation of Limestone/Shale/Claystone with Occ. Siltstone and sand/Sand stone bands.</u> Limestone is, white, dirty white mod.hd., compact fossiliferous occ. crystalline. Shale is grey, dk.grey, mod.hard, fissile and calcareous. claystone as above. Sand stone is grey, mod.hd., medium grained, sub rounded and subangular moderately cemented with calcareous matter.
Miocene to upper- oligocene	(423-718)		
Upper Eocene	752-806 (718-772)	54	<u>Mainly limestone with minor shale bands.</u> Limestone:- Grey, dirty white, mod.-hd. compact, fossiliferous, occ. crystalline, and at places argillaceous.
Middle Eocene (?)	806-850 (772-816)	44	<u>Limestone:- Limestone as above but more chalky and porous.</u>
	850-1205 (816-1171m)	355	<u>Mainly lime stone with shale bands and with Occ. siltstone bands.</u> Limestone is grey, dirty white, mod.hd., compact, fossiliferous, shale is grey to dark grey, mod.hd., fissile occ. calcareous. L.St in the interval 1025 mts to 1046mts is hard compact and dolomitic. Thin bands of L.St. below it, in the interval 1059mts-1086 mts are hydrocarbon bearing. Various siltstone bands have also been recorded in this group from int. 1102mt to 1137mts, which by and large are hydrocarbon bearing.

Lower Eocene	1205-1738 (1171-1765)	533	Mainly lime stone with minor shale bands up to 1562m (KB). Two prominent coal bands at about 1200 m (KB). Below 1562m to 1738m argillaceous sand stone and silty shale with limestone. Lime stone is:- White grey, dirty white, mod.hhd., compact Occ. chalky, fossiliferous and at places crystalline. Shale is grey dark grey, pyritic occ. carbonaceous mod.hard, fissile. Sand/Sand stone is Grey, dk.grey, mod.hhd., medium grained, sub rounded, subangular, mod. sorted, and cemented. Silty shale is grey, dk.gy green compact, poorly fissile.
Upper Cretaceous to paleocene	1735-1765 (1701-1731)	30+	Weathered trap:- Brown to chocolate brown in colour, mod.hard, compact, occ. sticky with lateritic material. Presence of flint variety of green coloured quartz with conchoidal fracture noted. Below 20m from top basalt observed which is more dark and hard.

**Remarks:**

Age boundaries are tentative and subject to confirmation from paleontological data which are still awaited.

**2.8 Correlation:**

Fairly good lithofacies correlation can be done between the two wells KD-2 and KD-1, drilled on 'D' structure.

Compared to KD-1, KD-2 has been observed to be structurally down by 20 to 25mts upto the upper Eocene level, thereafter it gradually reduces, and at pay zone level, loc. KD-2 is ~~15 mts to 8 mts down~~ as compared to location KD-1. At the level of upper coal band the location is only 7.0 mts down compared to KD-2. In the lower Eocene section, KD-2 is much down i.e. 16 mts to 35 mts. At the level of weathered trap well KD-2 appears higher up by 37 mts as compared to location KD-1.

Following table gives broad correlation. Depth given in brackets are sub sea

KD-2	KD-1	Remarks
33.9	25.0 m	
975.0 m (941.1 m)	970.0 m (945.0m)	
1025.0 m (990.1 m)	1011.0 m (986 M )	Dolomitic Lime stone
1058.5 m (1024.4m)	1043.5 m (1018.5m)	Lime stone (pay zone)
1103 m (1069.1m)	1095 m (1070.0m)	Silt stone (pay zone)
1139 m (1105.1m)	1124 m (1099.0m)	
1205.0 m (1171.1m)	1203.5 m (1178.5m)	Coal band (top )
1465 m (1431.1m)	1438 m (1413.0m)	
1556.0 m (1522.1m)	1521.0 m (1496.0m)	
1696.0 m (1662.1m)	1680 m (1655.0m)	Sand stone horizon
1735.0 m (1701.1m)	1763 m (1738 m)	Weathered trap

2.9 Electro logging Record

'KD - 2'

Date	Logs Recorded	Interval	Remarks
3.10.85	DLL-MSFL-GR	486-90 m	Well depth 490 m
4.10.85	LDL-CNL-	488-90 m	Before 20"
4.10.85	NGS	479-90 m	Casing in 12 1/4"
4.10.85	SLS (Sonic)	485-90 m	Hole NGS recorded along with LDL-CNL log
10.10.85	DLL-MSFL-GR-SP-CAL	970-480 m	For correlation
17/			
18.10.85	DLL-MSFL-GR-CAL-SP	1375-925 m	Drilled depth 1360 m
	LDL-CNL-NGS	1348.9-480.0 m	
18.10.85	DIL - SLS	470 - 1350 m	
	OHVDL	1340 - 800 m	
	HDT	1354 - 480 m	
	SWC	1344 - 876.5m	Details in SWC report
19.10.85	RFT	1269.5-557 m	Details RFT Report
20.10.85	DLL - MSFL - SP- CAL	1438 - 1250 m	Drilled depth 1440 m
	LDL- CNL - NGS - CAL	1436.9-1000m	Bit size 12 1/4"
	NGS	1427.9-1000m	
	SLS	1432 -1323m	
20/			
21.10.85	SLS - OHVDL	1432 - 1323m	
21.10.85	RFT - GR	1410 - 1312m	Details RFT report
28.10.85	DLL - MSFL- LDL - CNL - NGS	1743.5-1433.8 m	Drilled depth 1749 m
	CAL - SP log		In 8 1/2" Hole
	OHVDL ( from WF )		
	OH-VDL	- " -	
	SLS	1743.8-1433.8	In 8 1/2" Hole
	SHDT	1745.4-1433.8	"
29.10.85	RFT		Details in RFT Report
	SWC		Details in SWC Report.
2.11.85	CBL - VDL - (7" Liner)	1728 - 1360 m	7" Liner
2.11.85	CBL - VDL - (9 5/8" Csg)	1360 - 1000 m	9 5/8" Casing

