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NEW STEPS IN FINDING THE POTENTIAL PROSPECTS FOR UNCONVENTIONAL GAS RESERVOIRS IN TRANSYLVANIAN BASIN (ROMANIA)

1. INTRODUCTION

The present paper is considered a result of the Romgaz managerial team preoccupation for identifying unconventional gas resources and reserves in Transylvanian Basin and is also designed as a continuation of our last year assessments, In this respect was initiated a complex project in which were involved three separate teams belonging to our production subsidiaries and headquarter which have focused on different areas from Transylvanian Basin.

Because the very recently specialized studies have proved an insufficient maturity degree of the organic matter in Transylvanian Basin, so in this stage we can not speak about „shale gas'', only „tight gas''' category has been approached.

The methodology applied in our study preparation included more steps which are briefly presented in the paper. After the inventory of our whole data base, with all the productive fields and also the areas between them, we performed a filtering of the collected data and information, focusing mainly on the new zones, inside the known structures and also on the isolated wells, located between fields.

2. STEPS OF APPLIED WORKING METHODOLOGY

The main steps performed during our inventory campaign, consisted in:

- Graphical plots with total number of wells of each field.
- Quantitative analysis plots on each field (depth, geological limits, number of wells which passed sarmatian, buglovian, badenian, salt (Fig. 1).
- Synthetic tables for Buglovian and Badenian including production tests results.
- Mechanical cores analyses from reservoir studies, well files, our GIS data base, which allowed plotting the permeability versus porosity, in order to demonstrate the tight character (Fig. 2), comparing with the defining chart (Fig. 3).

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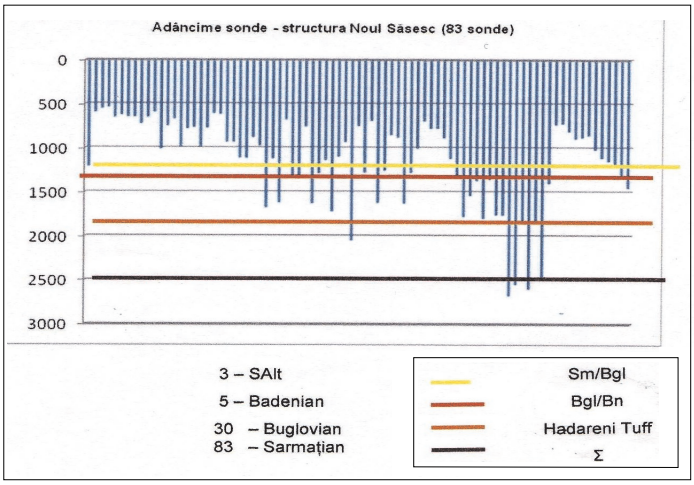


