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The use of the Modular Dynamic Tool in petrophysical parameters evaluation: application to the Bir-Berkine reservoirs - Algeria

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Abstract: The technological development and the complexity of the reservoirs unceasingly encourage us to improve our working methods, of acquisition processing and interpretation of well logs, but the information provided by the well logs related to the localisation of hydrocarbons bearing zones is not perfect. The Modular Dynamic formation Tester (MDT) is a new generation of tools designed for the more pointed tests of formation. By using its various configurations and options it offers, unquestionable opportunity to obtain, starting from the pressure taps, a varied range of invaluable information for the management of the reservoirs. The virgin reservoirs service MDT is used:

To determine the levels of the contacts of fluids (WOC and GOC):

- to determine the densities of the fluids;
- to characterize the reservoir heterogeneity;
- to decide the completion mode;
- to optimize the mud density to be used.

In the development of reserves:

- to establish a pressure profile;
- to estimate the vertical and horizontal permeabilities;
- to detect the robbers zones;
- to determine the communications between the wells;

The principal goal of this work is by combining the results of petrophysic measurements and pressure. To achieve this goal the study is articulated on four essential points:

- The evaluation of the petrophysical parameters of the Bir-Berkine reservoirs;
- Interpretation of pressure measurements;
- Well to well correlation;
- Result synthesis.

1 – Methodology

The combination between the evaluation of petropysical parameters and pressure measurement can bring invaluable information on the reservoir (Corbelleri, 1996). This ables to make a better exploitation and to avoid maximum production problems with a minimum cost (Schlumberger, 1997). For example a problem of production which is very understood: the water problem (Altunbay, 2001). This procedure to solve this problem is as follow: The operation side track and squeeze cement are not taken into account, as well as the costs of equipment.

The minimum profit is 30000 ($) + time which are very expensive ($):

- The cost of an operation of the MDT is evaluated by the number of points of measurement; therefore it is necessary to optimize these points of measurements;
- The MDT is the only tool which can know the density using the pressure data.

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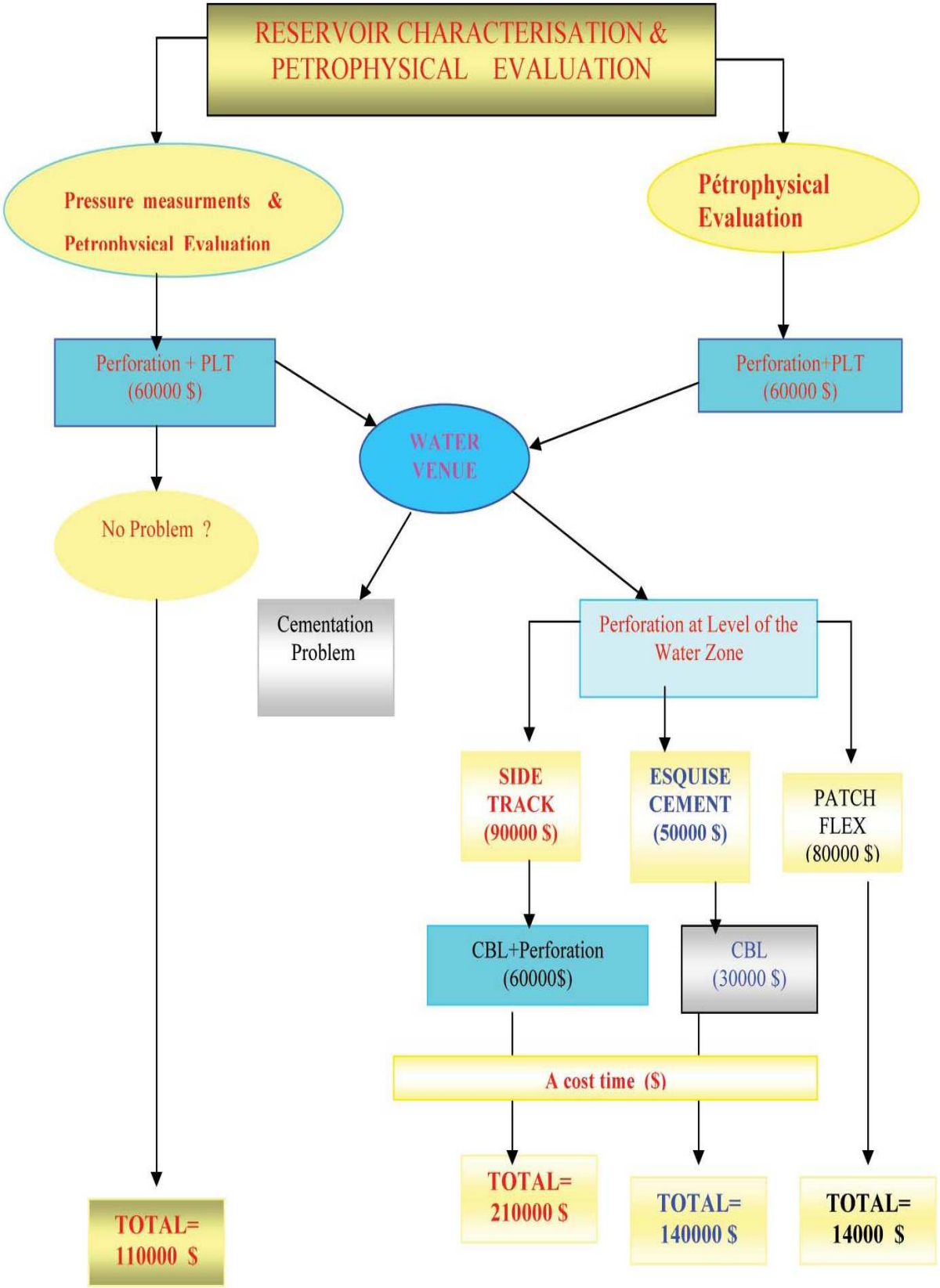

