THROUGH BIT LOGGING – YPF.SC.LP 2372

Author: Eduardo Arcas, Marcelo Bruni and Ezequiel Pozo.

Company: Respol-YPF S.A.

And

José Fernández

Company: Weatherford

Synopsis

The Golfo Basin lays on its fluvial origin, creating a multilayer and strongly discontinuous type of field, which provides a special environment for producer sands throughout 1500 m of stratigraphical column. This kind of sands constitute some permeable channels, no more than 4 m thick and a limited width, many times less than 200 m, which makes it difficult to define the correlation from the same layer placed between two neighbouring wells. For this reason it is possible drilling in these mature fields, between wells that produce with secondary injection.
While drilling this kind of wells, water crossing artificially treated from pressurised layers was observed. It caused some troubles in well stability, not allowing logging operation due to continuous well closing.
This situation urged us to look for alternatives. The available TBL System (Through bit logging), allowed us to solve the problem.
Basically, we combined techniques, taking advantage of TBL (bit with flowing passage) and tools of reduced diameter (2 ¼ in), with Conventional Well Logging (WL), recording well through drill pipe.
This work aims to show and comunicate about our experience in the well LP 2372, emphasizing the outstanding points of the system and communicating its recorded limitations.

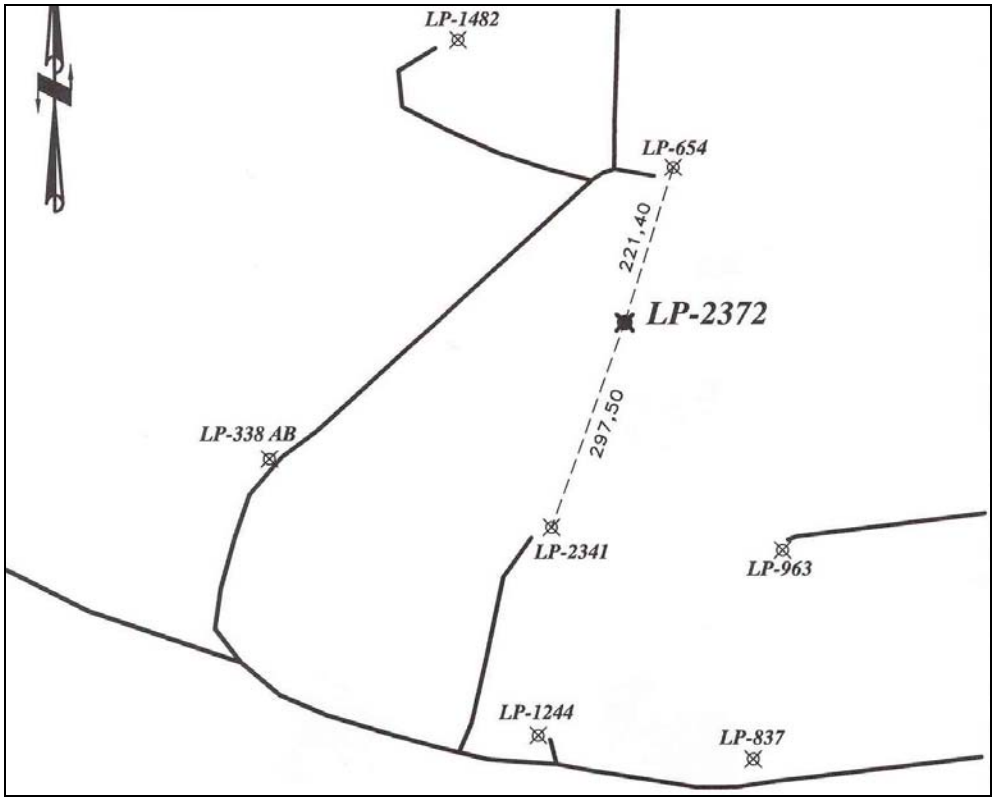
1 - Introduction

After the calibration trip of the well LP 2372, Baker Company made 3 Set-ups in their intention of logging the open hole. Many calibration maneuvers had to be done, and between 800 m and 900 m, the drill string had to be moved up and down because the well tended to get closed at those depths.
The mud engineer observed an increase in the percentage of chlorides (2800 ppm) and water that would provide from neighbour injection wells. It was intended to solve the problem by increasing mud density, but it was a difficult issue due to the depleted layers along the well.
The calibration trips were improved as the nearby injection wells were turned down, although, the Engineering apartment of Repsol-YPF contacted Weatherford WireLine in order to look for a solution to this problem. This company offered Through Drilling Pipe Logging (TDL) alternative by the use of a special bit through which it was posible to pass with the logging tool.