Fig. 1. Graphical synthetic plot for one field

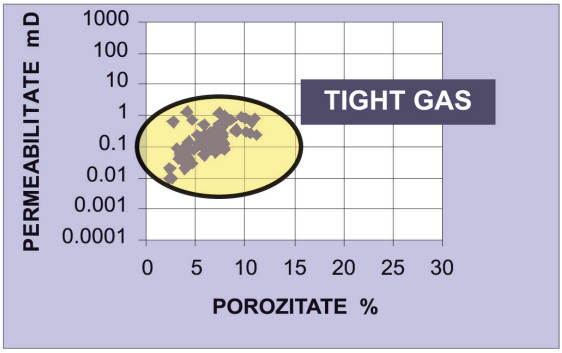


Fig. 2. Permeability vs porosity

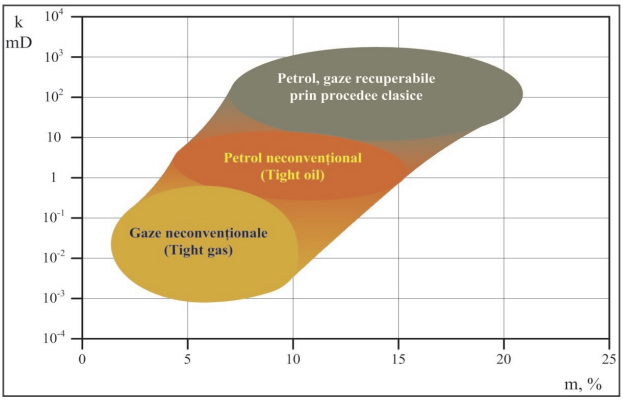


Fig. 3. Defining chart

In the same time, mineralogical composition analyses (Fig. 4) of different samples helped us to define which minerals are predominant, to define the type o cement, an important information for an eventual future hydraulic fracturing job.

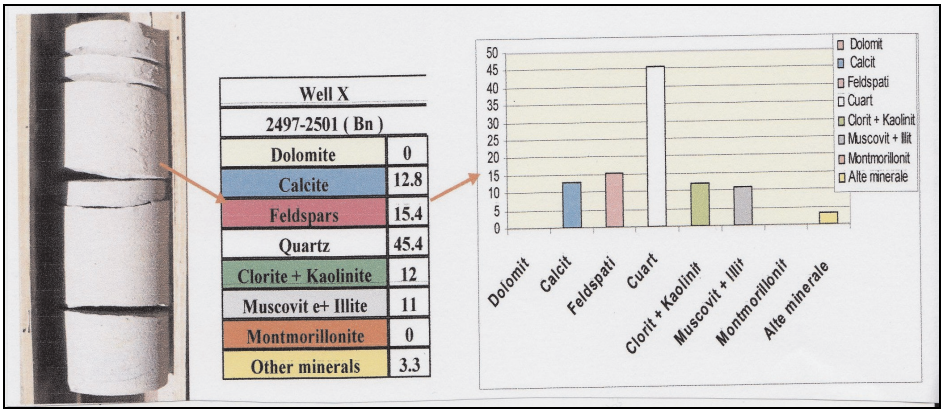


Fig. 4. Core photo and mineralogical composition

– Petrophyisical interpretations (B.K.Z., D.R.R.,P.G.A.C., ELAN).

From the petrophysical interpretation presented in the Figure 5, can be noticed the range of values in which we are in this section: low porosities, below 10% and also permeabilities, less 1 mD, typical for „tight gas'' formations.

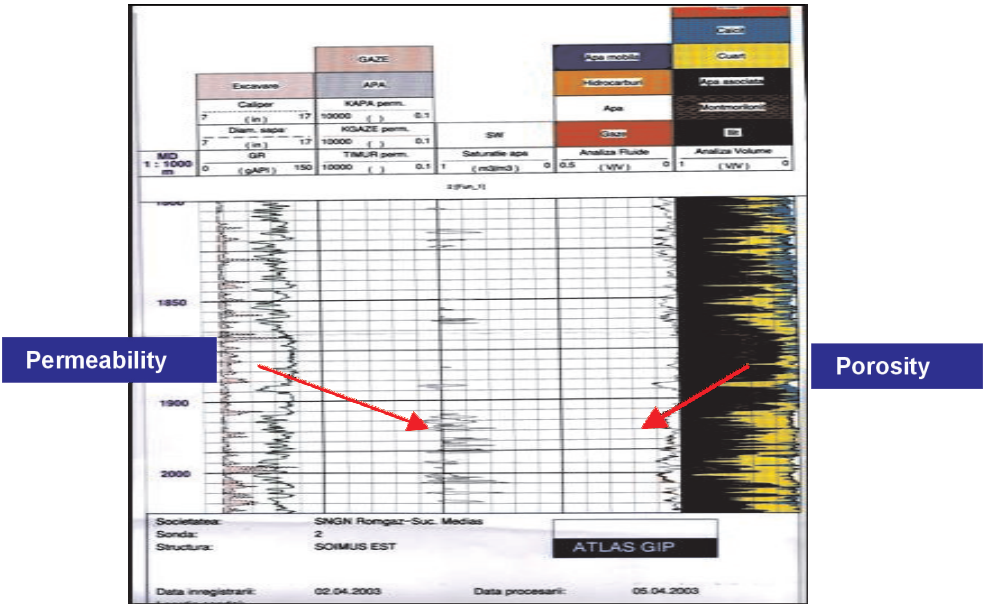


Fig. 4. Petrophysical interpretation

– Results of the production tests and drilling events as mud gasification (Figs. 5, 6), correlated with hydrocarbons indications from geophysics.