KD - 2

2.10 RFT Results : RFT was carried out after logging from 1357 m to 925 m

S1 No.	Depth (m)	Hyd.Pr (psi)	Formation Pr (Psi)	Remarks
1	557	909	0	
2	557(Retest)	909	0	
3	561	914	0	Dry test
4	701.1	1140	0	
5	728	1186	1000	Poor build up
6	812	1325	0	Dry test
7	820	1338	0	"
8	876.4	1431	-	Seal failure
9	876.4 (Retest)			
10	876.4 (Retest)	1431	0	
11	906	1479	0	
12	920	1502	0	Dry Test
13	1027.5	1680	0	
14	1059.5	1731	0	
15	1059.5 (Retest)	1731	0	
16	1062	1735	-	No seal
17	1062 (Retest)	1735	-	"
18	1063.5	1739	-	"
19	1063.6 (Retest)	1739	-	"
20	1063.4 (Retest)	1735	-	"
21	1065.5			
22	1072.0	1752	-	"
23	1070.0	1747	-	"
24	1085.8	1769	-	No seal
25	1083.0	1766	0	Dry test

26	1108.0	1807	0	Dry test
27	1115.0	1819	0	Dry test
28	1243.5	2031	-	No seal
29	1243.5 (Re test)	2031	0	Dry test
30	1249.5	2045	0	Dry test
31	1254.0	2054	0	Dry test
32	1260.5	2057	0	Dry test
33	1269.5	2073	-	No seal

21.10.85

RFT was carried out after logging the interval 1440 m to 1000 m

S1. No.	Depth(m)	Hydro.Pr (psi)	Formation.Pr (Psi)	Remarks
1.	1312.0	2148	1927	Poor build up (350 Secs.)
2.	1315.6	2151	-	Seal failure
3.	1315.8	2152	-	No seal
4.	1316.0	2152	-	No seal
5.	1317.2	2154	-	No seal
6.	1318.8	2156	-	No seal
7.	1327.5	2169	1956	Recovered 450cc of saline water with thin oil film having fluorescence and strong +ve cut. The salinity is 26359 ppm. The sampling pressure was 40 psi only, even after 120 minutes
8.	1406.2	2299	-	No seal
9.	1407.2	2301	0	Dry test
10.	1408.0	2301	-	No seal
11.	1408.2	2301	-	No seal
12.	1410.0	2303	-	No seal

Date 29.10.85

RFT was carried out after logging the interval 1749m to 1440 m

1.	1472.3	2387/2386	2174/2175	485 sec.(~ 8.08 min)
2.	1475.3	2390	0	Dry test
3.	1475.5	2390	-	Seal failure
4.	1477.5	2395/2397	2176	Build up pr.in 180 sec.

Recovered 3.5 lits. of formation water (N/F, N/C) having salinity 28701 psi  
Sampling pr.was 2175 psi in 55 min.

5.	1479.5	2400/2398	0	Dry test
6.	1479.3	2396	-	Seal failure
7.	1519	2454	-	Seal failure
8.	1520.3	2459	-	Seal failure
9.	1619.5	2625/2627	2372	290 sec (in 3.33 min)
10.	1621.5	2630	-	Seal failure
11.	1639.5	2654/2651	2409/2605	250 sec.(in 4.16 min)
12.	1641.5	2658	-	Seal failure

## 2.11 H<sub>2</sub>S Logging:

$H_2S$  was not detected during drilling/production testing at well KD-2

### Stimulation Studies on KD-2

Five conventional core samples and a side-wall core were received in IRS from BOP for analysis and design of a suitable stimulation plan for well testing. The six samples represent four interesting horizons encountered in well No.KD-2. The details of the core samples are given below:

	<u>Interval</u>	<u>Core</u>
1.	1520-1533 mtrs.	CC-7 Top most portion
2.	1328 mtrs.	Side wall core
3.	1249-1267 mtrs.	CC-5 26 to 119 cm
" VII 4.	1055-1073 mtrs.	605 to 620 cm Seg. 4 CC-3 453 to 545 cm. Seg. 55 1149 to 1680 cm. Seg. 47

For analysis purposes and stimulation design the core samples were subjected to solubility tests and iron,  $\text{Ca}^{++}$  and  $\text{Mg}^{++}$  analysis. The details of the laboratory results are annexed in table-I.