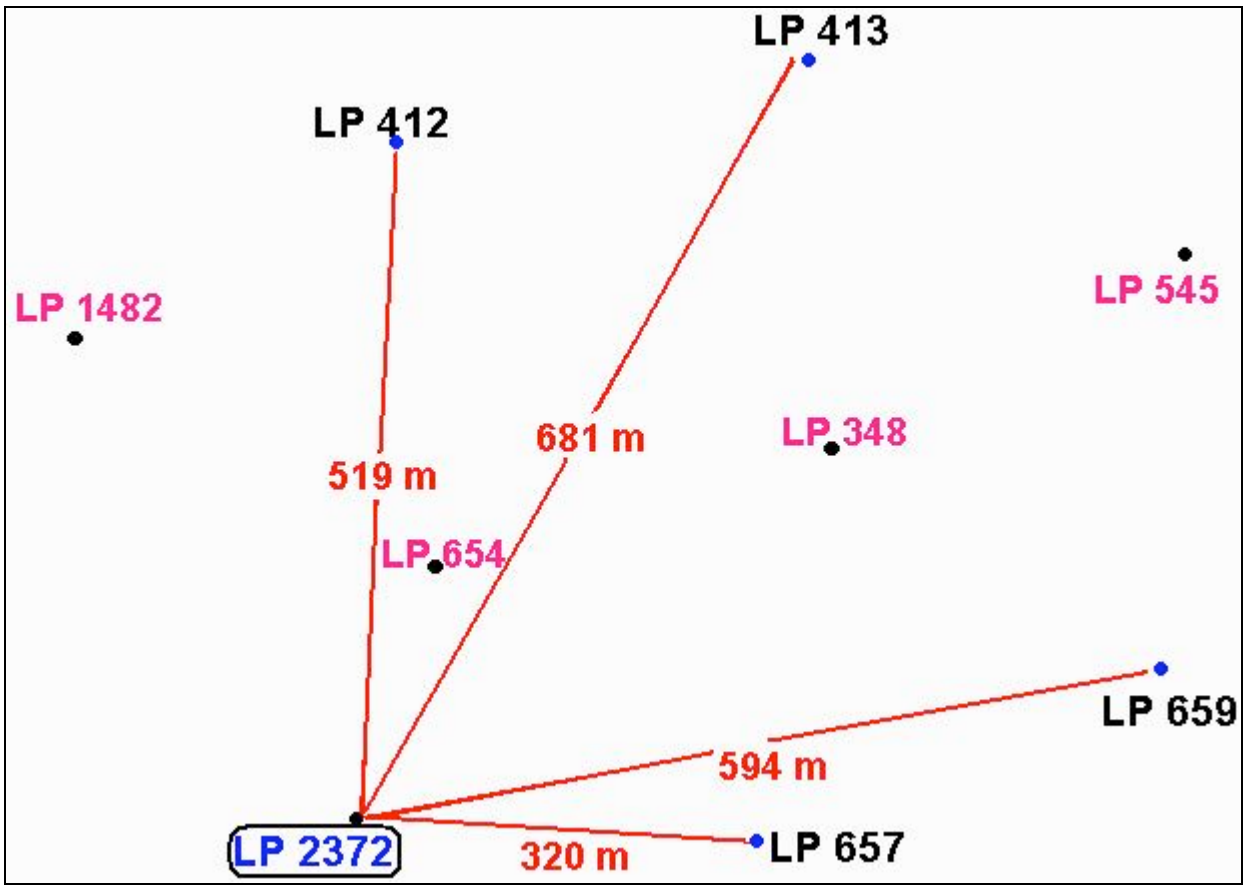
The table below details well´s data,

Well LP-2372	District 6
Depth: 1275 m	Surface facility nearby: LP-12
Shoe CSG 9 5/8”: 155, 42m	DATE: 14 November 2006
DATUM: Pampa del Castillo	X 4.902.900
PROVINCE: Santa Cruz	Y 2.487.520
FIELD: Los Perales	Sea level: 448 m +/- 4 m
AREA: Los Perales	

