On the Origin of Planets of Sun System Magnetic Fields.

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An accurate explanation of the origin of the Earth's magnetic field does not yet exist. There are several hypotheses, theories and experiments trying to find a solution to this problem, but the final, rigorous proof of these hypotheses has not been established. This article discusses the hypothesis that the main reason for the emergence and maintenance of this field are Earth's atmosphere and ionosphere. A number of estimates show the validity of this approach. Here we will give a brief summary.

1) It is well known how to determine the magnetic field of a rotating surface of a charged sphere ([1], [2]). The magnetic moment of a rotating sphere is

It is known [1] that the Earth's magnetic moment is m = 8 · 1025 units CGSE,

where a = 6,340,000 m - radius of Earth,

ω = 7.3 · 10-5 1/sec - the speed of rotation of Earth,

c = 300,000,000 m/sec - the speed of light.

Then, knowing the magnitude of the moment of Earth's magnetic field M, we find that the required electrical charge to generate the magnetic field is:

Q = 0.245 · 1023 CGSE = 8.1 · 1013 C.

It should be noted that a more accurate estimate of the charge, that is made on the assumption that the charge is in a spherical layer of Earth's surface and has a thickness equal to a few hundred kilometers, gives approximately the same quantity 7.5 * 1013 C.

2) On the other hand it is known (for example, [3]), that the Earth has a charge of approximately:

Qearth = 5.7 · 105 C.

It follows that it is not enough to create Earth's magnetic field. Suppose that there is an additional charge of a different nature, creating it. Let's find out its nature.

3) We need to pay attention to the following circumstances:

1. Only Earth has a strong magnetic field. Venus, Mars and most other planets have magnetic fields hundreds of times less.

2. Only Earth has air and water. This allows you to make the hypothesis that the Earth's magnetic field is due to the charge of the cloud layer, the value of which is enormous. It is known that the power of a lightning discharge can reach 100 Megawatt. On the other hand, there are 46 lightning discharges happening every second around the Earth.

We can estimate the charge of the clouds, assuming that the system of clouds and the ground form a spherical capacitor. Then, it is known that $Qc = C \cdot U$,

where the capacity of a spherical capacitor is:

where R1 = 6350 km and R2= 6340 km , R1, R2 - radius of the sphere and Eps = 8.85 · 10-12,

It should be noted that, given that dielectric constant of water is 80, the capacity of the cloud layer may be higher by one or more orders.

Then we see that capacity is approximately C = (0.45-4.5) Farads.

We estimate the potential voltage U between the clouds and the Earth's surface. Let's assume the voltage of air breakdown E = (10-30) Kvolt/cm. Then U = E · H = 3·106 ·H Volt, where H = (1-10) · 103 m - height of the clouds.

The result is an upper bound of the charge of the clouds of Earth:

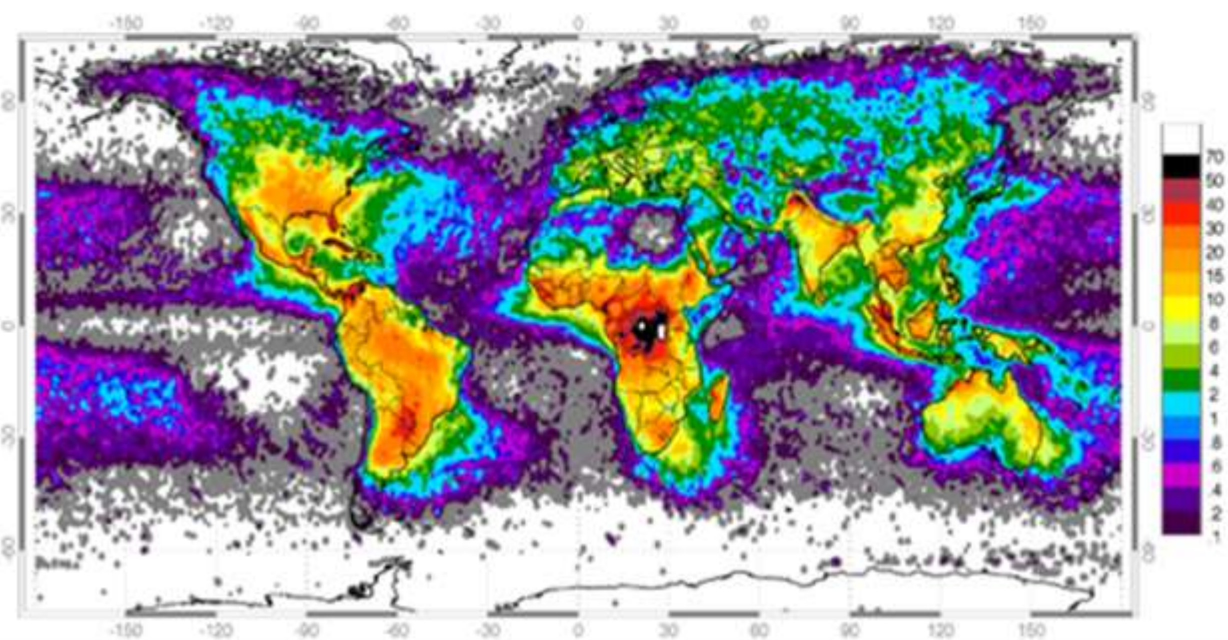
Q1 max = C · E · H = 4.5 · 3 · 106 · 104 = 1.35 · 1011 C.

