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INTERPRETATION OF DST TEST RESULTS FOR THE IDENTIFICATION OF HC ACCUMULATION LIMITS OR BOUNDARIES IN THE AREA OF THE CARPATHIANS AND CARPATHIAN FOREDEEP (SOUTH POLAND)**

1. NOMENCLATURE

C – wellbore storage coefficient [m3 / MPa],
S – skin-effect,
p* – initial pressure [MPa],
Rb2 – radius of the investigation during test [m],
L – distance from the well to boundary [m],
$\bar{p}$ – average pressure [MPa],
I.A.R.F. – Infinite Acting Radial Flow,
DST – Drill Stem Test,
Δt 2 – time of second build-up of the bottom pressure and time of the inflow [min],
n.o. – barefoot segment of the well,
perf. – perforated segment of the well,

2. INTRODUCTION

A detailed analysis of results of DST tests performed by PNiG Kraków with the use of modern Ful-Flo testers by Halliburton and Inflatable by Baker plays a very important role for identifying the character of interactions taking place in gas and oil fields as well as aquifers in the Carpathian Foredeep and Flysch Carpathians. The bottom pressure was measured with

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downhole pressure meters by Kuster -AK-1 and Amerada-GRC, and also electronic devices by Leutert and Panex.

The occurrence of various interaction zones in the form of faults, dislocation zones and edgings or strong facial changes of reservoir rocks in the oil prospecting area and also in the sites of planned underground gas storages can be identified on the basis of seismic data, drilling data (cuttings, cores, catastrophic mud losses, etc. in the dislocation area, preliminary eruptions), and also from the analysis of DST test results interpreted with the log-log method. The interpretation of DST results with the log-log method facilitates the identification of occurrence and shape of the interaction zone, its shape and distance from the well provided the build-up changes have been measured for sufficiently long (usually over 150 min.) The interpretation should be made for build-up pressure recorded by a downhole meter during the second build-up test because in a number of cases the boundary effects are usually recorded after the Infinite Acting Radial Flow (I.A.R.F.) takes place.

The results of tests performed with DST at the end of the 1990s were interpreted with the traditional Horner method in the semi-log coordinates system [5] and with advanced log-log method where the actual and model (diagnostic) build-up pressure plots were compared with the first derivative of build-up pressure in a function of time in a double-log system [9]. The model plots of a French company Kappa were worked out in reference to the model of the deposit, opening-up model and interaction zones model for the scope of interpretation defined in the „Saphir 202B" program.

For the needs of this paper the results of own analyses of industrial DST data, which were indicative of the presence of a definite interaction zone between wells in which DST tests were performed and where the results were analyzed with the log-log method, were selected and thoroughly interpreted.

3. THEORETICAL BASES OF DST RESULTS INTERPRETATION WITH LOG-LOG METHOD

The diagnostic plots of build-up changes (Δp) recorded during the build-up test and the first derivative of bottom build-up pressure in a function of time increase ($\Delta p^{'}$) are analyzed in the double-log scale. The logarithmic derivative is calculated from the relation:

$$\Delta p' = \frac{\partial \Delta p}{\partial ln \Delta t} = \Delta t \frac{\partial \Delta p}{\partial \Delta t} \tag{1}$$

These plots enable one to select a theoretical deposit model and identify the character of flow of fluid in the reservoir by comparing them with those based on actual data. The plots made in a double-log scale can be analyzed for their course in reference to the axis of the coordinates system. On this basis various effects taking place in the near-well zone (e.g. storage effect, skin-effect) and inside the reservoir (homogeneous or non-homogeneous reservoir, infinite radial flow, reservoir boundaries) can be analyzed [2, 3].

3.1. Diagnostic models and plots of boundaries of well interaction zones analyzed with the log-log method

During oil prospecting realized by PNiG Kraków at the end of 1990s the following instances of interaction of a well were observed in the analyzed area with the log-log method [4]:

- constant pressure circle zone of interaction;
- zone limited by one linear sealing fault or a zone of constant pressure;
- zone with two intersecting faults;
- zone of interaction in the form of a polygon.

Bearing in mind the already mentioned cases, there were presented models and plots referring to these interaction zones [9].

Infinite zone

In practice each zone of interaction has a finite range. During very short hydrodynamic tests one may encounter a considerable smaller radius of a zone investigated with a DST than the distance from the well to the actual boundary of interaction. In such a situation assumption is made that the reservoir operates as infinite.

Radial zone of interaction is closed

Model assumptions

The well is located in a centre of a reservoir with a circular boundary around. The interaction zone has a radius r_e (fig. 1.a). The logarithmic pressure derivative for long build-up times is asymptotic with respect to the inclination straight line of 1 (fig. 1b).