#### Interval 1520-1533 mtrs:

There was only one piece of irregular shape from the top portion of this interval. The sample was a friable sand stone of irregular shape. The solubility in HCl is low and 12% in mud acid indicating about 10% clay materials by difference in solubility. The percentage of iron in the matrix is also low. The porosity of the sample was determined to be 20.1%. Unfortunately the plug was too

:-: a) :-:

small to carry out a clay sensitivity or acid response analysis in the laboratory. However no serious problem in acidification of the interval is foreseen from the analysis.

Stimulation Design:

If the zone on initial testing shows a formation damage or pressure build up the following treatment is recommended to mitigate the effect of damage.

Preflush: 30 gallons/ft of perforated interval of 10% inhibited hydrochloric acid with a demulsifier.

Acid Job: 75 gallons/ft of 10-2 mud acid with inhibitor, a demulsifier and a clay stabiliser (0.4% L-53 of Dowell or 2% Cla Sta of Halliburton). The well should be immediately flown back for cleaning and testing. The injection pressure and rate should be limited to 1200 psi and 1/2 BPM which-ever is achieved later.

Depending upon the results of initial testing and matrix acidisation the well can be considered for sand fracturing.

✓ Interval 1328 mtrs and 1249-1267 mtrs.

The side wall core has a high solubility in neat HCl of the order of 97% in the interval 1328 mtrs. The core samples in the interval 1249-1267 mtrs. is having solubility in the range from 90-97%. Sample in the section 26-119 cm shows a slightly higher iron content and iron

control is recommended during acidisation.

Stimulation Policy:

The analysis of rock matrix indicates the following stimulation treatment to rectify the formation damage effects to be optimum for the above two intervals.

15% inhibited hydrochloric acid with 3% Acetic acid to safeguard against secondary precipitates. An antisludge agent (AS-5 of Halliburton or W-50 of Dowell) and a demulsifier. The well head pressure and pumping rate should be 1000 psi and 1/2 BPM which ever is achieved later. The well should be flown back immediately for cleaning after treatment. Depending upon the results of matrix treatment and production testing the zone can be considered for acid fracturing.

Interval 1055-1073 mtrs:

Four spot analysis on the two core plugs were carried out for this interval. Acid solubility varies from 61 to 93 percent and iron content from 0.22 to 0.87 percent. A similar analysis was earlier carried out on the drill cuttings from well No.KD-1 for the corresponding depth. It was informed that rock matrix contains high clay content and would release lot of fines during acid treatment which need to be suspended for easy clean out. A spot sample from one core plug indicates slightly lower acid solubility of 60% and is comparable with two earlier analysis of KD-1 sample. The zone in well No.KD-1 had produced oil

:-: 23 :-:

at the rate of 160 BOPD with a high drawdown. The PI was estimated at 0.3 B/d/psi. The following stimulation is suggested to rectify formation damage in this zone.

- (a) 15% inhibited HCl 3% Acetic acid
- (b) An antisludge agent (AS-5, of Halliburton or W-50 of Dowell) and a demulsifier.
- (c) A silt remover (F-78 of Dowell or a similar product) is recommended.
- (d) The pump pressure should be restricted to 800 psi.
- (e) No shut in time need to be given and the well can be flown back for cleaning immediately.
- (f) Depending upon the results of production testing, matrix acidisation and state of well completion the zone will be considered for acid fracturing to further improve the well productivity.

T A B L E - I

Sl. No.	Interval	Solubi- lity in 15% HCl %	Solubi- lity in Mud Acid %	F <sub>¶</sub> <sup>++</sup>	CaCO <sub>3</sub> %	MgCO <sub>3</sub> %
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1	CC-7 1520-1538 mts. Top most portion	1.6	12	0.64	-	-
2	Side wall core Interval 1323 mts.	97	-	0.88	85.8	6.7
3	CC-5 1249-1267 mts. 26-119 cms segment Box $\frac{2}{9}$	89	-	3.49	76.8	4.6
4	CC-5 1249-1267 mts. Segment 4, 605-620 cms Box - 9/9	99	-	0.73	94.6	2.7
5.	CC-3 1055-1073 mts. Segment 55, 453-545 cms Box - 6/18, White coloured portion	90	-	0.22	81.1	7.3
6.	CC-3 1055-1073 mts Seg-47, Box $\frac{13}{18}$ 1149-1680 cms Top portion	89	-	0.49	82.4	2.5
7.	CC-3 1055-1073 mts. Seg-47, Box $\frac{13}{18}$ , 1149-1680 cms Middle portion, White in colour	93	-	0.42	88.4	2.4
8	CC-3 1055-1073 mts, Seg. 47, Box 13/18 Bottom portion, Black coloured.	61	-	0.87	53.7	5.3