Table 1 – Well Data



Picture 1 – Well location



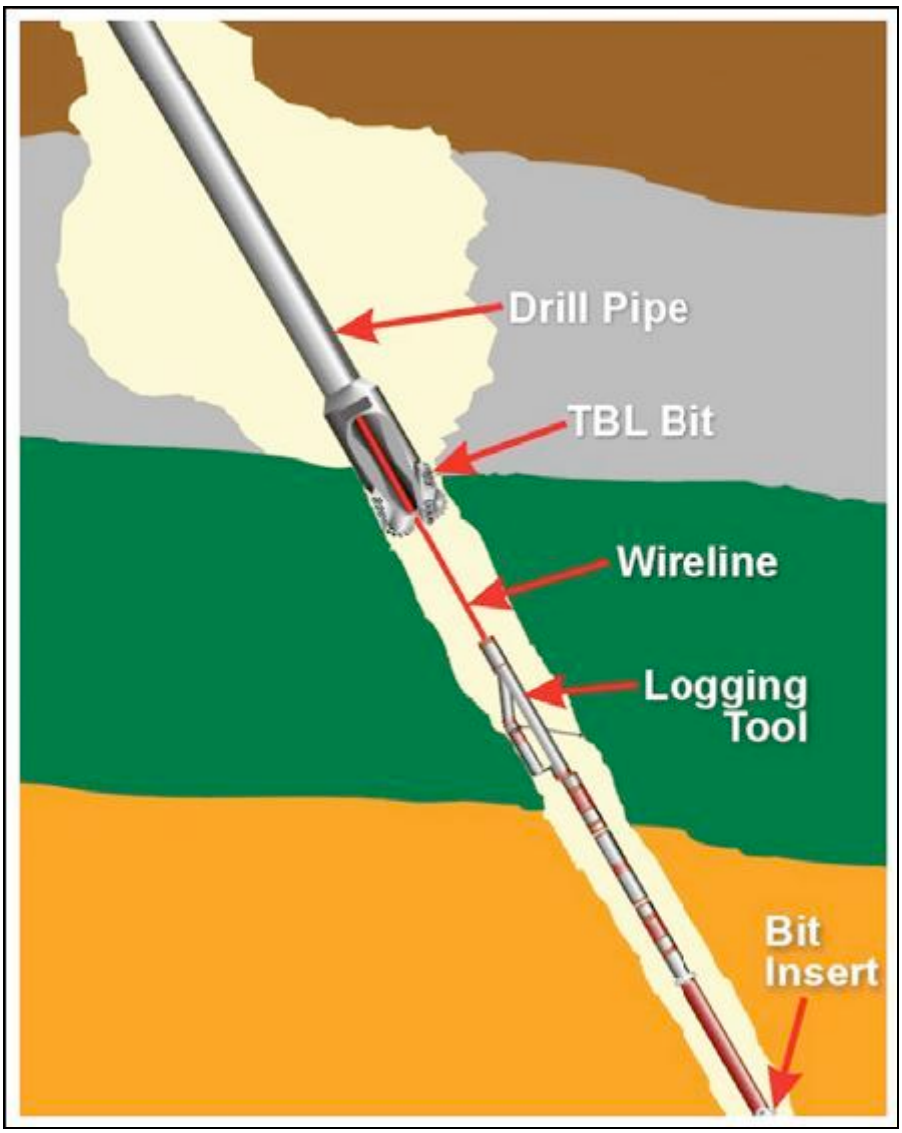
Picture 2 – Distance to injection wells

2 - Development

The main analysis in order to succed in the logging operation, consisted in deciding between two alternatives. The first one was using the drill string and bit as a ´through drill pipe´ logging system and using the wireline to logging through and out of the bit. The second consisted in hanging the logging tool with a memory from the TBL bit, and register recording while tripping out the string.

2.1 - Logging Through Drill Pipe with wireline

The alternative analised was to position the drill string over 900 m, either with flat-end pipe, set shoe or a TBL bit. Then Weatherford Company, would run with Wireline the tools (2 ¼" OD) through the Bottom Hole Assembly (BHA) in order to get data. The logging tool would be lowered to the bottom and registrate up to the depth were the bit had been positioned. The operation would be performed with Wireline and would be repeated to log from 900 m and complete the interval.



Picture 3 – TBL Bit Alternative

Picture 4 – Shoe

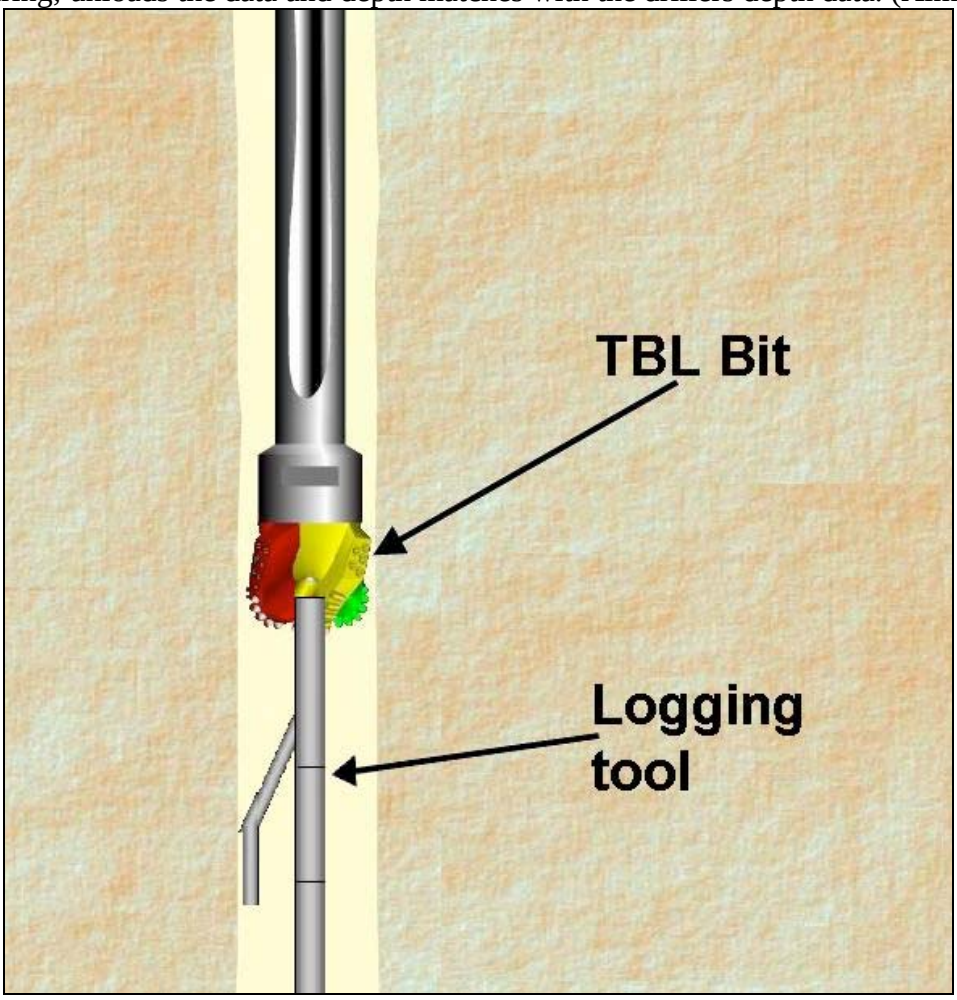
The two problems that appeared were,

1. It was necessary to rotate along the closed interval, then it was not possible the use of flat-end pipe or shoe.
2. There was also a need of getting data over the depth of the interval in trouble.

According to this, for this alternative it would be used the TBL Bit at the bottom of the drill string.