However, it should be noted that deposits of iron and nickel in the upper part of the crust could increase this magnetic field.

Which proves that the charge of the clouds can create a sufficiently strong magnetic field comparable with the Earth's magnetic field.

4) Another estimate of Earth's magnetic field gives approximately the same result.

The fundamental work of A. Karelin estimated the charge density of thunderclouds [4].



Distribution of lightning on the Earth's surface.

Fig. 1

At every given moment on Earth there are about 1500 storms. The average frequency of lightning discharge is estimated as 46 per second. Storms are unevenly distributed on the planet's surface.

As a result, there is given calculations and experiments, the density of the charge is in the range $q = (9\text{-}280) \cdot 10^{-9}$ C / m3. Then, taking the amount of cloud cover in the form $V = 4\pi \cdot R^2 \cdot H$, where H = 1000 m - thickness, we get

$$V = 50 \cdot 10^{17} \text{ m}^3$$

Then we obtain an estimate of the charge of storm clouds on Earth, which varies in the range of

$$Q_1 = V \cdot q = (4.5\text{-}140) \cdot 10^{10} \text{ C.}$$

Assuming that the area of the storm clouds takes up one-tenth of the sky, and they have the lowest charge density, we get a lower estimate of the charge equal to

$$Q_{1\,min} = 4.5 \cdot 10^9 \text{ C.}$$

The highest estimate will be equal to

$$Q_{1\,max} = 1.4 \cdot 10^{11} \text{ C.}$$

which practically coincides with the estimate obtained in the previous section.

The procedure of this evaluation indicates that the charges of Earth's atmosphere can be a major source of Earth's magnetic field. However, they are not enough. Additional contributions can give the effect of the location of the iron in the Earth's crust and charges are in the Earth's ionosphere.

5) One of the missing links in determining the Earth's magnetic field may be the effect of the upper layer of the earth's crust to a depth of 15 kilometers, where lie the iron and nickel deposits, which have a temperature below the Curie point (equal to 768 degrees Celsius). And it has enormous deposits of iron and nickel (which make up 5% of the total weight of the crust of the earth and at 30% of its volume), which may influence the magnitude of the magnetic field of the Earth, increasing it a few times. Note that the total amount of iron in the world has changed for all its life, as part learned from her, it is on its surface and in its interior portion. It changed only their relationship.

6) Offer a theory of occurrence of Earth's magnetic field explains the presence and magnitude of the magnetic field close to Earth planets.

This is especially Venus. Venus is the most Earth-like planet that does not have a strong magnetic field, but the internal structure of their identity. Venus has an atmosphere and ionosphere consisting mainly of CO2 gas, which has a certain capacity and who are constantly recharged by the solar wind like Earth. It should also be noted that the length of day Venus more than 243 times greater than the Earth. The rate of motion of the charges in the ionosphere of Venus is hundreds of times slower than in the Earth's ionosphere, which explains why the magnetic field of Venus is less than the magnetic field of the Earth in 300 or even more times.

Consider Mercury. It is well known that its magnetic field is more than a hundred times smaller than the Earth. On the other hand the length of his day is less to 58 times then Earth, and his radius is 2440 km. Than the velocity of the negative charges in the ionosphere of Venus is 152 times slower than the Earth's ionosphere. This may explain the decrease in its magnetic field, as compared to the Earth.