2.13 Casing and Cementation Data

Casing size	30"	20"	9 5/8"	7" liner
Well diameter/Well depth	-	26" 490 m	12 1/4" 1440m	8 1/2" 1765 m
Casing shoe at	90m	480 m	1434	1757 m
Float collar at	-	-	1410m	1732 m
ECP at	-	-	499.70 m	-
Hanger at	-	-	-	1360 m
Pup joint at	-	-	-	-
Nos of centralisers			47	6
Casing type/weight	Vetco	94 ppg	N-80/43.5 ppf	N-80/26 ppf
Lowering of casing started	Lowering of casing completed	0520 hrs, 6.10.85	1230hrs, 21.10.85	2130 hrs, 30.10.85
Cement type		1000hrs, 6.10.85	1745 hrs, 21.10.85	0130hrs on 3110.85
Qty.of cement used		Class 'G' oil well	Class 'G' API grade	Blended
Wt & Vol. of Gel slurry	Pile driver	1581 sx	552 sx	5
Wt. & Vol.of neat slurry		14ppg, 370 bbl	13.6 ppg, 113bbls(383sx)	12.5ppg, 40 bbls (130 sx)
Pumping of gel slurry started		14ppg, 241 bbl	15.8ppg, 246 bbbs(1198sx)	15.8 ppg 86 bbbs (422 sx)
Pumping of Gel slurry completed		1313hrs, 6.10.85	1955hrs, 21.10.85	0424hrs, 31.10.85
Pumping of neat slurry started		1416hrs, 6.10.85	2015hrs, 21.10.85	0431hrs, 31.10.85
Pumping of neat slurry completed		1416hrs, 6.10.85	2015hrs, 21.10.85	0431hrs, 31.10.85
Displacement started		1454hrs, 6.10.85	2049hrs, 21.10.85	0445hrs, 31.10.85
Displacement completed		1525hrs, 6.10.85	2120hrs, 21.10.85	0504hrs, 31.10.85
Vol. & wt. of displacing fluid		520 bbls	335bbls of mud(9.7" & 37")	11469bbls of mud(9.9 & 36")
Plug hitting pressure		-	1500 psi	1800 psi
E.C.P. set at		-	2400 psi	-
Rise of cmt.(Plan)		Sea bed	To be decided after logging	Top of liner hanger: 1360 m
Rise of Cmt.(Actual)		Sea bed	Cement top not recorded	
Remarks:			Remarks: Normal	Remarks: Normal.

Production Testing & Bottom Hole Studies

Carried out cement squeeze job at 1724 m and 1711.5m

Object - I 1714 - 1716 m Tested by PCT

Perforated the above interval with 4 shots/ft. in 9.6ppg brine. RIH 2 7/8" tubing and PCT tool with 300m diesel cushion. Set packer at 1692m, opened the well through  $\frac{1}{4}$ " choke for initial flow of 10 minutes. Observed weak air blow. Closed the well for initial build up for 2 Hrs. Opened the well thru  $\frac{1}{2}$ " choke for 23 Hours. Observed mild air blow at 0-1 psi. No gas observed. Reversed out and collected bottom sample of water of salinity 97695 ppm (?). Observed 25 bbl of water influx. Concluded testing of Obj - I. No smaple was trapped in the PCT tool. Isolated obj - I by setting bridge plug at 1560 m.

Reservoir data

Initial hydrostatic pressure	= 2484.6 psi
Initial first flowing pressure	= 1176.0 psi
Final first flowing pressure	= 320 .4 psi
Final first shut in pressure	= 2449.1 psi
Initial second flowing pressure	= 371.1 psi
Final second stabilised flowing pressure	= 2423.7 psi
Final hydrostatic pressure after unseating packer	= 2727.8 psi
Bottom hole temp	= 194° F
Measuring depth	= 1695 m

OBJECT - II PCT Testing

Perforated the interval 1545-1533 m at the rate of 4 shots/ft. RIH 2 7/8" tubing and PCT with 300m diesel cushion. Set packer at 1520m. Opened the well for initial flow thru  $\frac{1}{2}$ " choke. Observed only very mild air blow. Closed the well for initial build up for 2 hrs. Opened the well thru  $\frac{1}{2}$ " choke. No activity observed. Tested injectivity in stages and found  $\frac{1}{2}$  bbl in 5 minutes at 2500 psi.

Acidized the well with 15% HCl. Opened the well thru  $\frac{1}{2}$ " choke, mild air blow observed. Well trickled spent acid and with non combustible gas. Reversed out. Bottom sample spent acid and brine. No influx observed. Concluded testing of Obj - II and POOH. Collected 1300 cc of muddy water and spent acid, non-combastible gas. Champs pressure 1050 psi. Isolated object-II setting bridge plug at 1465 m.

Reservoir Data

Measuring depth	= 1524.5 m
Initial hydrostatic pressure	= 2483.5 psi
Initial shut in pressure	= 259.6 psi
Final shut in pressure	= 279.8 psi
Pressure before acidisation	= 1810.5 psi
Pressure after acidisation	= 2078.3 psi
Pressure before opening well for final flow	= 1562.2 psi
Flow	
Final flowing pressure	= 2195.6 psi
Final hydrostatic pressure after unseating	= 2474.4 psi
Packer	
Bottom hole temp.	= 182°F

OBJECT - III Tested by PCT tool

Cement squeeze at 1436 m.