2.2 - Logging while tripping out drill string

1. Once the drilling crew finishes calibrating, pulls out of hole and places the bit with extention and hanger (provided by Wireline company).
2. The drill string is run to the bottom, circulates and pulls back a length equal to the logging tool length.
3. Weatherford loweres the logging tool and memory (on slick line) down to and through the bit, and the top of the end of the logging tool is hung off in the bit. The slick line is detached and retrieved and the logging tool is started automatically.
4. The drill string is pulled out of hole, sliding up the logging tool, getting data and storing it in the memory package for future processing.
5. Once the bit is placed on the shoe, Weatherford retrieves the tool and memory from string, unloads the data and depth matches with the drillers depth data. (Almost 2 hs.)



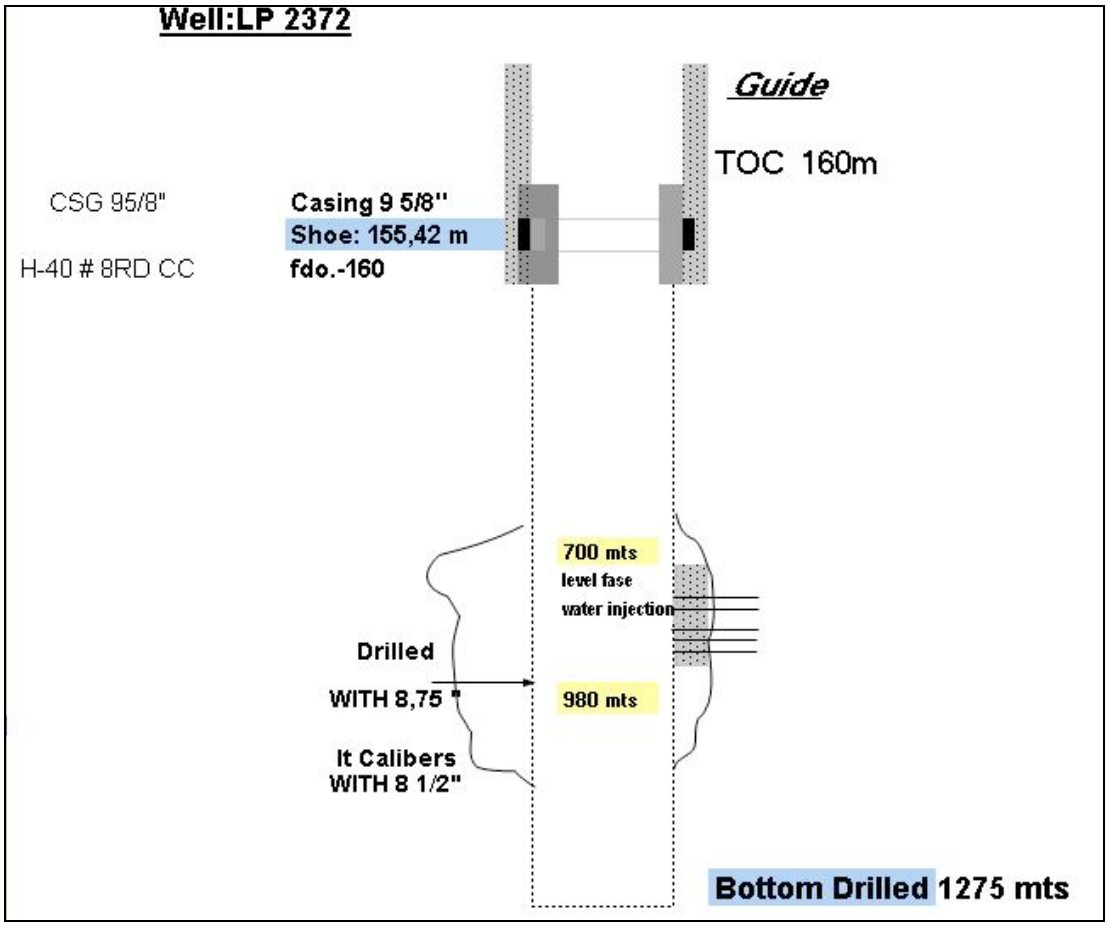
Picture 5 - Top of the end of the logging tool is hung off in the bit

The main problem here was that a drill string depth monitoring system is required (similar to that for LWD) to record a driller's depth vs time.The one provided by Weatherford (Advantage) was abroad and Pason did not have the portable equipment in the area.

2.3 - Adopted solution

The solution taken was Logging Through Drill Pipe with a TBL Bit at the bottom of the BHA, instead of using a shoe. The OD of Baker´s tool which had made 3 setups was of 3 ½". Then Weatherford was hired because their tool was OD 2 ¼" and would be able to pass through the drill string. The drill collars were not included (ID 2 ¼") in the BHA **(Table 2)**.

1. The TBL bit was set up without snubber, (the central openning removed).
2. The string was run up to 931 m. (avoiding the interval in trouble).
3. Weatherford lowered the tools with wireline, through Pipe and Bit, up to the bottom of the well (1273.6 m) and registered Induction, Gamma Ray and Caliper from bottom to 931 m.
4. Weatherford takes out to surface logging tools.
5. The driller replaced the bit at 533 m.
6. Weatherford lowered again through drill pipe and bit in order to find set-up depth. The setup depth was not found, and the interval from 931 m to 533 m was registered.
7. Weatherford Wireline takes logging tools out.
8. The drilling crew recovered bit and reductions.