Radial (open) interaction zone of constant pressure

Model assumptions

The well is located in a centre of a reservoir and has a circular zone of interaction, at the edge of which a constant initial pressured is observed. The zone of interaction has a radius r_e (fig. 1a). The logarithmic pressure derivative decreases tending to zero on the boundary (1b).

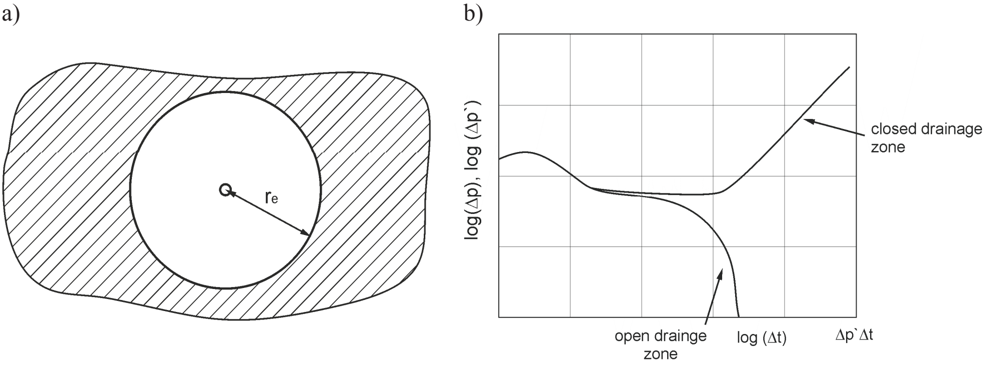


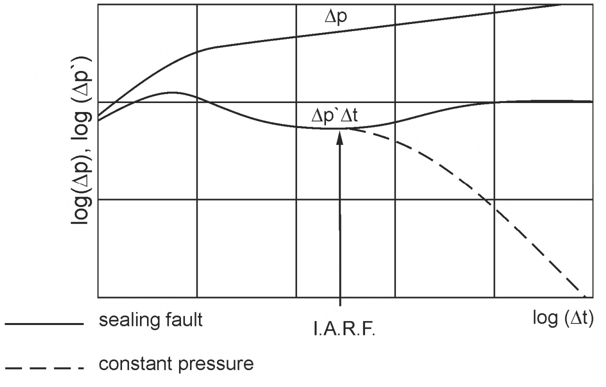
Fig. 1. Radial zone of interaction

Zone of interaction with linear fault

Model assumptions

One fault localized at a distance L from the production well limits the contact between the well and the deposit in this direction (sealing) or exerts pressure from this direction of the deposit (constant pressure). The shapes of diagnostic plots in the log-log system are presented in fig. 2.a, and specialist plots in fig. 2b.

a)



b)

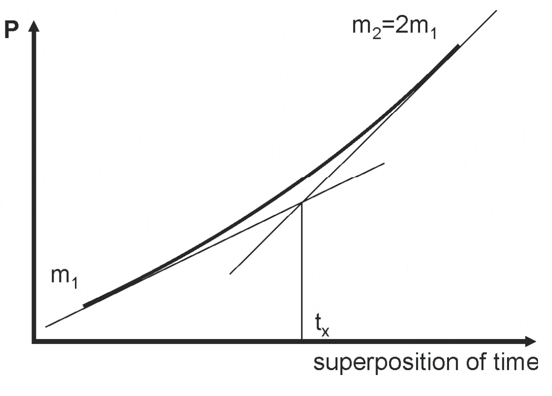


Fig. 2. Diagnostic and specialist plots for sealed and open faults

Prior to the boundary interaction, the pressure build-up plots in a well are the same as in a deposit of infinite range. The time of finding the boundary interaction is proportional to L^2. The barrier near the well may be of different character. Two cases are plausible:

a) sealing fault. When the deposit sealing boundary is achieved, the flow of fluid is limited on one side. This behavior corresponds to the infinite system of rock permeability equal to half of the initial permeability. The log-log model plot of the first derivative of build-up pressure reaches 0.5, to later achieve the second level of values, i.e. 1.0.

b) constant pressure boundary. The inflow of fluid to the well takes place at a constant pressure. In the double-log system the plot of the first derivative of build-up pressure initially stabilizes at 0.5, then decreases when the pressure growths become constant over the DST test.

Interaction zone with two intersecting straight-linear faults

Model assumptions. Two intersecting linear boundaries (sealing of a reservoir or of constant pressure) can be found at a certain distance from the production well. They limit the development of a reservoir in two directions. The angle between them is 90° or less, with the production well located at any point of the inner zone of this angle (fig. 3a). The shapes of plots are presented in the log-log system (fig. 3b).

