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**FEASIBILITY STUDY FOR EXPLOITATION
AND EVALUATION FOR A COMMERCIAL FIELD
FROM THE GETIC DEPRESSION**

1. WORK TARGETS

The work targets are:

- update of the geological model;
- update of the production history;
- resources and reserves reevaluation;
- well production predictions;
- discounted cash flow analysis.

The oil reservoirs and oil reservoirs with gas cap from Burdigalian (Helvetian) and the non-associated gas reservoirs from Meotian are exploited by one company and the free gas reservoirs from Burdigalian (Helvetian) are exploited by another company.

This work refers to the oil reservoirs and oil reservoirs with gas cap from Burdigalian (Helvetian) and the non-associated gas reservoirs from Meotian.

2. RESERVOIRS PARAMETERS AND PRODUCTION STATUS

The field is located in the central part of the Getic Depression.

There were discovered hydrocarbon accumulations during 1958–1965 based on seismic work.

The field is represented by an WSW – ENE anticline, longitudinal and transversal faulted by a fault system.

The free gas reservoirs exploited by *COMPANY B* are situated in Burdigalian (Helvetian) (III a2, II b, II a, I e, I d, I c, I b, I a and Transition), the free gas reservoirs exploited by *COMPANY A* are situated in Meotian (III, I) and the oil and associated gas reservoirs (dissolved gas or gas cap) exploited by *COMPANY A* are situated in Burdigalian (Helvetian) (IV c, IV a, III b1, III a3, III a2, III a1, II b, II a, I d, I c, I a, Transition).

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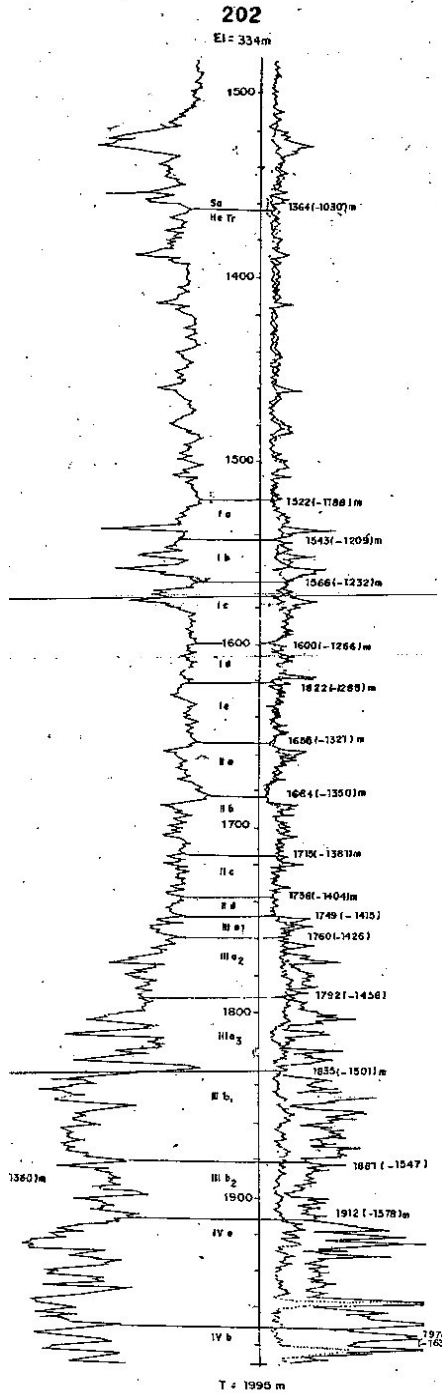
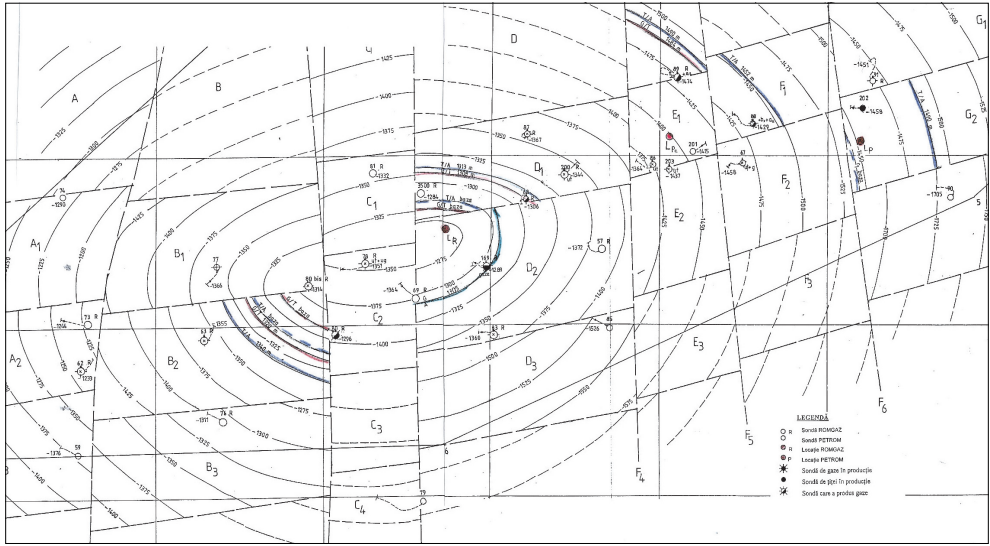