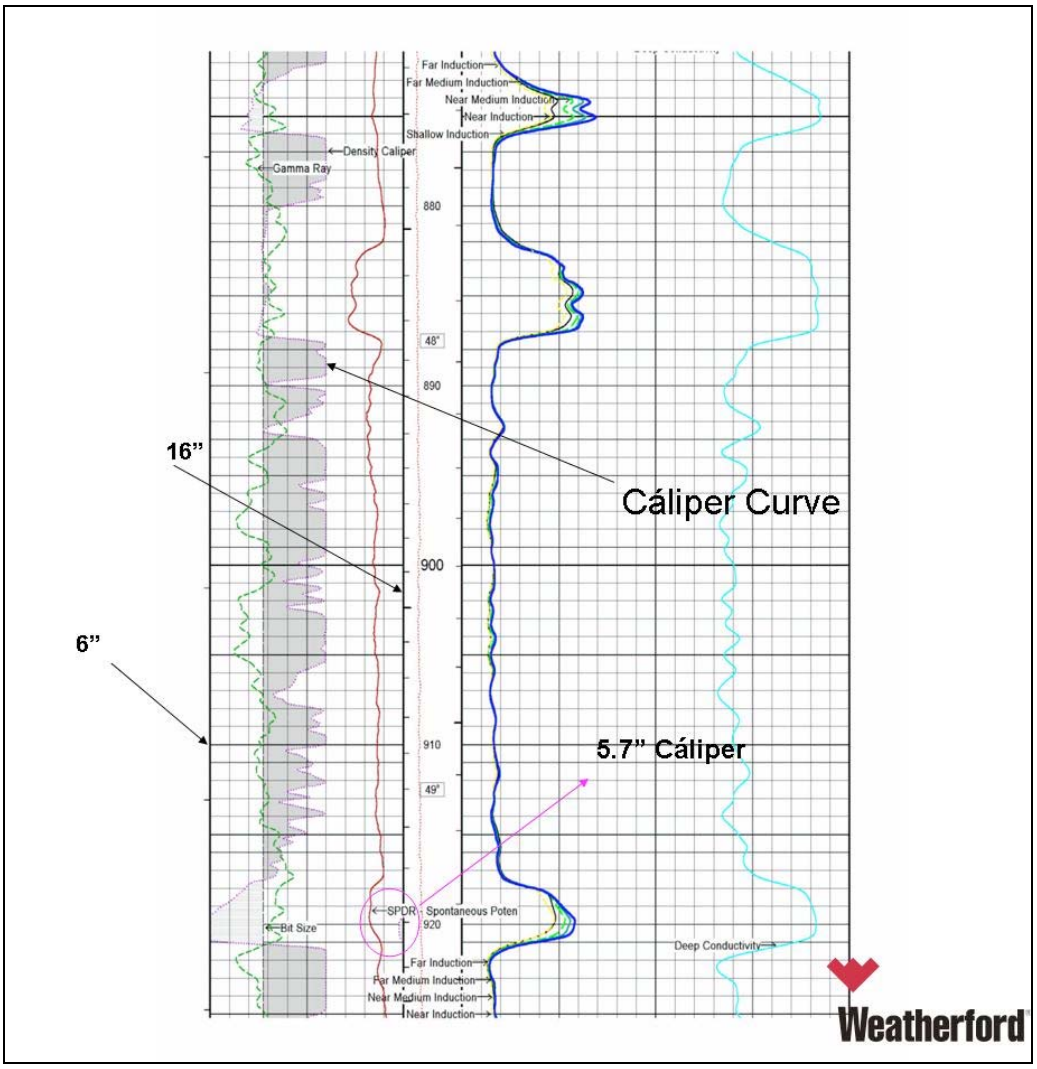
Picture 6 – Scheme of the well LP 2372

	OD	ID		Length
TBL Bit	8 ½"		SKS 75 TBL	0,3 m
Reduction	6"	2 ½"	4 ½ " Reg a NC 46 B – B	0,71 m
Drill Pipe	4 ½ "	2 11/16"	NC 46	1274 m