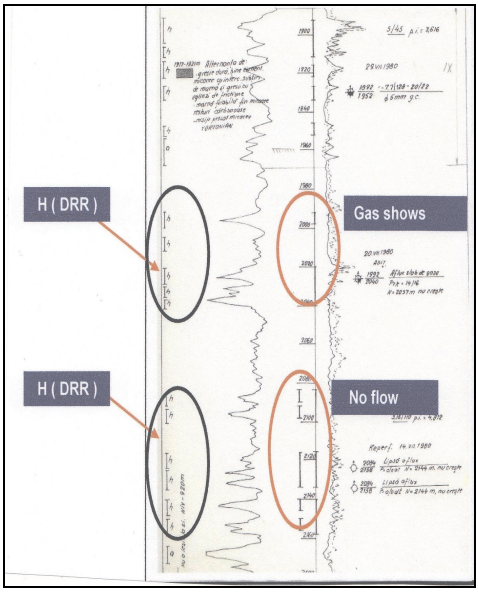


Fig. 5. Electrical standard log 1

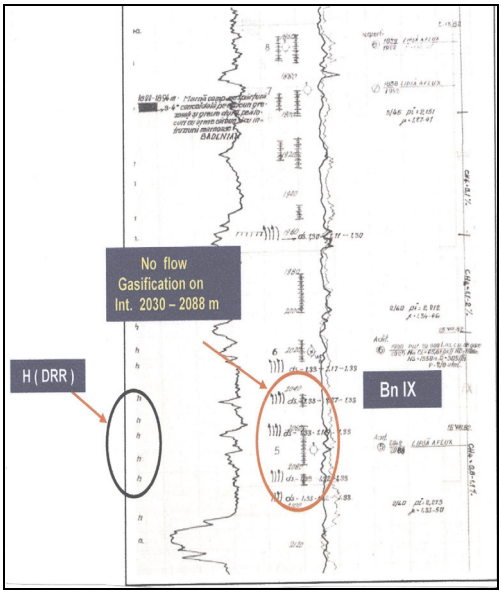


Fig. 6. Electrical standard log 2

The inventory of the areas between gas fields was made in the same manner, analysing the isolated wells, but without proving in this stage a continuity, perhaps in the future, if we'll have a higher degrree of seismic coverage of the Basin.

The whole data base assessment was afterward analysed and filtered, focusinfg in principal on new zones and isolated wells, in order to achieve finally our target, represented by an estimation (evaluation) of the unconventional geological resources.

The main selection criterions taken into account were:

- Badenian and even Buglovian formations,
- Deeper zones, more than 2000 m depth in general,
- Lithology _ sandstones,siltstones,
- Petrophysical parameters: maximum porosity 10% (with few exceptions up to 15%) and permeabilities of max 1 mD or a little higher,
- low gas influx (low flow rates), even no flow, relatively high static pressures,
- results of previous stimulation experiments: fracturing, acid jobs.

3. GEOLOGICAL RESOURCES ESTIMATION

For each selected packages and the individual isolated wells,we estimated the geometrical parameters in terms of area and net pay, petrophysical ones (porosity, gas saturation) and energetical (the volume factor), for the section from between top salt and top Badenian, in order to go further to computing the initial geological resources by volumetric method.

Due to the uncertainty of each parameters involved, beside the computation in deterministic way, was applied the statistical method by Monte Carlo simulation, in three versions: P10, P50 and P 90, taking into account the minimum and maximum values of the parameters.

Two examples of computation are presented below, for the new zone (Fig. 7) and an isolated well (Fig. 8).