Perforated the interval 1438 - 1444m with 4 shots/ft. R/I 2<sup>7/8"</sup> tubing and PCT tool with 300m diesel cushion. Set packer at 1420m. Opened the well thru 1/2" choke for initial flow of 10 minutes. Observed very mild air blow. Closed the well for initial build up for 2 hrs. Opened the well thru 1/2" choke. No activity. Found injectivity 1/3 bbl/min. at 2000 psi. Acidised the well at the rate of 1-2 bbl/min at 1900 psi. Opened the well at thru 1/2" choke, and trickled diesel at 5 psi. Well kept open for 16 hrs after acidisation. No activity. Reversed out. Observed spent acid only. Concluded the testing. POOH. Collected 2.5 litres of spent acid with little traces of diesel and non combustible, gas, at chamber pressure 100 psi. No hydrocarbon detected on analysis of gas. Isolated object-III by setting bridge plug at 1370 m.

Initial Hydrostatic Pressure	2337.6 psi
Initial Flowing Pressure	1944.4 psi
Virgin Pressure	872.8 psi
Pressure before Acidization	1729.4 psi
Pressure after acidization	1830.8 psi
Final flowing pressure	2114.6 psi
Bottom hole Temperature	178°F
Measuring depth	1424 m

OBJECT - IV Tested by PCT tool

IV a: Perforated the interval 1294.5 - 1302m, 1311.5-1316.5 m, 1321-1323m 1327 - 1333 m. at the rate of 4 shots/ft. Ran in hole 2 7/8" tubing

and PCT tool with 300m diesel cushion. Set packer at 1277 m. Opened the well thru  $\frac{1}{2}$ " choke for initial flow for 10 min. Observed mild air blow. Closed the well for initial buildup of 2 hrs. Opened the well for thru  $\frac{1}{2}$ " choke for final flow. Observed air blow at "0" psi. Stopped after 12 hrs. Reversed out. Bottom sample salinity 90205 ppm. Influx 17 bbls of water.

Found injectivity 2-3 bbls/min. at 1600 psi. Open the well thru  $\frac{1}{2}$ " choke. Well trickled diesel at "0" psi for 11 hrs. Reversed out. Observed diesel followed by spent acid. No hydrocarbon and no formation water, observed. POOH.

#### OBJECT IV(b) 1337.5-1347 m

Perforated the above interval with 4 shots/ft. RI 2 tubing and PCT tool with 300 m diesel cushion. Set packer at 1275m. Opened the <sup>well</sup> thru  $\frac{1}{2}$ " choke, for initial flow for 10 minutes. Observed strong air blow, at 4 psi. Closed the well for initial build up for 2 hrs. Again opened the well thru  $\frac{1}{2}$ " choke. No activity. Reversed out. Observed 19bbls of water influx. Salinity 1,50,537 ppm. Acidized the well. Opened the well thru  $\frac{1}{2}$ " choke. Observed no activity. Reversed out. Observed spent acid. No water influx. Concluded the testing of Obj - IV. POOH collected 1.6 lts of water of salinity 1,82,754 ppm, and non combustible gas. Isolated the object by setting bridge plug at 1280m.

#### Reservoir Data

Initial hydrostatic pressure	= 2057.7 psi
First initial flow	= 451.0 psi
First final flow	= 491 psi
Pressure after 2 hrs B.U.	= 1839.8 psi
Initial second flow	= 587 .9 psi
Final Second flow	= 1900 psi
Pressure after acidisation	= 1581.6 psi
Final flowing pressure	= 1900.6 psi
Bottom hole temp.	= 176 F
Measuring depth	= 1281 M

#### OBJEC V Tested by PCT Tool

Perforated the interval 1253-1265m with 4 shots/ft. RIH 2 7/8" tubing and PCT tool with 300m of diesel cushion. Set packer at 1238m. Opened the well for initial flow for 10 min thru  $\frac{1}{2}$ " choke. Observed strong air blow at 10 psi and came down to zero. Reversed out observed influx of 16 bbls of brine of salinity 1,40,580 ppm. Found injectivity 1 bbl/min at 900 psi. Acidised the well. Opened the well thru  $\frac{1}{2}$ " choke. No activity. Reversed out. Observed 7 bbls of diesel and 16 bbls spent acid. Displaced

the string vol of diesel. Opened the well thru  $\frac{1}{2}$ " choke. Pressure dropped to "0" psi. Reversed out. POOH. Collected 1400 cc of spent acid, from PCT.

Perforated additionally the interval 1243-1247m with 4 shots/ft. RIH 2 7/8" tubing and PCT tool with 100 m of diesel cushion. Set packer at 1228m. Opened well thru  $\frac{1}{2}$ " choke. Observed pressure dropped to "0" psi. Strong air blow. Opened the well after 2 hrs build up. No activity. Reversed out. Observed 20 bbl influx, of spent acid, and brine salinity 1,30,925 ppm.

Repeated the test of Obj-V RIH tubing and PCT, with 100m diesel cushion. Set packer at 1228m. Opened the well thru  $\frac{1}{2}$ " choke. No activity. Well closed for 2 hrs initial build up. Observed weak air blow at "0" psi. No hydrocarbon. Concluded the testing of Obj - V.  
Isolated object V by setting a bridge plug at 1130 m.

#### OBJECT - VI Tested By PCT Tool

Carried cement squeeze job at 1111.5m, 1094m separately. No injectivity in both the cases. Tested casing at 2000 psi. It was OK.