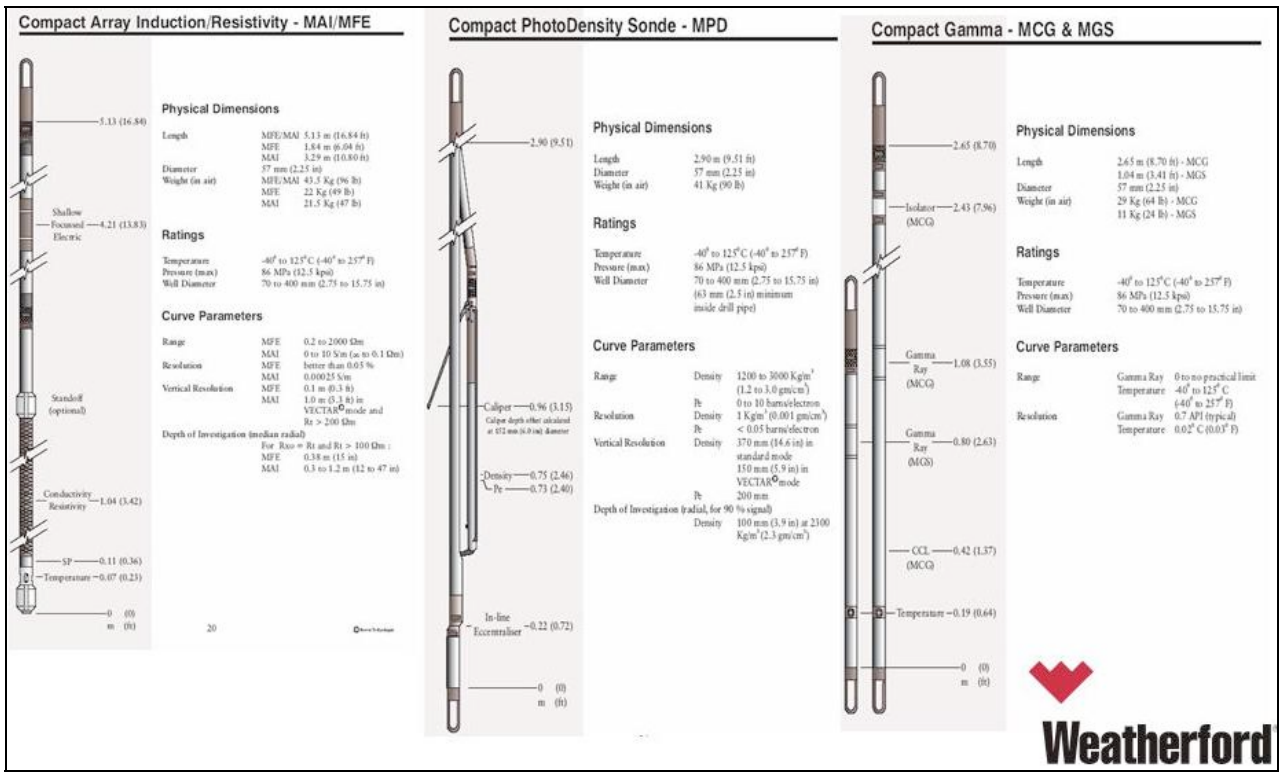
Table 2 - BHA used during TDL operation

During second phase registration (931 m to 533 m) there was a considerable reduction of the caliper at 920 m (caliper = 5,7”), although the bit (8 ½”) had already been at such depth just 90 minutes earlier, while pulling tool.

Total Operation Time: 8,5 hs.
Total Time until TBL: 360 hs. (15 days)