The model has the following parameters:

L_1, L_2 – distance from the well to the boundary;

Θ – angle of intersection of boundaries.

Initially, prior to the moment the first boundary has been observed, a change of pressure in the well resembles the situation of an infinite deposit. The beginning of the boundary influence is proportional to a distance smaller than L_1 or L_2. Two cases can be analyzed here:

a) Two sealing faults. If a well is localized in the central zone of the reservoir staying under the influence of a sealing fault, the impact of the closer fault will be observable as first and the change of pressure in the well will correspond to the closest sealing fault situation. Upon reaching the second fault, a reservoir will be limited from two sides and its behavior resembles that of an infinite reservoir of rock permeability equal to half of the initial permeability. In the double-log system, the derivative plot stabilizes at 0.5, then reaches 1 to eventually stabilize at N.

a) Constant pressure reservoir boundary. If one (or both) boundaries are constant pressure boundaries, the pressure build-up plot stabilizes and the pressure build-up plot lowers down. If a sealing faults forms a boundary close to the well, the derivative plot increases to 1 to drop down when the influence of the other constant pressure fault starts being noticeable. If the closer boundary is the constant pressure boundary, this effect will blur the interaction of the fault staying at a further distance from the well.

a) b)

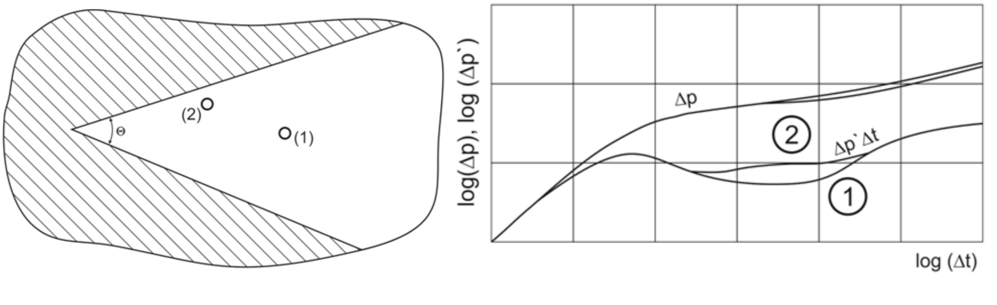


Fig. 3. Geometry of the well and diagnostic plots for a well between two faults

Polygonal zone of interaction

Model assumptions

The zone of interaction has a polygonal form. Either a fault or a constant pressure boundary may appear on either its side. The well is localized inside the polygon (e.g. rectangle as in fig. 4.a). Three boundaries are impermeable, the fourth (open) one has a constant pressure.

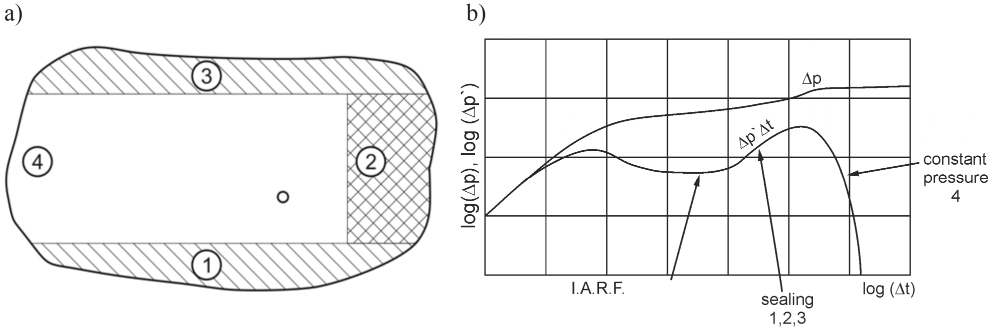


Fig. 4. Polygonal zone of interaction and diagnostic plots

The following model parameters were assumed:

L_1 – distance to boundary 1;

L_2 – distance to boundary 2;

L_3 – distance to boundary 3;

L_4 – distance to boundary 4.

In the initial period, prior to the moment the first boundary has been noted, one can observe the courses of pressure and pressure derivative plots as in the case of the infinite reservoir.

Sealing boundaries

The sealing effect of faults is observable as a function of distance from the well: the effect of the closest fault will be visible as first and it will resemble the one of the sealing fault situations. If the well is located in one of the corners of a large polygon, the effect will be similar to that of the intersecting faults. If the well is sited close to a long and narrow deposit, the effect of parallel sealing faults will be observed. This system may act as in the case of a circular closed model if the particular distances to the well are equal. In the case of a gas flow, the pseudo-steady flow is achieved in time being a function of surface, i.e. (L_1+L_3). (L_2+L_4) and the shape coefficient. The pressure build-up values tend to the average value of lowered reservoir pressure.