Fig. 1. Representative well log



RESERVOIRS REPARTITION PATTERN

Block	A2	B2	C1	C2	D1	D2	E	E1	E2	F1	F2	G1	G2
Bg (He) Tranz	GL	GL						GL					
Bg (He) I a	T+CG		GL		GL	GL		GL					
Bg (He) I b			GL		GL	GL							
Bg (He) I c	T+CG				GL	GL							
Bg (He) I d	T+CG			GL	GL	GL							
Bg (He) I e				GL	GL								
Bg (He) II a	T+CG			GL	GL							GL	
Bg (He) II b	T+CG											GL	
Bg (He) III a1		T+CG		T+CG	T+CG		T+CG	T+CG			T	T+CG	
Bg (He) III a2		T+CG		T+CG	T+CG	GL		T	T	T+CG		T+CG	
Bg (He) III a3		T+CG			T+CG	GL	T+CG			T			T
Bg (He) III b1		T+CG						T	T	T			
Bg (He) IV a								T+CG		T+CG	T		
Bg (He) IV c										T			

T – oil reservoir,
T+CG – oil reservoir with gas cap,
GL – free gas reservoir.

Fig. 2. Structural map – *Burdigalian III a3*

In the field there were discovered:

- 33 oil reservoirs in Burdigalian (Helvetian), among them 22 have gas cap, situated in 11 blocks, belonging to *COMPANY A* concession;
- 29 free gas reservoirs:
 - 25 in Burdigalian (Helvetian), situated in 8 blocks, belonging to *COMPANY B* concession,
 - 4 in Meotian, situated in 4 lens, belonging to *COMPANY A* concession.

There were drilled 38 wells (33 exploration wells and 5 production wells) and among them 21 started production.

The oil production started in December 1959, through the first well drilled: #91.

The natural gas production started in the year 1962, through the well #57, which is still producing from the same horizon Bg I a.

The free gas reservoirs from Meotian were pointed by the wells #76 and #82 in the year 1960, but they were not exploited, being small accumulations only.

The flow rates for the oil reservoirs were between 1-45 t/day, with 3–96% watercut, depending on the well location from the initial oil-water contact and depending also on the unsuccessful primary cementing of the production casing (wells #67, #69, #73, #87, #201). It was tried to repair the cementing work through technical perforations with some positive results (#67, #87, #201).

In order to increase the flow rates there were performed 17 stimulation operations (14 acid treatment operations and other 3 treatment operations with special solutions). The successful percentage of these operations was over 50%.