Fig. 1: Estimating of the costs during managements in the reservoir characterizations.

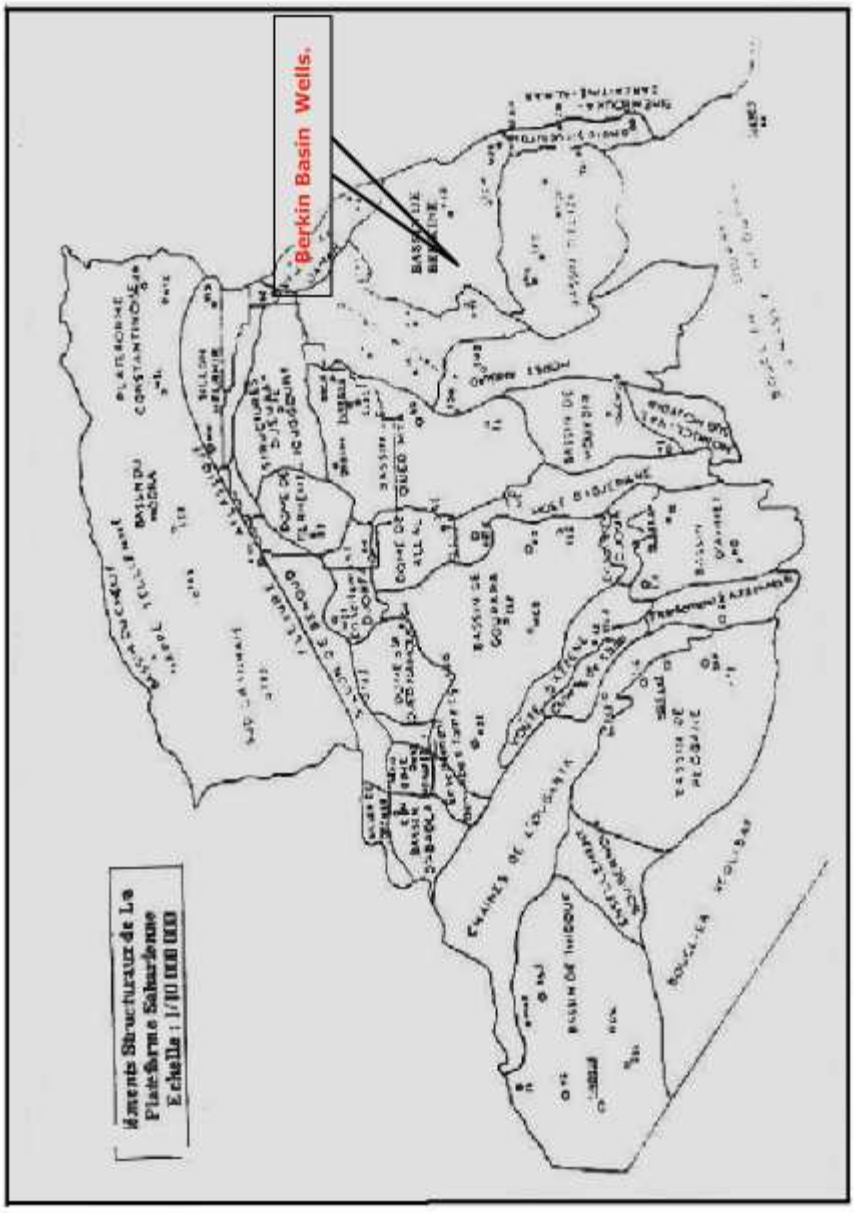

Fig. 2: Field location of the Berkin Basin (Algeria).

3- Geological Framework and Stratigraphy

The Berkin basin has a circular form and results from the superposition of two basins (Noureddine Yahi, 2001):

- The Palaeozoic basin: It is characterized by the subsidence of its central and western part and by significant thickness and facieses variations shown at certain stratigraphic bevels.
- The Mesozoic basin: the thickness of the Mesozoic section decreases gradually southeast. The Interest of this section is in the presence of sandy reservoirs of the TAGI surmounted by a siliceous LIAS where the reservoirs are not covered. The stratigraphic one of the zone of study synthesized in the following log:

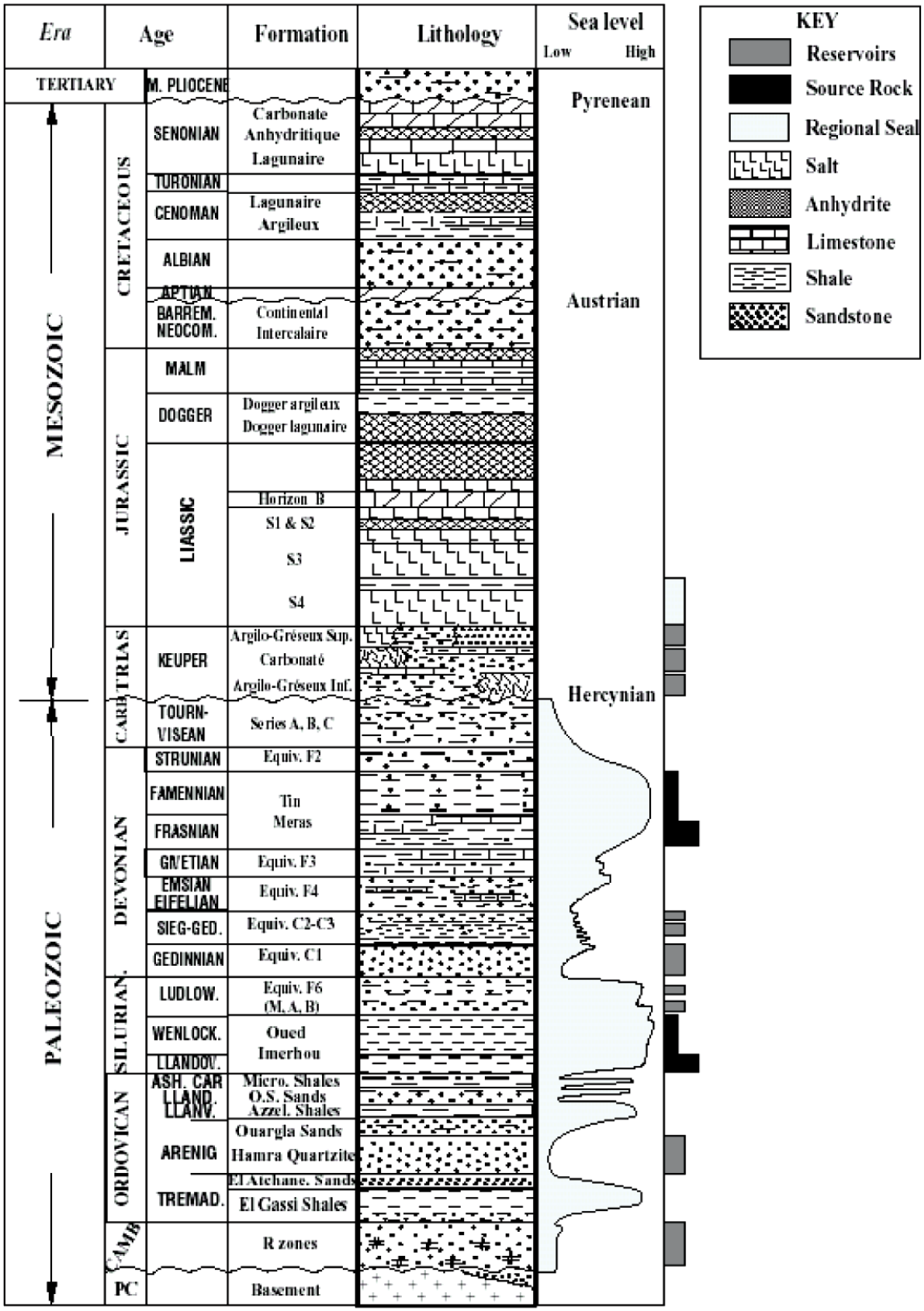

Fig. 3: Stratigraphic evolution of the Palaeozoic and Mesozoic in the Field of Bir Berkin.

