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OVERPRESSURES GENERATING PROCESSES IN OLIGOCENE OILFIELDS OF ROMANIA

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ABSTRACT. The Oligocene depositis of the folded zones from Romania belonging to the Capathians Belt generated and preserved in their existence many overpressured layers consisting of an succession of interbeded oil shales and sandstones. The occurrence of these overpessured formations are related with two main causes, rapid sedimentation and folding up to overthrusts and even napping. The estimated/calculated values of these overpressured zones are varying between slightly abnormal till some very high values close to lithostatic gradients. They provide seriously drilling problems and also a peculiar relation between the amount of resources and reserves.

СВРЪХНАЛЯГАНИЯ ВОДЕЩИ ПО ПРОЦЕСИ В ОЛИГОЦЕНСКИТЕ НЕФТЕНИ ПОЛЕТА НА РУМЪНИЯ

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РЕЗЮМЕ. Олигоценските находища от нагънатите области на Румъния принадлежащи на Карпатския пояс са генерирари и съхранили при своето развитие много пластове подложени на свръхналягания, представени от последователност от взаимопроникващи нефтени шисти и пясъчници. Присъствието на тези пластове е свързано с две основни причини – бърза седиментация и нагъвания до възсявания и навличания. Предполагаемите и изчислени стойности на тези зони на свръхналягания варират от леко анормални до изключително високи стойности близки до литостатичния градиент. Те предизвикват сериозни проблеми при сондирането, а също така особено съотношение между количеството на ресурсите и установените запаси.

Introduction

Mechanisms of Overpressure Generation

The most important mechanisms of overpressures generation, for subsidence analysis are:

- clays (shale's) under compaction
- tectonic uplift
- thrusting all of them providing important clues regarding basins evolution.

Clays under compaction is provided by a very fast subsidence and sediments accumulation. In this case will appear a very thick sediments column and, when the sediments have a high clay content the reducing of pore space is important (Fig. 1).

In many cases a thick clayey formation expel the fluids in a specific manner (Chapman, 1976) consisting in a rapid expelling at the borders of the layer thus the limits of the unit will suffer a very rapid decreases of porosity and will became almost impermeable whit the inner past of the unit pressure an important amount of fluids which cannot be expelled so it will be overpressures (Fig. 2).

We may calculate, from well logs, from drilling data and from production data the pressure of the fluids at a certain depth. Assuming that the calculate pressure, higher than normal one, corresponding to a certain depth, added to a vertical.

In the same manner we may calculate a minimum depth corresponding to a smaller porosity and pressure. The subsidence must be placed between these values. When the origin of overpressures is the uplifting of a tectonic isolated unit the task is easier because the pressured fluid pressure is corresponding to a burial depth (Chirita, 1986).

In this case we may find a depth where the calculated pore pressure is a normal one. The existence of these overpressures involves a dedicated drilling technology and many times during the drilling of the wells will appear a lot of difficulties like borehole constriction, blow up, differential sticking etc.

For a better understanding are presented two case studies from the Diapiric Fold Zone.

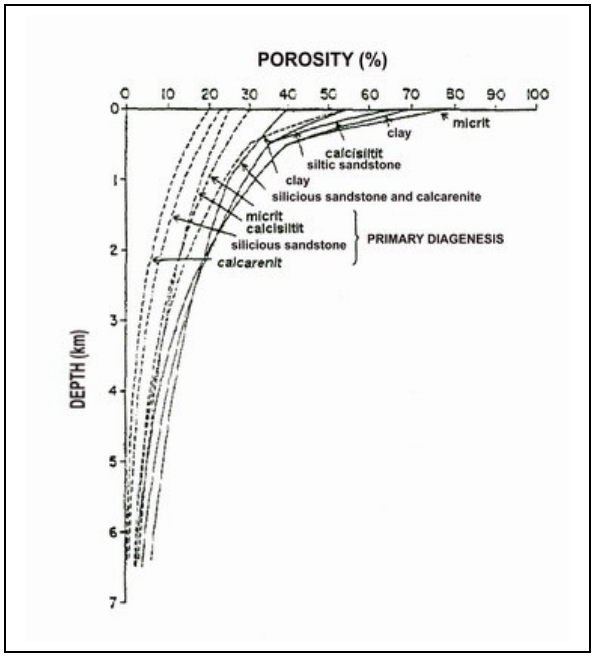

Fig. 1. Porosity versus depth variations for different kinds of rocks

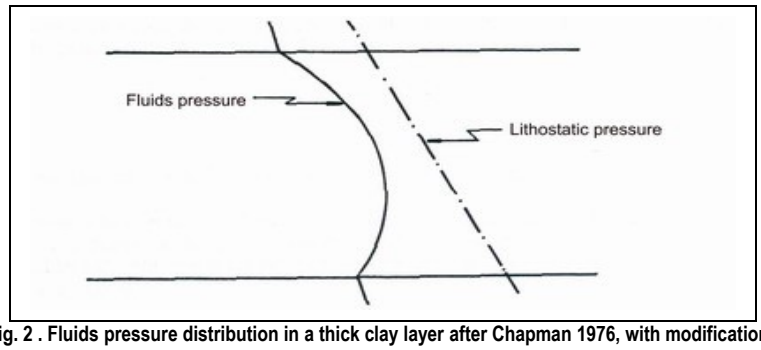

Fig. 2 . Fluids pressure distribution in a thick clay layer after Chapman 1976, with modifications