Constant pressure deposit boundaries

If any boundary is a constant pressure boundary, the shape of the pressure build-up plot stabilizes in the double-log system, and the build-up derivative plot decreases. The sealing faults localized closer to the well may be noticed, but the effect of the constant pressure boundary blurs the further impact. In the initial phase of interpretation the infinite reservoir is the starting model. In the case of wells revealing storage capacities with the skin-effect or in the case of double-porosity deposits [6], Authors of this paper accounted for all boundary effect models. The well supply and reservoir models were appropriately selected for particular reservoir boundary models (table 1).

4. DIAGNOSING CHARACTER OF WELL INTERACTION ZONES FOR HYDROCARBONS IN THE CARPATHIAN FOREDEEP AND CARPATHIANS WITH THE LOG–LOG METHOD

The presence of various interaction zones (linear faults, dislocation zones, wedging area, facial changes) in the analyzed area of the Carpathian Foredeep and the Flysch Carpathians were mainly identified on the basis of seismic data, drilling data (cuttings, cores, presence of reservoir fluid in drilling mud, mud losses). In selected cases the character of the interaction zones was recognized on the basis of the results of DST tests or production tests interpreted with the log-log method. The results of analysis of character of an interaction zone with the log-log method were interpreted with a computer program Saphir 202B worked out by a French company Kappa, and listed in table 1.

The constant pressure circular zone of interaction was identified with a DST test no. 120/1995 (table 1) in Husów 121K well, on an underground gas storage made in a partly depleted gas deposit. The reservoir water inflow obtained during the DST test equalled to 8.88 m^3/h, with traces of natural gas. The computer program Saphir 202B was also used for diagnosing a homogeneous reservoir model and well supply model in the conditions of a strong storage effect (C= 0.0037225 m^3/kPa) and negative skin-effect (S_2= -6.12), showing to a considerable improvement of the near-well zone in loose reservoir rocks of the Miocene in age (fig. 5).

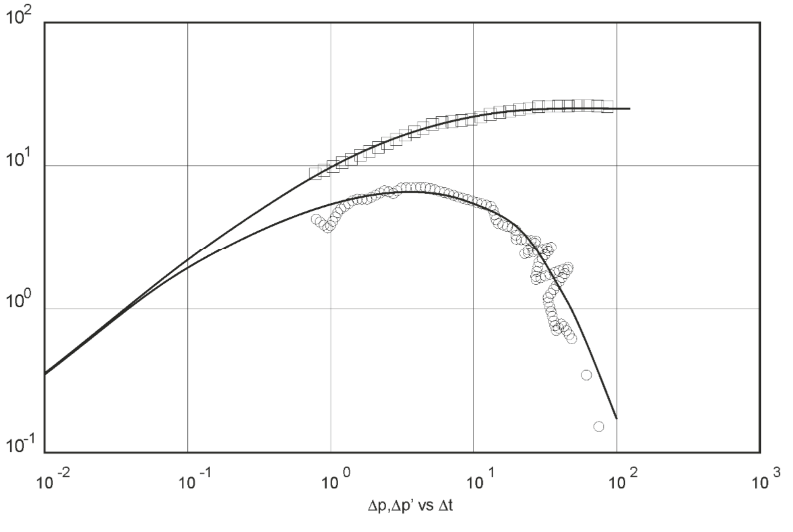


Fig. 5. Example of diagnosed circular reservoir boundary on the basis of DST test results in the Miocene of the Husów -121K well.

A graphical example of the way in which a zone of interaction with a linear barrier was diagnosed on the basis of results of DST test no. 35/1996 in the Upper Cretaceous sandstones in Jaszczew - 35 well is presented in fig. 6. Moreover, there was also adapted a reservoir model of double block porosity as well as the model of a production well operating in the conditions of relatively low storage effect (C= 2.0 x $10^{-6} m^3/kPa$) and considerably improved near-well zone (S_2= - 2.93).