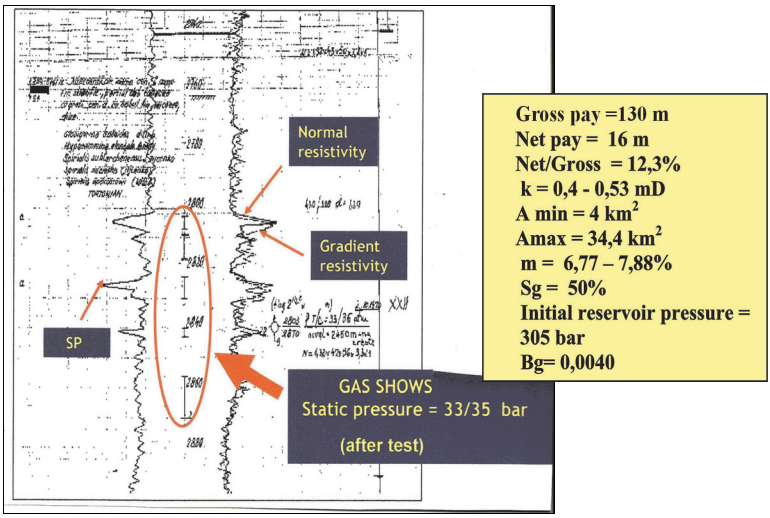
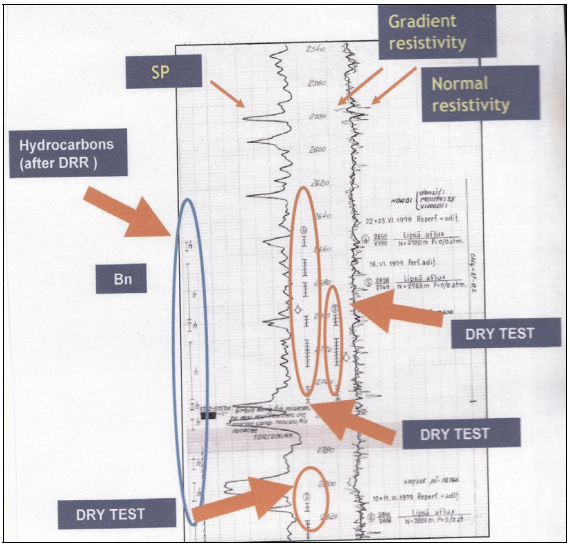


Fig. 7. Example of resources computation for a new zone



Gross pay = 1300 m
Net pay = 123 m
Net/Gross = 9,4%
k = 0- 0,97 mD
A min = 0,19 km^2
Amax = 0,78 km^2
m = 5,92 – 12,3%
Sg = 50%
Initial reservoir pressure = 285 bar
Bg = 0,0044

Fig. 8. Example of resources computation for an isolated well

4. CONCLUSIONS

The conclusions derived from our estimations, allowed us to define a play associated with the deep zone of Basin „Deep Basin Center" (Figs. 9 and 10) and to propose few prospects, based on the most attractive selection criterions, in terms of volumes, net pay, cores and logs, 3D seismic, etc.