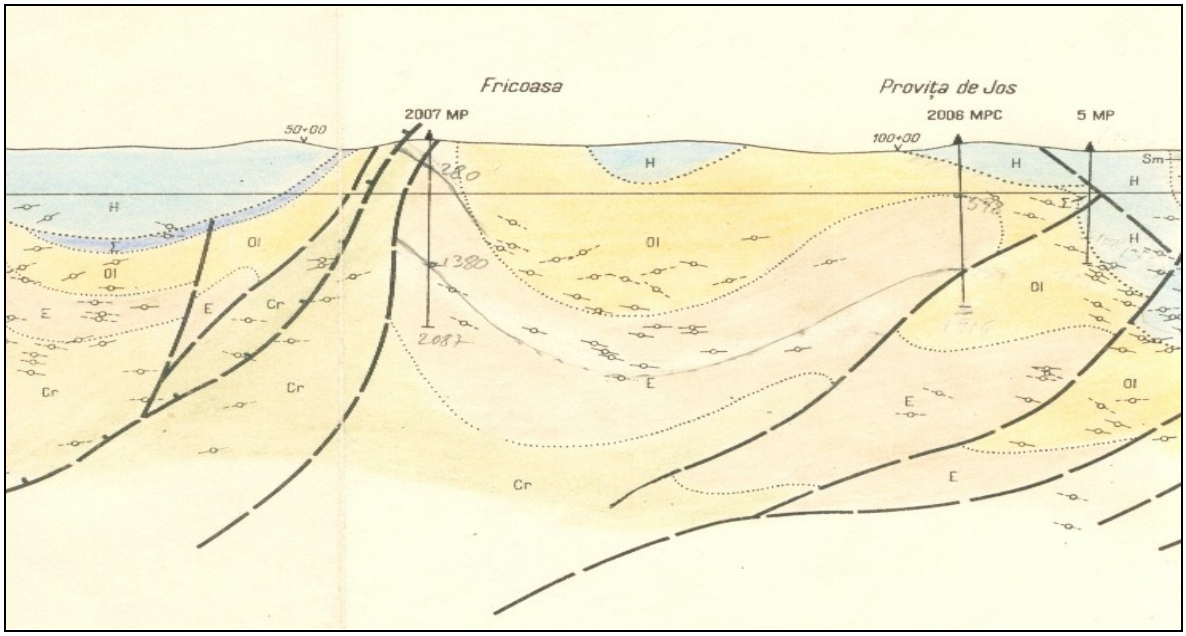

Fig. 3.. Cross-section of the northern border of Diapiric Fold Zone

Case study: Diapiric Folds Zone

In the Diapiric Folds Zone, Known as the most productive oil region of Romania, have been drilled more than 7000 wells. Almost all these wells have been investigated with geophysical well logs, mainly electric methods.

From these logs interpretation we may obtain a huge amount of geological data. Among them we focused on overpressures values, their distribution on geological units, ages, formations and their signification. From north to south the changes are related to the existence of Homoriciu and Valeni spurs belonging to Tarcau nape and, in the outer part, the "foredeep" oligogene belonging to the Subcarpathian nappe, occurring at deeper levels, until 6000 m, overpressured and maybe oil-bearing.

So the Homoriciu spur is present on large zones (at different depths) and is changing from east to west from Kliwa sandstone facieses to Pucioasa facieses. On the northern border of the Diapiric Folds Zone the main productive formation is Oligocene. It belongs to the Tarcau Nape and is developed in different facieses.

As we can see in the Fig. 3 the thrust processes in the studied area are important and they provide a high pressure gradient for mainly shally Oligocene deposits. One of the most visible effects of overpressures is the change of the resistivity values for the marls and shales

In the next figure we may observe the resistivity values from a well placed in the sothern part of the section, in the Provita structure zone (Fig. 4). Based on these values we may calculate the pressure gradients the most suitable method being the one established of Ben Eaton (1976) with a small modification of α exponent which for this region has values around 1.15 instead of the original 1.5 used by Ben Eaton (Fig. 5).

The overpressures of Oligocene deposits are related with shales under compaction, as a consequence of rapid sedimentation and burial, and, mainly in the outer zone, to the tectonic uplift of formations.