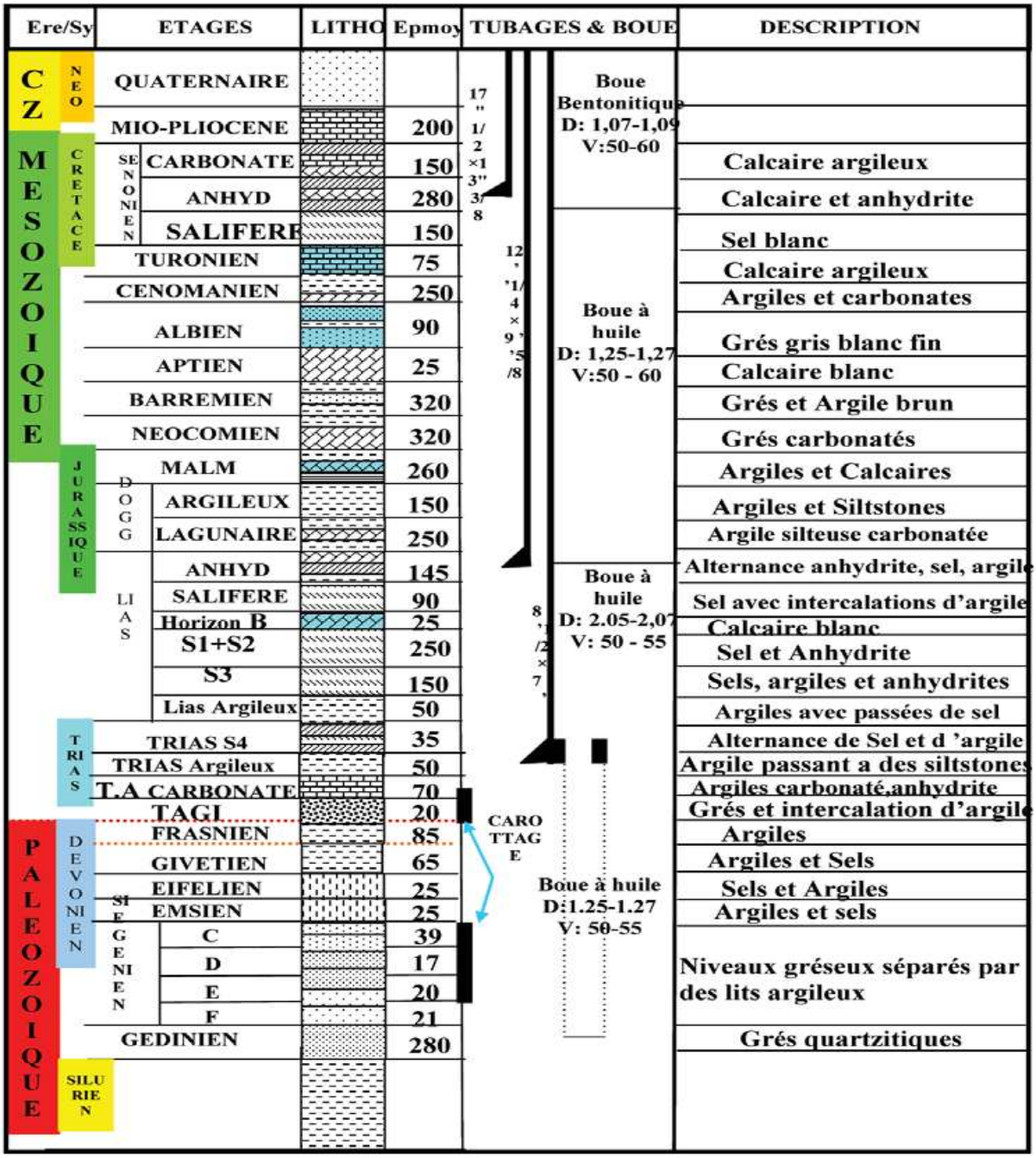

Fig.4: Stratigraphic column of the Bir Berkin Field.

IV - Determination of the petrophysical parameters in the Berkin Basin Wells

The Lower Shaly Sand Reservoir: TAGI.
The Litho logy of this reservoir is given after processing using ρb = f(NPHI), and obtain φ = 8 % and ρ = 2.52 g/cc.
The standard of Clay is determined after start with Thor = f(Pota) and one found in the interval 3335 - 3337.5 m Illite of 70 % with a small proportion of Montmorillonite in the interval 3342.5 - 3345.0 m.

V – Results

Reservoir C : In the interval 3540-3560 m, possibility of 100% kaolinite and Montmorillonite; In the interval 3560-3600 m, a mixture of kaolinite et illite.

Reservoir D, E, F: In the interval 3630-3650 m possibility of 100 % Kaolinite and Montmorillonite with a pass of 100 % of illite at