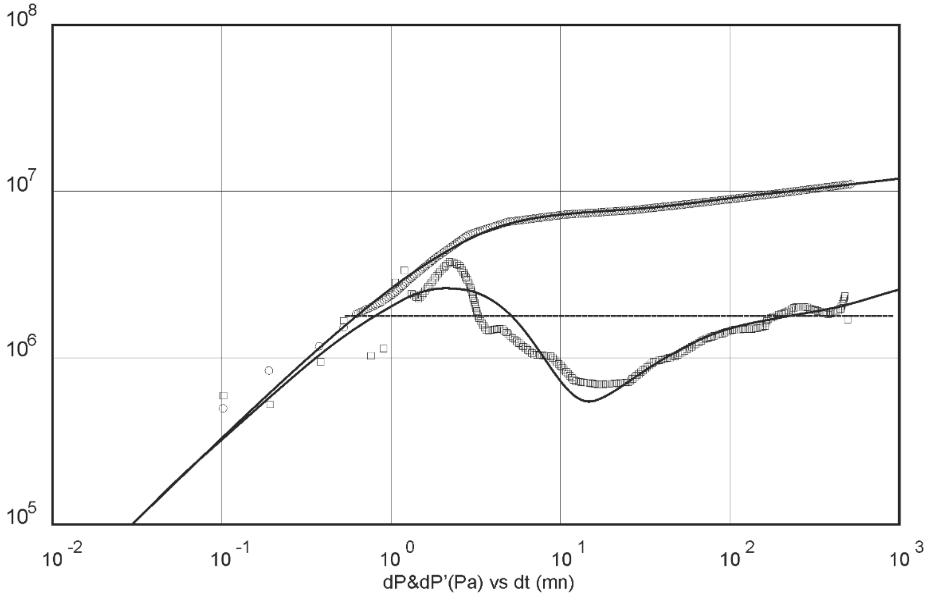


Fig. 6. Example of diagnosing a zone of interaction with a fault based on the results of DST tests in Jaszczew - 35 well.

The polygonal zone of interaction was diagnosed on the basis of the results of DST test no. S-2KB of gas-bearing Devonian carbonates in Stryszawa -2K well (fig. 7), the double block porosity reservoir model, model of reservoir fluid supply to a well in the conditions of considerably high storage effect (C= 0.000335 m^3/ kPa) and considerable improvement of the near-well zone (S= -3.99). The presence of this type of dislocation zones was confirmed with the results of DST test no. 8/1997 in the Devonian carbonates in the same well (table 1). Moreover, very extensive mud escapes (tens of m^3/24h) were observed while drilling Stryszawa -2K well.

The analysis of data listed in table 1 reveals that:

- in 9 cases the DST tests were performed in an uncased interval, therefore due to the risk of DST seizure the time of second build-up test (Δt_2) was reduced to 65 to 303 min. However, owing to the small changes of the skin-effect S_2 from –4.4 to + 5.6 the influence of the zone of wellbore interaction could be observed;

– in the remaining 11 DST tests were performed in cased and perforated intervals, thanks to which the time of measuring the II and III build up pressure (Δt_2 or Δt_3) could be elongated to even 2775 min. The duration of the production test (Δt) was about 9850 min.;
– when the deposit was opened up through the perforations in the casing, the skin-effect (S_2) had a positive value, in two cases exceeding +20. In this way the possibility of determining the radius of the zone of interaction was limited;
– the assessed radius of the zone under the test (L) ranged from about 4 m to about 819 m, and the radius of the tested reservoir zone (R_{b2}) from 19 to 1345 m;
– the presence of a fault or constant pressure zone was observed in 16 cases; individual cases of a closed zone, zone with two intersecting faults or a polygonal zone were confirmed with various tests;
– the diagnosed reservoir model: 11 cases of homogeneous reservoir, 9 cases of double-porosity reservoirs, in that 2 cases of 2 Phi Sphere, and 5 cases of 2 Phi PSS;
– the diagnosed opening-out model (well supply model): 11 cases of well supply in the skin-effect (S) conditions (positive value – damaged permeability of reservoir rocks in the near-well zone, or negative value – improved permeability); in 7 cases the storage effect (coefficient C in table 1) dominates; in 2 cases the main supply of the well took place through the fracture of infinite conductivity. The dominance of one of the well supply conditions (e.g. skin-effect S_2= +20.7 or S_2= -7.56) may have a significant influence on the accuracy of reservoir boundary identification.