Miocene deposits preserve also important overpressures related with the same causes like Oligocene deposits. Pliocene deposits are usually normal pressured excepting a small zone (Valcanesti Magurele) where are present overpressures in Pontian and Dacian, related with tectonic events and diapirs evolution. The links between formations pressures and geological evolution of the zone are obvious and thus plotting the pressures values we may highlight some important geological data.

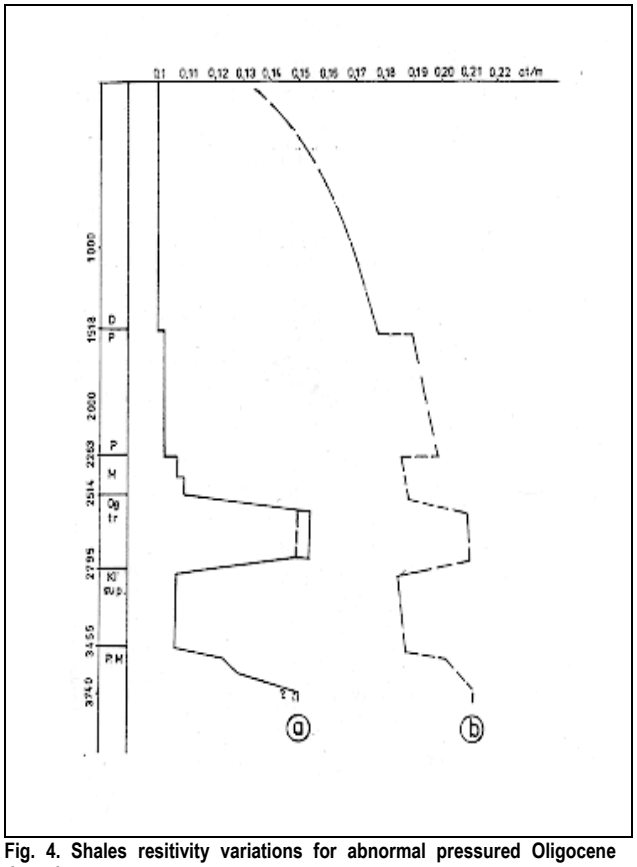

Fig. 4. Shales resitivity variations for abnormal pressured Oligocene deposits

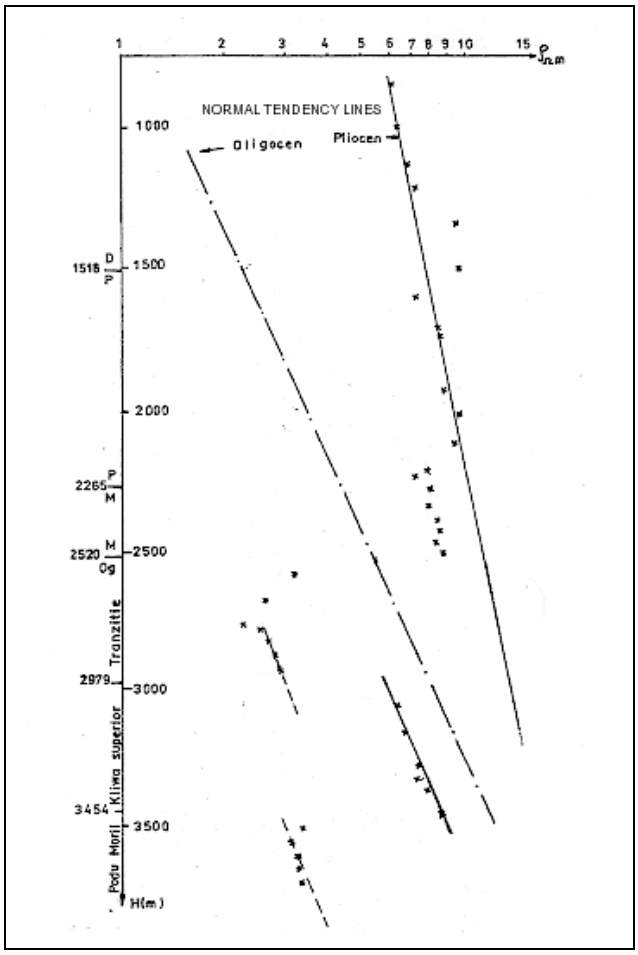

Fig . 5. Pressure gradients values for 5511 Provita well calculation

Conclusions

The Oligocene deposits from Romania are usually defined by high pressure values. These values are depending first of all of the lithology of the deposits, mainly sahles and marls.

The principal mechanisms of overpressures developing are related with rapid subsidence and high rate of sediments accumulation and also with the tectonic evolution of the sedimentary basin. The drilling conditions for these formations are difficult and they need a high experience and technology.

The existence of the overpressures and its values is an important clue in sedimentary basins evolution analysis and also for oil generating potential estimation.

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