In the present there are producing 6 wells (one oil well belonging to *COMPANY A* concession and 5 gas wells belonging to *COMPANY B* concession), which are producing from 5 reservoirs as following:

- Bg (He) III a3, block G2, through the oil well #202 (*COMPANY A* concession);
- Bg (He) I d, block D1, through the gas well #200 (*COMPANY B* concession);
- Bg (He) I c, block D1, through the gas well #3500 (*COMPANY B* concession);
- Bg (He) I c, block D2, through the gas well #169 (*COMPANY B* concession);
- Bg (He) I a, block D2, through the gas wells #57 and #83 (*COMPANY B* concession).

The reservoir parameters values are presented in Table 1.

The hydrocarbon displacement mechanisms are as follows:

- dissolved gas drive – oil reservoirs without gas cap,
- dissolved gas with gas cap drive – oil reservoirs with gas cap,
- elastic gas drive – free gas reservoirs.

Till the reference date of this study there were extracted from the field 145 Mtons of oil, 396 MMscm of associated gas and 381 MMscm of free gas.

The exploitation status of the 5 producing reservoirs is presented in the Table 2.

Table 1
Reservoir parameters

Initial reservoir pressure	Meotian	55–61 atm
	Burdigalian	139–201 atm
Actual reservoir pressure	Meotian	55–61 atm
	Burdigalian	62–93 atm
Reservoir temperature	Meotian	48–50 °C
	Burdigalian	64–82 °C
Effective porosity	Meotian	25%
	Burdigalian	15–26%
Interstitial water saturation	Meotian	30%
	Burdigalian	22–30%

Table 2
Production parameters

Specification	Units	<i>COMPANY A</i>	<i>COMPANY B</i>
Formations		Bg (He), Meotian	Bg (He)
Production wells	–	#202 Bg (He) III a3, bl G2	#200 Bg (He) I d bloc D1 #3500, Bg (He) I c bloc D1 #169 Bg (He) I c bloc D2 #57, #83 Bg (He) I a bloc D2
Production starting date	year	1959	1962
Oil cumulative	Mtons	145	–
Gas cumulative	MMscm	396	381
Recovery factor, oil/gas	%	6/39.5	–/48.8
Initial pressure	atm	201	139–167
Actual pressure	atm	93 (#202)	62–66
Oil flow rate	t/d	2	
Gas flow rate	Mscm/d	0.6	2–13
Tubing/casing pressures	atm	18/60	17–25/36–58
Total flow rate, oil/gas	t/d / Mscm/d	2/0.6	–/31

3. ANALYSIS AND EVALUATION METHODS

The geological model of field was performed through a common study for both concessions. That study was approved by *COMPANY A* and *COMPANY B* and based on it there were shared the concession areas depending on the hydrocarbons nature, blocks and depths:

- the oil and the associated gas from Burdigalian (Helvetian) and the free gas from Meotian are exploited by *COMPANY A*,
- the free gas from Burdigalian (Helvetian) I and II and III a2, block D2 are exploited by *COMPANY B*.

There were proposed some changes in the geological and in the physical model, but during the meetings between the *COMPANY A*, *COMPANY B* and *National Agency for Mineral resources* representatives it was decided that due to the lack of new geological data (there were not drilled new wells) it is not recommended to change the models.

In this situation it was taken into consideration the geological model and the resources estimated in the year 2000. There were performed some small changes for *COMPANY B*.

In this study it was reanalyzed the opportunity of drilling both new wells proposed in the last study:

- the new unconditioned well L (206) (1840 m depth) proposed for Bg III a3, block G2, it is considered justified, because the well #202 is producing in natural flow from the year 1989 till in the present, with a rather constant flow rate;
- the new conditioned well L (204) (2015 m depth) proposed for Bg IV a, III b+III a2+III a1, block E1, it is considered risky, but the final position of this location will be established after drilling the new unconditioned well L (206), after reanalyzing the geological model and productivity analysis. Therefore there were estimated probable reserves for this well.

The production predictions were calculated per well using the exponential decline analysis and then there were added for each reservoir and finally there were added for the entire field.