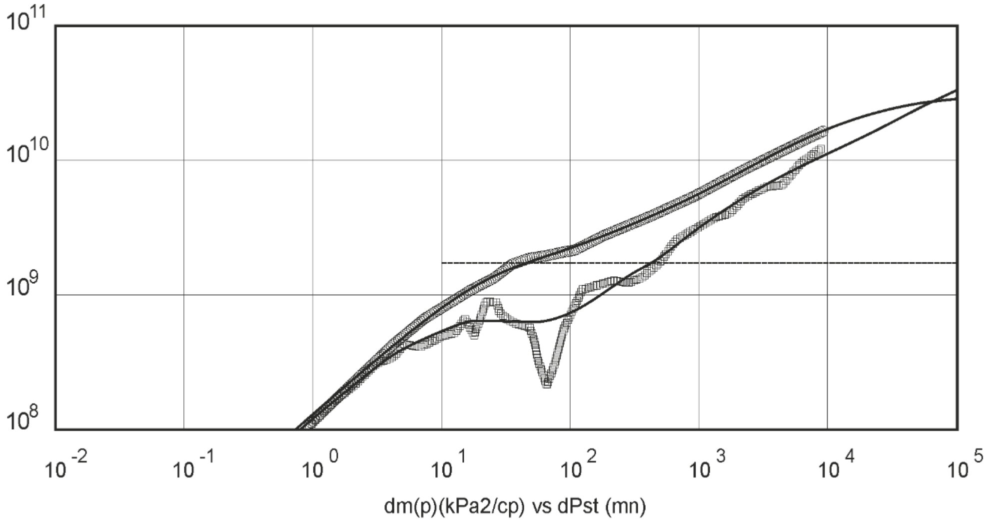


Fig. 7. Example of diagnosing a polygonal zone of interaction based on the results of a production test no. S-KB/1997 from the Devonian carbonates in Stryszawa-2K well.

Table 1

List of selected instances of identification of interaction zones detected with log-log method on the basis of DST results

No.	Name of well DST test no.	Stratigraphy (interval, m)	Well interaction model in log-log method	Selected reservoir parameters defined with log-log method from DST result	Adapted reservoir model and opening-up model (after Saphir 202B)
1	*Osobnica-141; 4/1998*	*Eocene n.o. (602-620m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *303 min.; S2 = 0; ½ length xf=8.93 m; L = 40m; Rb2= 52 m ;*	- Homogeneous; - Frac. infinite cond.
2	*Skrzyszów-1K 96/1994*	*Fo;ded Miocene; perf. (932-949m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *1610 min.; S2 = - 1.5; L= 7m; Rb2=19m*	- Homogeneous; - Changing storage
3	*Skrzyszów-1K 92/1994*	*Folded Miocene perf. (1022-1030m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *176min.; S2 = - 1.3; L = 4m; Rb2= 21m*	- 2 Phi Sphere; - Changing storage
4	*Husów -121K 120/1995*	*Miocene perf. (968-981m)*	*Reservoir limited by the circle shape boundary;*	$\Delta t2$ = *150 min.; S2 = - 6.12; Re = 305m; Rb2=468m*	- Homogeneous; -Storage and skin-effect
5	*RyszkowaWola-7; 121/1996*	*Miocene n.o. (2324-2345m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *104 min.; S2 = + 5.6; L= 60m; Rb2=290m*	- Homogeneous; -Storage and skin-effect
6	*Jaszczew-35; 35/1996*	*Upper Cretaceous perf. (2398-2408m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *500 min.; S2 = - 2.93; L= 26m; Rb2= 51m*	-2 Phi PSS; -Storage and skin-effect
7	*Zagorzyce-6; 5/1996*	*Dogger n.o. (4055-4067)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *97 min.; ½ length xf = 402 m; L= 819 m; Rb2= 1345 m*	- Homogeneous; - Frac. infinite cond.

Table 1. cont

8	*Radłów-3; 88/1995*	*Miocen n.o. (804-855m)*	*Reservoir with two crossing sealing faults or with constant pressure;*	$\Delta t2 = 65$ *min.;* $S2 = +0.03$; $L1 = 36$ *m;* $L2 = 72$; $Rb2 = 223m$.	- Homogeneous; - Changing storage
9	*Strzelce Wielkie-1 51/1995*	*Miocen perf. (365-378m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 2775$ *min.;* $S2 = -0.16$; $L = 56$; $Rb2 = 118$ *m*	- Homogeneous; - Changing storage
10	*Zagość-2 187/1994*	*Dogger perf. (11235-1145m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 180$ *min.;* $S2 = +10$; $L=25m$; $Rb2 = 64m$	- Homogeneous; -Storage and skin-effect
11	*Tarnawa -1 68/1995*	*Dogger n.o. (2944-3003m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 104$ *min.;* $S2 = -3.97$; $L = 30m$; $Rb2=122m$	2 Phi PSS; - Changing storage
12	*Łętowice-19 79/1995*	*Jurassic n.o. (1516-1533m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 91$ *min.;* $S2 = +0{,}002$; $L=16m$; $Rb2 = 23m$	- Homogeneous; - Changing storage
13	*Zaczernie-8 47/1996*	*Jurassic-Malm n.o. (1280-1299m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 123$ *min.;* $S2 = -2{,}6$; $L=56m$; $Rb2 = 98m$	- 2 Phi Sphere; - Changing storage
14	*Kózki-4 114/1996*	*Jurassic-Malm n.o. (657-702m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 121$ *min.;* $S2 = -4.4$; $L=22m$; ; $Rb2 = 121m$	-2 Phi PSS; -Storage and skin-effect.
15	*Rączyna -6 106/1996*	*Carpathian-Stebnik overthrust perf.(2958-2977m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 442$ *min.;* $S2 = +20{,}7$; $L = 62m$; $Rb2 = 128m$	- Homogeneous; -Storage and skin-effect
16	*Lachowice-7 117/1994*	*Devonian Perf.(2875-2877m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2 = 500$*min.;* $S2 = +15.5$; $L = 154m$; $Rb2=221m$	- Homogeneous; -Storage and skin-effect