Perforated the interbal 1109.5-1107m and 1103.5-1100.5m, with 4 shots/ft. RIH. tubing with PCT tool with diesel cushion of 250m. Set packer at 1084m. Opened well for initial flow, thru  $\frac{1}{2}$ " choke. Observed mild to strong air blow at "0" psi. Closed the well for initial shut in for 2 hrs. Opened the well thru  $\frac{1}{2}$ " choke from PCT valve. Observed strong to mild air blow. Kept well under observation. No activity.

Reversed out. Observed 10 bbl influx of oil of API gr 31.8

Reperforated the interval, 1100.5-1110 m with 4 shots/ft. after POOH. RIH production string with NAVY PUMP, after filling water in the string. Set packer at 1090 m. Operated Navy Pump on different RPM's. Water in surges followed by gas surfaced. On reversing out observed one stand filled with oil.

RIH again Navy Pump with diesel cushion. Set packer at 1092m. Operated the Navy Pump in low RPM. Diesel trickled followed by intermittent air flow, which finally ceased. Reverse circulated and POOH.

RIH PCT tool with 2 tubing, with 150m of diesel cushion. Set packer. Opened the well. Well trickled brine; and traces of gas at zero psi. Recorded Pressure Gradient Survey and sampling.

Sampling details as under:-

Bottom Hole Study

Bottom to 870 m - Water with brine  
 870m to 270m - Oil (600 m)  
 270m to 170 m - Diesel  
 170m to top - Gas or Air.

Carried out mud acid job. Opened the well through  $\frac{1}{2}$ " choke. Pressure dropped to 450 psi within 5min. Well flowed diesel followed by CO<sub>2</sub> and spent acid, at "0" psi.

Carried out Nitrogen job. Cleared the tubing up to perforation by N<sub>2</sub>. Observed spent acid and traces of gas and oil. Kept well under observation for 5 hrs. Pumped N<sub>2</sub> again; observed little spent acid with traces of oil, with N<sub>2</sub>. Well kept under observation. Reverse circulated, observe, oil with water. Concluded the testing of Object-VI. Set Bridge plug at 1090m.

Bottom Hole Study data

Depth of measurement	1088m
Initial FBHP	368 psi
Virgin pressure	1514 psi (Not stabilized)
Final FBHP	1036 psi
SBHP first reverse out	1524 psi
BHT	142 F
After Mud acid Job	
Depth of measurement	1091 m
Hydrostatic pressure	1714 psi
FBHP after opening the well	245 psi
Before 1st coil tubing job (N <sub>2</sub> )	1617 psi
After 1st coil tubing job pressure rose to 280 psi from 52.4 psi in 4 $\frac{1}{2}$ hrs.	
Before 2nd coil tubing job	695 psi
Immediately after 2nd coil tubing job	54.0 psi
Before reversing out	368 psi (pr. rise in 9.3 hrs)
Gas analysis shows 68% total Gas. C <sub>1</sub> =50%, C <sub>2</sub> =4.75%, C <sub>3</sub> =4.00%, iC <sub>4</sub> not recorded nC <sub>4</sub> =2.00	

OBJECT VII TESTED BY PCT TOOL

Squeeze job at 1056m, with 16 shots/metre.

Perforated the interval 1077-1069m, 1066-1058.5m with 4 shots/ft. RIH 2 tubing with PCT tool with 250m of diesel cushion. Set packer at 1048m. Open the well through  $\frac{1}{2}$ " choke for initial flow. Observed strong to moderate air blow. Opened the well through  $\frac{1}{2}$ " choke after 2 hrs buildup. Observed strong air blow.

which subsequently came to nil. Opened MIDRV, reversed out. Observed oil in emulsion with brine. 15% oil 85% brine. Salinity of sample 1,43,325 ppm, brine salinity 1,90,125 ppm. Displaced tubing vol. by diesel and open the well for flow. Observed trickling of diesel at "0" psi. Reversed out. Observed crude mixed with diesel and brine. POOH PCT and collect 1300 cc of oil from PCT sampler at 215 psi, and 2300cc of oil from DVS and packer. Gas negligible.

Again, lowered PCT and acidized the well with 1% HCl of 70 bbls. Well under observation. Well trickled spent acid with traces of oil. Reverse circulated and displaced the tubing volume with diesel. Well trickled diesel at "0" psi. Reversed out, observed diesel and crude. POOH.

Lowered Navy Pump with d/p. Ran Navy Pump at different RPM. Well flowed diesel on an average 2lit/min. Closed for Build up of 4 hrs. Again ran Navy pump for 7 hrs at different RPM flow rate increased by the end to 4 to 5 lit/min. and gas surfaced, after 6 hrs of operation. Well closed for 4 hrs. B.U. Again ran NAVY pump for 7 hrs flow rate 2.9 bbl/hr. Finally only gas being pumped out. Closed the well for 18 hrs, build up. Reversed out and concluded the testing of object-VII. Set Bridge plug at 1052m. Test at 1500 psi. Found holding.