4. STUDY RESULTS

For *COMPANY A* concession the initial geological resources calculated in the study are the same with those ones confirmed in the year 2004.

For *COMPANY B* concession the initial geological resources calculated in the parallel study are smaller with 47 MMscm of natural gas regarding the last confirmation from the year 2003.

The exploitation perspectives for *COMPANY A* concession have been re-analyzed through two production options:

Option 1 – exploitation with the present producing well (#202);

Option 2 – option 1 plus drilling a new well L (#206) in the same horizon and in the same block with the well #202, till 1840 m depth, in the year 2008, evaluated at 1 mill. EURO.

There were not estimated proved or probable reserves for the wells #88, #201 and #203, which are waiting for workover, due to unsuccessful primary cementing of the production casing and the repair tentative of cementing work through technical perforations.

It is proposed also to verify the hydrocarbon content at the upper horizons where the well logs are positive. Eventually it is proposed to be performed cased hole investigations PNN type, before perforation, in order to verify the hydrocarbon content, for the wells: #88 (Bg II b, II a), #201 (Bg I b, I a), #202 (Bg II b, II a, I a) and #203 (Bg II b, II a, I a), before abandonment.

The oil and associated gas reserves calculated in the study for *COMPANY A* concession presents the following differences regarding those ones confirmed in the year 2004:

- the proved reserves are with 16 Mtons of oil and 8 MMscm of associated gas higher than the confirmed ones due to:
 - reservoir production behaviour (3 Mtons of oil and 1 MMscm of associated gas higher);
 - lower exponential production decline(5% regarding to 20%), higher entry flow rate and GOR regarding to the former study (it is proposed an initial oil flow rate of 4 t/day and GOR of 260 scm/cm, equal with the present GOR), for the production well, taking into consideration its higher position in the field.
- the probable reserves are 10 Mtons of oil and 2 MMscm of associated gas, the same with the confirmed ones, due to the same new well proposal as in the former study.

The operations proposed in order to develop the probable reserves for *COMPANY A* concession are:

- drilling the new conditioned well L (204) (2015 m depth) proposed for Bg IV a, III b+III a2+III a1, block E1, which is considered risky, but the final position of this location will be established after drilling the new unconditioned well L (206), after reanalyzing the geological model and productivity analysis. Therefore there were estimated probable reserves for this well.

It is proposed also to verify the hydrocarbon content at the upper horizons where the well logs are positive. Eventually it is proposed to be performed cased hole investigations PNN type, before perforation, in order to verify the hydrocarbon content, for the wells: #88 (Bg II b, II a), #201 (Bg I b, I a), #202 (Bg II b, II a, I a) and #203 (Bg II b, II a, I a), before abandonment.

5. CONCLUSIONS AND PROPOSALS

For *COMPANY A* concession it is proposed to continue the exploitation in accordance with option 2, with the present well (#202), investments of 1 000 000 EURO, in order to drill a new production well (L 206) for Burdigalian III a3, block G2, because:

- option 2 has a higher NPV than option 1:
 - NPV@5% is greater with 1 500 000 EURO,
 - NPV@11% is greater with 700 000 EURO,
 - NPV@15% is greater with 400 000 EURO.
- option 2 has a higher reserve than option 1 with 21 Mtons of oil and 7 MMscm of associated gas (undeveloped proved reserve). Option 2 becomes inefficient if production decreases with 55%.

It is estimated to obtain till reaching the economic limit - year 2034: NPV@5% = 1 500 000 EURO and a proved reserve of 32 Mtons of oil and 10 MMscm of associated gas.

Internal rate of return for the well #206 is 32.67%. The new well becomes inefficient if production decreases with 40%. The payout date for the investment is the year 2012.

The existent reserves for *COMPANY A* are as following:

- proved developed reserves 11 Mtons of oil and 3 MMscm of associated gas;
- proved undeveloped reserves 21 Mtons of oil and 7 MMscm of associated gas;
- probable reserves 10 Mtons of oil and 2 MMscm of associated gas.

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