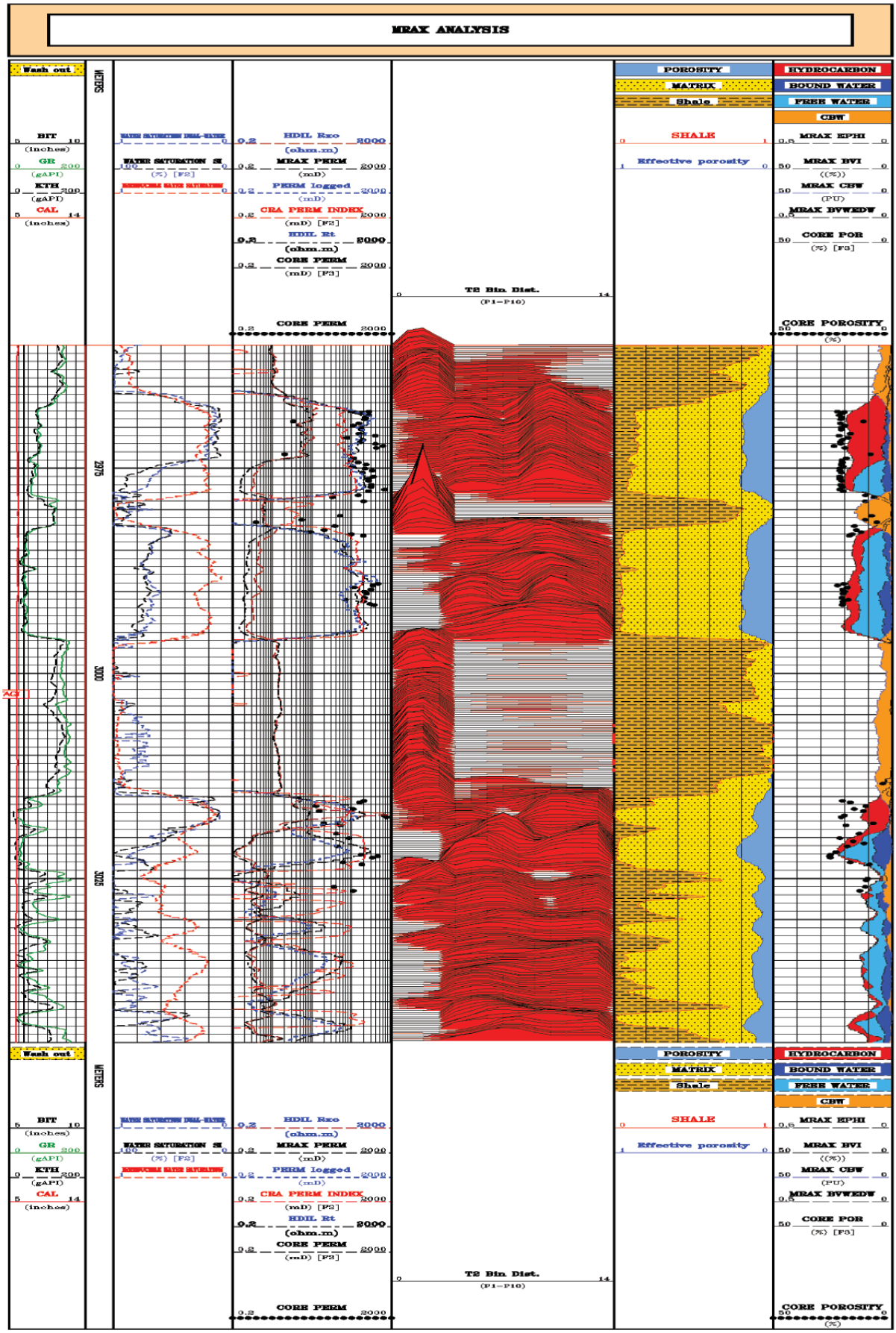

Fig. 5: MRAX analysis - Well BBK.

3650 m. In the interval 3660-3700 m, kaolinite and illite with a larger Kaolnite concentration. To simplify the study, Clay with average characteristics of the unit, but each time one varies a little. The properties of the parameters of model to adapt with new interpretation (SGR), therefore models simplified for all the TAGI reservoirs and the curves used are: NPHI, RHOB, DT, HAS and CALL, therefore the model suggested is : Lithology quartz, clays (Illite, Kaolinite, Montmorillonite), fluid : Oil and Water.
The Upper Shaly sand Triassic: T.A.G.I

The BBK8, BBK4 and BBK3 Wells have the same thickness of tank and similar petrophysic characteristics (Vsh, PHIE) thus the only parameter which have in the impact on the useful height in this case is the water saturation (Altunbay, 1997) what thus proves that inevitably has the existence of a fault between
wells BBK8, BBK 3 and BBK 4.

For well BBK7 the variation thickness of the tank is probably due to the variation of facies or lithology or both for wells BBK8 and BBK 3 that have of the similar petrophysic properties it may be possible that there is a communication between the wells on this level.

VI – Conclusions

The Lower Shale Sand Triassic (TAGI), Siegenian and Gedinian of Bir Berkin Basin have the same petrophisics and litho logics characteristic, different and variables from well to well which reflect this study very complex. Obtaining adequate geological model of these reservoirs requires a large discipline, knowing: geology, geophysics, geomechanic, well test etc. The Analysis of the distribution of dimensions of the pores, as their quantifications on the scale of the microns allows environment the geologists the study of depositional. It also makes it possible to identify the Oil benches productive as well as the degree of production. To determine the points of pre-test with the open logs