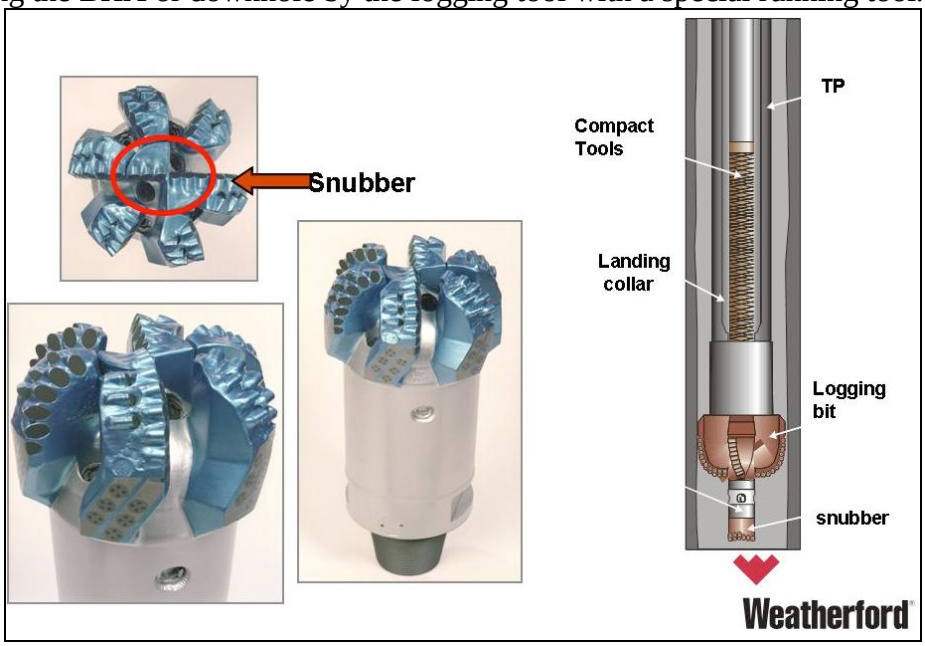
Picture 7 – 2nd phase log



Picture 8 – Tool specifications

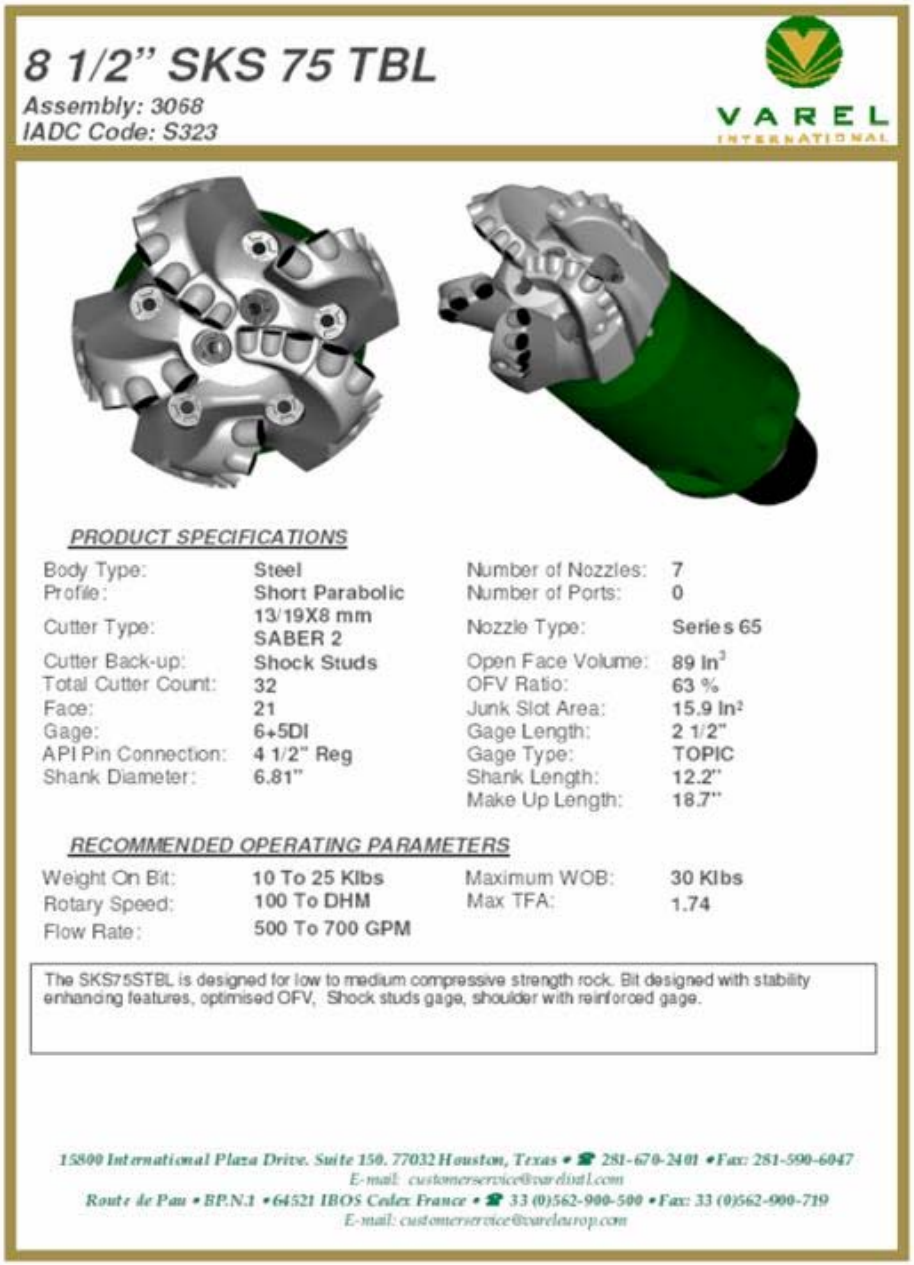
2.4 - Description of the bit

The TBL Bit is a PDC that is fitted with a central opening that can be removed either at surface before lowering the BHA or downhole by the logging tool with a special running tool.



Picture 9 – TBL Bit

The bit applied in this particular case is the one detailed below.



8 1/2" SKS 75 TBL
Assembly: 3068
IADC Code: S323

VAREL INTERNATIONAL

PRODUCT SPECIFICATIONS

Body Type:	Steel	Number of Nozzles:	7
Profile:	Short Parabolic	Number of Ports:	0
Cutter Type:	13/19X8 mm SABER 2	Nozzle Type:	Series 65
Cutter Back-up:	Shock Studs	Open Face Volume:	89 In^3
Total Cutter Count:	32	OFV Ratio:	63 %
Face:	21	Junk Slot Area:	15.9 In^2
Gage:	6+5DI	Gage Length:	2 1/2"
API Pin Connection:	4 1/2" Reg	Gage Type:	TOPIC
Shank Diameter:	6.81"	Shank Length:	12.2"
		Make Up Length:	18.7"

RECOMMENDED OPERATING PARAMETERS

Weight On Bit:	10 To 25 Klbs	Maximum WOB:	30 Klbs
Rotary Speed:	100 To DHM	Max TFA:	1.74
Flow Rate:	500 To 700 GPM		

The SKS75STBL is designed for low to medium compressive strength rock. Bit designed with stability enhancing features, optimised OFV, Shock studs gage, shoulder with reinforced gage.

15800 International Plaza Drive. Suite 150. 77032 Houston, Texas • ☎ 281-670-2401 • Fax: 281-590-6047
E-mail: customerservice@vareditl.com
Route de Pau • BP.N.1 • 64521 IBOS Cedex France • ☎ 33 (0)562-900-500 • Fax: 33 (0)562-900-719
E-mail: customerservice@varelurop.com

Weatherford®

Picture 10 – TBL Bit used in LP 2372

2.5 - Chronology after reaching final depth

	OD	ID		Length
Bit	8 ½"		GT1 for calibration	
Reduction	6"	2 ¼"	4 ½ " Reg a NC 44 B-B	0,91
Drill collars	6 ½"	2 ¼"	20 drill holder	170,90
Reduction	6"	2 ½"	NC 44 Pin – Box NC 46	0,71
Drill Pipe	4 ½ "	3,8"	NC 46	

Table 3 – BHA used during drilling operation before TBL operation

The following activities were performed to solve kick at LP-2372 well.

- 23rd, 12/2006

Drilling from 718 m to 1275 m-
Flowing and Thickening Mud from 1120 g/l. to 1160 g/l.-
Pumping: Well Observation. It runs (water and oil). Low density at 1140 g/l. It flows and thickens.