#### Bottom hole study data

Depth of Measurement	1052 m
Hydrostatic pressure	1657 psi
Initial FBHP	145 psi
Virgin pressure	1265 psi
FBHP before first reverse out	777 psi
FBHP with diesel before second reverse out	1381 psi

#### After Acid job

Depth of measurement	1052 m
Hydrostatic pressure	1652 psi
Max. pressure during acid job	2781 psi
Minimum pressure after opening the well	725 psi
FBHP before 1st reverse out	1333 psi
FBHP with diesel column	1250 psi
BHT	140 F

#### With Navy Pump

Hydrostatic Pressure	1645 psi
Minimum pressure with 40 rpm	888 psi
Max. pressure after 4 hrs of build up	1455 psi
Min. pressure with 40 RPM	546 psi
Max. Build up after 4 hrs build up	1325 psi
Min. pressure with 60 RPM	333 psi

Max.build up after 18 hrs 1469 psi  
 BHT 141 F  
 API gravity of oil 27.05 °  
 One gas sample collected from PCT sampler shows T.gas 3%,  $C_1 = 9\%$ ,  $C_2 = 3.5\%$ ,  
 $C_3 = 4\%$   $iC_4 = \text{nil}$ ,  $nC_4 = 1.8\%$  (PCT chamber pressure Zero)  
 Another gas sample collected from Choke manifld shows T.gas = 68%,  $C_1 = 50\%$ ,  
 $C_2 = 4\%$   $C_3 = 4.0\%$ ,  $iC_4 = \text{nil}$ ,  $nC_4 = 1.75\%$

## 2.16 Cement squeeze jobs:

From the study of CBL-VDL log, it was observed that cement bondage behind casing was unsatisfactory and as such, cement squeeze job was required to be carried out against object - I, 3, 6 and 7. Details of which are given below.

Object - I : Int. 1714-1716.0 m: To repair cement bondage cement squeeze job was carried out by perforating 7" liner at 1724 m and 1711.5 mts @ 4 shots/ft.

(i) Perforated at 1724 @ 4 shots/ft.

Test injectivity at 1200 psi. It was found nil. Spotted cement by pumping 10 bbls of cement slurry of sp.gr 15.0 ppg w.o.c. cleared hole down to 1722m.

(ii) Perforated at 1711.5m @ 4 shots/ft. Tested injectivity at 1200 psi found nil. Spotted cement placed cement plug of 5 bbls of sp.gr. 152ppg. Both the perforations were tested in water and found to be sealed at 3000psi.

Object - III : Int. 1438-1444m. cement bondage was repaired by perforating at 1436m @ 4 shots/ft. Tested injectivity. No injectivity at 1200 psi. Spotted 15 bbl cement of av: weight 15.6 ppg. After woc drill and cleared hole upto 1465m, casing hermetically tested in brine at 1000psi. It was holding.

OBJ PCT.- VI : Int. 1100.5-1103.5 and 1107.0-1109.5m. Squeeze job was carried out to repaircement bondage of object - 6.

(i) Perforated at 1111.5 m @ 4 shots/ft. Injectivity was found nil at 1000 psi. Pumped 15bbls cement of 15.7 ppg. Kept well under 1800 psi pr. for 4 hrs woc. cleared the well upto 1184m. Tested casing at 2000 psi and was found holding.

(ii) Perforated at 1094m @ 4 shots/ft(.) Injectivity was found nil at 1000 psi. Spotted cement. woc. cleared the well upto 1097 m. Tested casing at 2000 psi. OK .

Object - VII : Int. 1058.7-1066.0 and 1069.0-1077.0 m. Squeeze job was required to be carried out to repair the bondage as such. Perforated at 1056m. Found injectivity 0.5 bbl/min at 1000 psi. Pompei 15bbl of 15.6 ppg cement slurry. Displaced P/o 7 stands. Squeezed 5 bbls at max Pr. 1800 psi after woc, cleared the hole upto 1058m. Tested casing at 2000 psi.

#### 2.17 Conclusions and Recommendations:

Location KD-2 was released to assess the commercial viability and delineation of the pay-zone met with at location KD-1. Target depth was later extended to Trp top to explore for expected hydrocarbon shows between 1270m to 1350m, 1380m to 1385m and 1680m to 1725m below MSL.

As many as seven objects were tested by PCT tool. Objects I to V did not give any indications of hydrocarbons, whereas object VI (siltstone bands) and VII (Limestone) gave oil influx which can be assessed to 100 bbls/d (both together) on artificial lift. No gas show was observed during drilling and it was negligible during testing. Because of the lack of gas energy oil did not surface, and could be got only in reversed out samples. Navy pump used as artificial lift for oil, also did not give expected results due to poor influx (Compared to KD-2, KD-1 produced 172 bbls/d of oil and 18.4 MSFD, all by its own energy)

It is possible that oil has migrated northwards. Core cut for int.(1019-1091m), on initial study also suggests the horizon having source rock character, rather than reservoir rock character. Absence of gas energy and comparatively less oil saturation and poor permeability can be attributed for the well KD-2 being a poor producer of oil and gas.

From the data available so far, it appears, prospects of oil accumulation can be much better to the north of location KD-1, where better reservoir development can be expected based on KD-1 and KD-2 results.