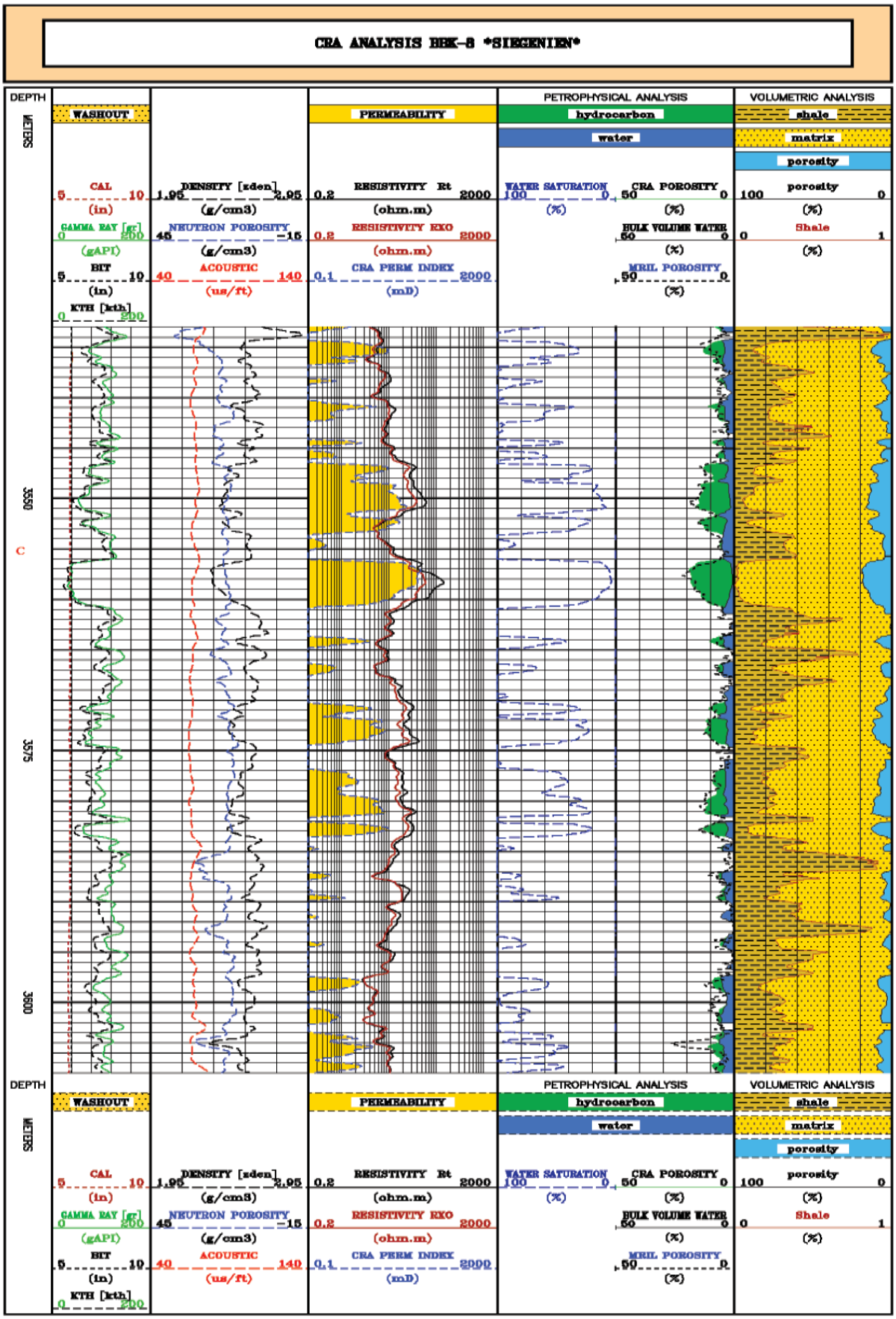

Fig. 6: CRA analysis – Well BBK.

hole and imagery with high resolution to avoid the depleted zones, to conclude for each test before passing to an other one. Well let us can reduce the errors of precision by taking a great number of points in a reduced zone, to have a good test it is recommended to use the module with double packers but it is very difficult to make a success of this operation indeed the matter constituting the packers is easily damaged by the walls of the hole in the zones undetermined or oval for that this matter should be improved.

The thickness of Mesozoic is reduced gradually towards South-East. The interest of this Mesozoic series is with the presence of the sandy reservoir of the Lower Shale Sand Triassic (TAGI) surmounted by a siliceous cover of Sorted and siliceous Lias, this one disappears gradually towards South-east from the basin where the tanks of Sorted are not covered. the tanks of Sorted are not covered.

The qualitative analysis allows the localization of hydrocarbons. The measurement of the water portion related to clays makes it possible to quantify the free volume of fluid, the definition of the Dual Water model, The determination of the irreducible water portion and the estimate of the volume make it possible to determine the Cut off in Production.

VII - References:

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