Table 1. cont

No.	**Name of well DST test no.**	**Stratigraphy (interval, m)**	**Well interaction model in log-log method**	**Selected reservoir parameters defined with log-log method from DST result**	**Adapted reservoir model and opening-up model (after Saphir 202B)**
17	*Stryszawa-2K 8/1997;*	*Devonian n.o.(3255-3265m)*	*Rectangle- L1 sealing; L2-sealing; L3-sealing (folded polygon boundary reservoir);*	$\Delta t2$ = *85 min. S2 = + 2; L1 =5.5 m; L2 =10m; L3=15 m ; Rb2= 20m;*	-2 Phi PSS; -Storage and skin-effect.
18	*Stryszawa-2K S-KB/1997*	*Devonian perf. (3263-3272m)*	*Rectangle- folded polygon boundary reservoir -L1 sealing; L2- sealing; L3-sealing*	Δt *=9850 min.; S2 = - 3.99 L1 =6.7m; L2 =9.5m; L3=13.4m ; Rb2= 57m;*	-2 Phi PSS; -storage and skin-effect.
19	*Stryszawa-2K 32/1997*	*Cambrian perf. (3286-3292m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t2$ = *299 min.; S2 = -7.56; L= 152m; Rb2= 370m;*	-2 Phi PSS; -Storage and skin-effect.
20	*Zawada-7 41/1997*	*Malm perf. (2628-2645m)*	*Reservoir limited by sealing fault or with constant pressure at the boundary;*	$\Delta t3$ = *817min. S2 = + 20.1; L= 67m; Rb2= 109m*	-2 Phi PSS -storage and skin-effect

n.o – without casing, perf. – range of the perforation depth.

5. GEOLOGICAL INTERPRETATION OF RESERVOIR BOUNDARIES DIAGNOSED BY RESULTS OF DST TESTS

The interpretation of DST results through the analysis of build-up curve with the log-log method provides information about the type and range of zones of interaction defined by standard reservoir and opening-up models [6]. These models are theoretical and they do not need to fully (if at all) suggest the properties of actual geological structure of the interaction zone. Owing to the ambiguity of the reservoir tests results they may be later verified by the geological-reservoir analysis.

The main causes of these problems are:

- diversified characteristics of test results, despite the similar geological conditions;
- diversified technical conditions in the wells, where different reservoir tests are applied;
- different lithology and different degree of reservoir rock diagenesis in the analyzed intervals;
- presence of reservoir rocks differing in the saturation with water and hydrocarbons of different composition (e.g. high-methane gas, gas/condensate, light oil).

All these points create problems with the repeatability of test conditions. The geological conditions are evidently masked by the differentiated conditions and technological parameters of the test.

Examples of reservoir test result interpretations are presented in table 1. The interaction zone model and the general characteristic of reservoir in this zone were diagnosed with the log–log method. These examples refer to wells performed in a broad oil-prospecting area in the south of Poland, covering:

- autochthonous Miocene of the Carpathian Foredeep, where selected gas-bearing horizons in thin-bedded or laminated fine sandstones were analyzed;
- Mesozoic substratum of the Carpathian Foredeep in the zone of gas-bearing fracture-cavern carbonate rocks of the Upper Jurassic and sandstones of the Middle Jurassic;
- folded sandstones of Eocene and Upper Cretaceous age of the Flysch Carpathians, the Silesian Unit and partly folded Miocene of the Stebnik Unit;
- Paleozoic basement of the Flysch Carpathians, mainly Cambrian sandstones and fracture-cavern limestones and dolomites of the Middle and Upper Devonian and Upper Devonian, containing gas and gas/condensate accumulations;
- zone of the edge Carpathian overthrust with the folded Miocene beds.