- 24th,12/2006

Flowing and Thickening Mud at 1180 g/l. The well flows slightly.-
Drilling for logging.-
At 700 m the string pulled out.- (The well continues flowing even more strongly, about 3.6 m3/h).-
Lowering trip at 710 m. Re drills it again at 740 m; Lowering trip at 1064 m. Tool sets up.
Flowing, returning with variable density: between 1110 and 1150 g/l.
Flowing comes back to normal parameters, with a density of 1150 g/l. Drilling stops and a heavy pill is replaced. Raises tool to 150 m.

- 27th,12/2006

Calibrating well. It is unstable. Well moves.
Baker Company logging. Setup at 950 m. Company strips down tool.
Diffcult well calibration due to amount of water from injection wells.

- 28th, 12/2006

Baker Company sets up and operates, setup at 950 m. While logging, well continues flowing.

- 29th, 12/2006

Tool is run down calibrating, it stops at 951 m, places kelly and drills it again up to 1000 m.
It circulates and takes stem out.

- 30th, 12/2006

Taking out the tool, resetting at 893 m. (tool pulling)
Drillstring stops.
Tubing (without logging) up to 940 m. (pipe stops)
Preparing tongs and deck for unsetting.

- 31st, 12/2006

POOH drill string.
Tool is lowered setting; well flows; kelly is placed and well comes to normal parameters. Rod continues lowering up to 894 m, stops and turns over up to 905 m. Well comes up, arrives to normal parameters and makes ready to take the tool to the shoe.
Dense plug is taken out.

- 2nd, 01/2007

Tool is lowered to 630 m. (injectors are decided to be stopped) (LP-657, 413 y 412)
It flows, comes to normal parameters and drills it again with rod at 687 m. (Partial Admision, mud is being prepared).
Well flows and injection comes to normal parameters at 687 m.
It continuous drilling it again up to 706 m. With resistance and a tendence to get stuck.
Well flows with reduced amount and crew wait for injection materials.

- 3rd, 01/2007

Mud continuous being thickened with baritine at 1280g/l-
Well flows, tip of bit at 687 m, and takes mud to field.
About 30 m3 of field is contaminated; with a returning density of 1230 g/l; well closes.-

- 4th, 01/2007

Thickens mud in pools, from 1250 g/l to 1310 g/l-
Drilling and pulling.

- 1115 m pulled 140.000 lbs
- 890 m pulled 120.000 lbs
- 700 m pulled 130.000 lbs
- 580 m pulled 110.000 lbs

Tool weight: 80.000 lbs

- 5th, 10/2007

Well drills it again from 1042 m to 1090 m. It downstrokes free at 1275 m, bellow.
It flows and thickens mud from 1230 to 1330 g/l-
Complete drilling. Bit supervision.
Drilling comes down up to 680 m, stops. It drills it again at 748 m.-

- 6th, 01/2007

Drilling comes down, making it again from 748 m to 822 m. Free at 1275 m.-
It flows and recovers density from 1290 g/l to 1330 g/l-
Drilling, well calibration, from 1275 m to 600 m. Dragging from 5 to 15 tons. At field, from 1100 m to 700 m. At 780 m, particular dragging of 30 tons. Drilling comes down from 600 m to 835 m; stops. It drills it again at 844 m-
Well flows. It recovers density from 1310 to 1330 g/l. Pumping with clearing pill with mar-sweep.-
Drilling, calibrating at 600 m. Dragging at 875 m. Almost from 15 tons. The rest is over usual parameters.-

- 7th, 01/2007

It comes down up to 835 m. Stops and drills it again at 900 m. Density decreasing at 1290 g/l. It downstrokes free at 1275 m.-
It flows and thickens mud at 1330 g/l.- (type of mud prepared for kick)

- 8th, 01/2007

Drilling at 650 m. Plug injection from 1500 g/l. It is taken out completely for logging-
Artex Co. Tool operates downstroking, induction, gamma ray and caliper; logging from bottom at 942 m.
Artex tool downstrokes and logs from 942 to 540 m. The tool is taken out-

- 9th, 01/2007

Density at 1280 g/l. It thickens without finishing.
Injection thickens from 1280 g/l. to 1380 g/l.-

Well calibration. Drilling at 500 m. It downstrokes up to bellow well.-
It flows. Density stays at 1380 g/l-

- 10th, 01/2007

Preparing and running casing 5 1/2", k-55 de 14.0 #.
Shoe 1271,42 m. collar 1270,62 m.-
Cementing with 750 bbls. + additives. Moving with 106.5 bbls. pressures: 110/1260 y 1860 psi. Returning is observed at surface from lower quality cement.
Normal operation.-

3 - Conclusions

- ✓ The TDL system proposed by Weatherford allowed Repsol YPF to solve the problem with the LP 2372, which had taken 15 days after 3 setups.
- ✓ The delay in closing the injection wells around, resulted in the water inflow between 700 m and 980 m.
- ✓ After 3 setups, and having failed running casing 5 ½", Repsol YPF´s Management took control of the situation. (this well was being drilled in a turnkey contract).
- ✓ The idea was to perform an assited looging operation through drill pipes and TBL bit.
- ✓ The restriction was that the logging should be done in two runnings with Induction, Gamma Ray and Caliper.
- ✓ An important issue to be considered was that after 15 days with well problems the logging operation took only 8,5 hs.
- ✓ The final cost, (including the rent of bit, the logging tool and the transport from Neuquén to Las Heras), resulted similar to an ordinary logging plus a PDC cost.

Thanks,

Picture 11 – Homage to those days