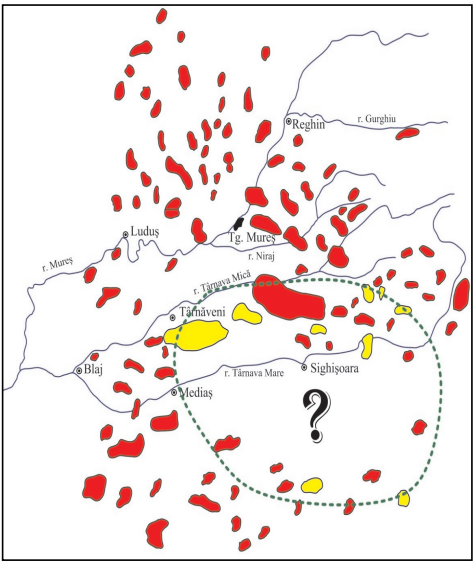


Fig. 9. Defining a play

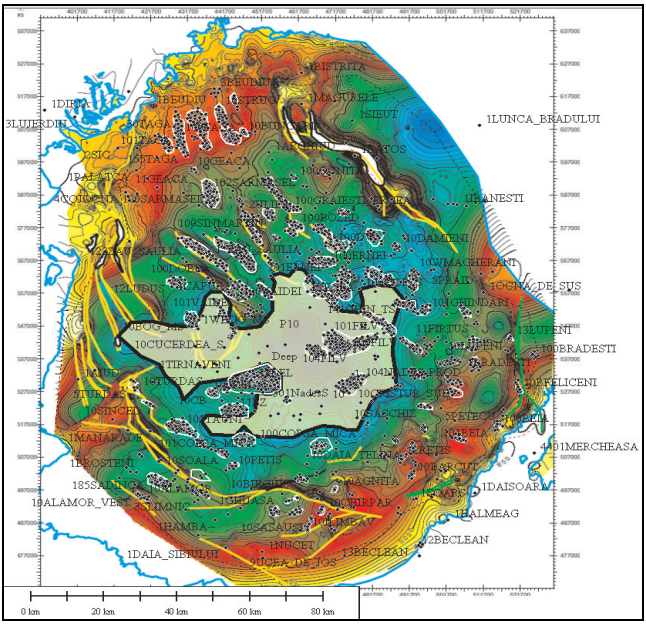


Fig. 10. The deepest zone of upper Bn in Transylvanian Basin corresponding to the highest gross pay

Although our main target was finding the new zones inside the known gas fields and between them, our assessments revealed that we have also tight gas packages in badenian formation with already confirmed resources, or in few exploited reservoirs, where the recovery factor is low, but these aspects are not presented in our paper.

In this respect we could say that the total gas resource is composed from conventional gas confirmed resource and also unconventional gas one, and tahe last one has also two components : an existing unconventional gas resource and an assumed hypothetical) unconventional gas resource (Fig. 11).

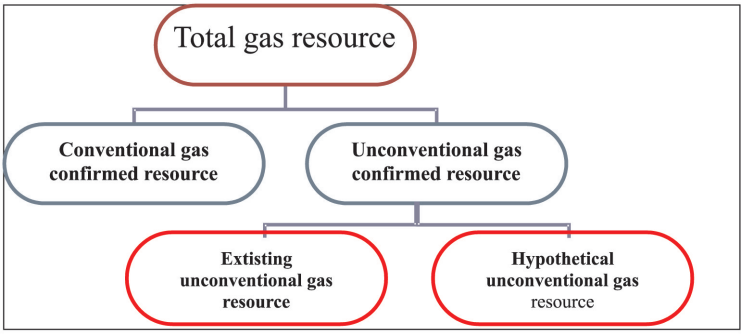


Fig. 11. The components of total gas resource in our view

Based on the above assumptions we proposed in the first stage, as a starting pilot project, to initiate a fracturing campaign in deeper badenian tight packages, on some well known fields, where are available more data regarding cores, logs, seismic. In this case, we consider to be very helpful a re-analysis the existing cores, in terms of stress and geomechanics, and in the new already designed well to extract more cores and to run the special logs as MicroImager, Dipole Sonic and others, for evaluation the geomechanical properties of the rocks as: Young modulus, Poisson ratio in –situ stress, the fraccability potential, all necessary input data for hydraulic fracturing.

If this experiment will be successful, we can think in depth and to propose eventually one or even more (horizontal) wells

Now, we hope to be implemented in the near future. a pilot project after our managerial team will take a decision.

REFERENCES

[1] Shehata A., Ramse L.: *Overview of Tight-Gas field Development in the Middle East and North Africa Region*. SPE 126181, presented at SPE North Africa Technical Conference and Exhibition, Cairo, 14–17. February, 2010.

[2] **** Romgaz Archive.