The reservoir tests were performed at depth intervals of 365 to ca. 4000 m, which were lithologically and facially differentiated reservoir rocks of different degree of saturation with water and hydrocarbons.

The correct geologic and structural interpretation of HC accumulation boundaries defined by models based on results of DST-tests can be obtained when the seismic 1D and 2D modeling may be applied. A good example of such interpretation is the Lachowice – Stryszawa zone where gas/condensate accumulation was discovered in Middle and Upper

Devonian carbonates of a deep West Carpathian substratum. Seismic models of 1D and 2D seismic modelling confirm the existence of a fault system creating a tectonic block named Stryszawa tectonic block [1].

The tectonic element of Stryszawa has been interpreted by structural geology reconstruction and seismic modeling of 1D and 2D models [fig. 8] as elevated tectonic block (horst) formed by longitudinal normal faults of sub-latitudinal orientation crossed by transversal faults of sub-meridional orientation. Faults were formed during Variscan tectonic movements. During early Miocene (Badenian) they were syndepositionally transformed into reverse growth faults with Lower Miocene molasse what was connected with the northward Carpathian fold – thrust tectonic movements [8].

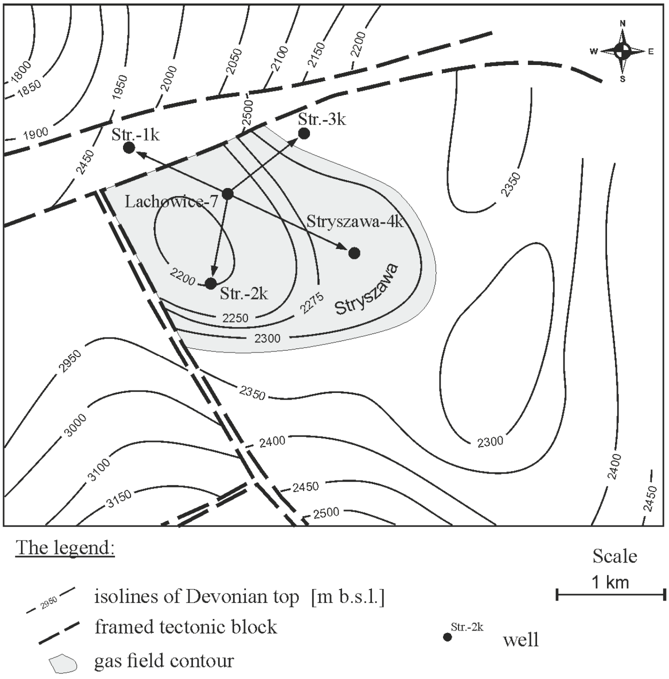


Fig. 8. Reservoir boundaries of the Stryszawa accumulation and its tectonic structure determined by seismic modelling and geological structure interpretation (Acc. Baran U., Jawor E., Jawor W. 1997, simplified)

The seismic and geologic interpretation presented in fig. 8 quite accurately confirms the previous model representing the character of interaction zones which was assumed on the basis of DST test results: their boundaries formed a rectangle folded polygon – table 1 no. 17 and 18). The boundaries of accumulation in the Łętowice zone were also confirmed [7] in the form of a fault cutting thee complex of carbonate rocks of Upper Jurassic age, which on the basis of DST tests were described as having sealing fault/constant pressure at the boundary (table 1, no. 12).

Structural maps based on seismic explorations confirm the existence of tectonic boundaries within the Jaszczew zone as a NW extension of the Potok anticline where the Ciężkowice Sandstone beds are cut by transversal faults.

A similar phenomenon can be observed within the oil and gas-bearing zone of Osobnica [tab.1, no. 1] being a NW prolongation of the Bóbrka fold.

6. CONCLUSIONS

1. The use of appropriate methods of interpreting DST test results allows to considerably increase the efficiency of oil prospecting, and so define the character of hydrocarbon accumulation zones.
2. Information about the type, shape and character of interaction zones under DST tests can be retrieved thanks to application of a new interpretation log-log.
3. The presented analytical examples of DST tests results used for diagnosing the interaction zones, especially the example of the coincidence determined outer zones of interaction with results of seismic modelling and geological-structural reconstruction in the gas/condensate accumulation zone of the Lachowice-Stryszawa structure, demonstrates the necessity to apply the DST test results for geological interpretation.
4. The examples of interaction zone diagnosed on the basis of DST test results and interpreted with the log–log method (table 1) show some technological limitations of industry, e.g. the applicability of this method, its accuracy in the identification of the character of these zones (too short time of the build-up test), dominating influence of skin-effect and/or wellbore storage coefficient.

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