#### 2.19 Personnel Attended Wellsite:

##### Geologists S/Shri

V.M.Nashipudi  
R.D.Gohil  
Murthy N.C.G.S  
V.N.Pathak  
A.K.Vinod  
C.Vijayakumar

##### Chemists S/Shri

S.P.Tomar  
V.K.Mangla  
P.K.Jain  
Saudagar  
B.K.Saha  
V.M.Dave

2.18 Totco Survey Readings:

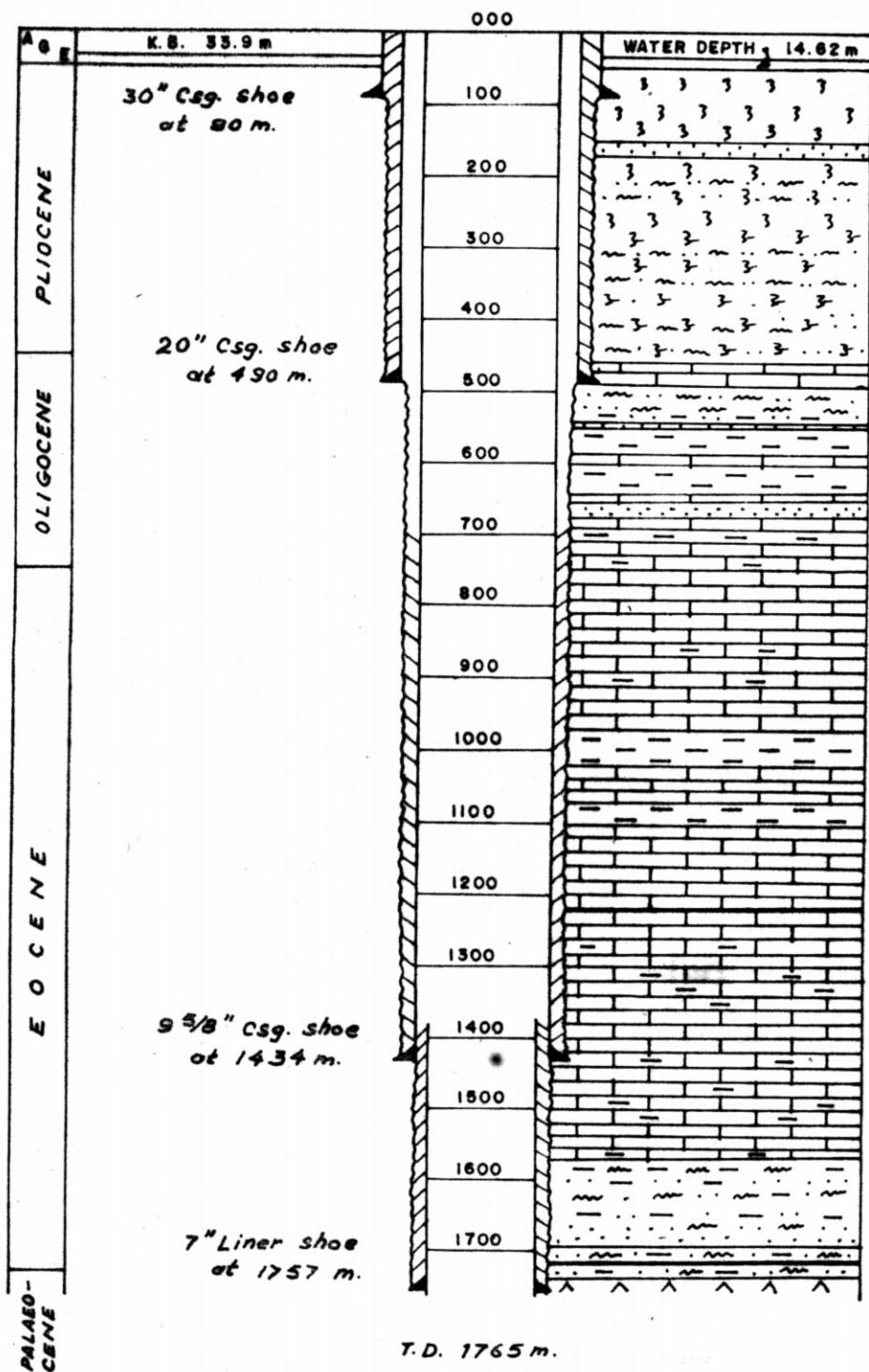
Date	Depth(m)	Angle
3.10.85	263 m	0°
3.10.85	387 m	3/4°
4.10.85	490 m	0°
8.10.85	597 m	0°
8.10.85	722 m	1/2°
9.10.85	871 m	3/4°
11.10.85	1017 m	1/4°
15.10.85	1205 m	1/2°
17.10.85	1355 m	0°
24.10.85	1520 m	1°
26.10.85	1624 m	0°
28.10.85	1749 m	1°

Totco Survey

This Report has been compiled by Geologists working on rig Shenandoah under the guidance of Mr. S.Ganapathi and Mr. R.K.Gulati.

## WELL CONSTRUCTION OF WELL NO: KD - 2

SCALE - 1:10 000

LEGEND

	CLAY
	CLAYSTONE
	SAND
	SILT
	SHALE
	LIMESTONE
	BASEMENT

Prepared by

R. D. GOHIL

Drawn by

A. K. RANA

Checked by

V. M. NASHIPUDI

Approved by

S. GANAPATHI

SCALE  
VERTICAL 100M=2CM  
HORIZONTAL 1KM=2CM

# CORRELATION BETWEEN KD-1 & KD-2