The site: https://sites.google.com/site/astronom1543/mag indicated that the measurement of the magnetic field of Mercury is 0.006 of the magnetic field of the Earth, that is 150 times smaller than that coincides with our assessment!

Let's consider now the magnetic field of Jupiter. It is known that Jupiter has a magnetic field approximately 20 times greater than the Earth.

It is known that the radius of Jupiter is 11 times greater than the radius of the Earth, and the rotational speed is 2.4 times greater. So the velocity of the charges in the ionosphere of Jupiter in 26.4 times greater than the Earth's ionosphere. Measurements have shown that the magnetic field of Jupiter is 20-50 times greater than the magnetic field of the Earth. In this case, the magnetic field of Jupiter Rated via offers theory also gives good agreement with the measurement!

Only Mars is not subject to the laws are risen. The magnetic field of Mars is extremely small - more than 500 times weaker than the magnetic field of Earth. The size of Mars and its rotational speed is almost completely coincide with the Earth. Therefore all the conditions for the operation of the mechanism same hydrodynamic dynamo must be similar create magnetic fields. However, the difference in the observed magnetic field is due to the actual current lack of Mars's atmosphere and ionosphere. The pressure of the atmosphere at the surface of Mars is 160 times smaller than the Earth. This proves that the source of the magnetic field depends on the presence of the ionosphere, because the rest of the parameters of the planets almost are same . Analysis of tectonic rocks shows that when the magnetic field of Mars was quite noticeable and had reversal of the magnetic field. We know that the destruction of the Marsian atmosphere is relatively recent, and continues to be now. The lack of atmosphere and magnetic field are the main reason for the absence of life on Mars, but does not rule out its existence in the past. There are several hypotheses causes destruction of the Martian atmosphere, but we will not dwell on them. The fact is that in the absence of an atmosphere and the ionosphere notable planet's magnetic field cannot exist.

Thus the connection of existence of magnetic fields of the planets with their ionosphere is another proof that the reason for their existence hydrodynamic dynamo mechanism is not because in a Mars hydrodynamic dynamo mechanism, located inside the planet would have to continue to work and create a magnetic field commensurate with the Earth's magnetic field.

We will build a Tab.1

Planet	Diameter	rotation	mag. field	Atmos. pressure
Mercury	4879	58.8	0.006	0.001
Venus	12104	243.7 93	0.003	93
Earth	12742	1	1	1
Mars	13558	1.01	0.002	0.06
Jupiter	139 822	9.92	25	12

Tab.1

From Table 1 the following conclusions:

1) Where there is no atmosphere and ionosphere of the magnetic field, or negligible, if any, it almost does not (Mercury, Mars).

2) From the Earth and Mars comparing seen that the dimensions and rotational speed are nearly the same. Time and conditions of occurrence should be almost identical. Therefore, if there was a valid hypothesis on the origin of magnetic fields thanks to the mechanism of hydrodynamic dynamo, then they would have been identical to the magnetic field. But it is not! So the hypothesis of the origin of Earth's magnetic field through the mechanism of hydrodynamic dynamo is incorrect.

3) Radiuses and speeds of the planets determine the velocity of the charges in the ionosphere. And hence the current.

Then those planets that have an atmosphere and ionosphere country powered according to our hypothesis from the solar wind should be proportional to the magnetic field of the linear velocity of the ionosphere, so multiply of the radius by the angular speed! Indeed Venus, which has a radius slightly smaller than Earth, but with a smaller rotating 243 times the speed of a magnetic field nearly 300 times smaller. Jupiter, which has a radius of 11 times larger than the Earth and rotating with an angular velocity of 2.4 larger than the Earth's magnetic field is 25 times greater. These estimates confirm the correctness of our hypothesis that the mechanism of borrowing and the Earth's magnetic field is produced by moving charges ionosphere created by solar wind.

Hence, our hypothesis is the emergence and existence of the Earth's magnetic field has more reason then hydrodynamic dynamo hypothesis than its origin.

7) Note that offers a hypothesis about the cause of Earth's magnetic field makes it easy to explain not only the origin of the Earth's magnetic field, but the geomagnetic Inversion, that occurs every few hundred thousand years is stochastic.

Analysis of the Earth's magnetic field, conducted with the help of satellites and modeling has shown that the solar wind is currently bears, because it mainly content electrons negative charge. In case of a positive charge in the solar wind and Earth's magnetic poles form of distortion of the magnetic field of the Earth, associated with the existence of wind would have been different.

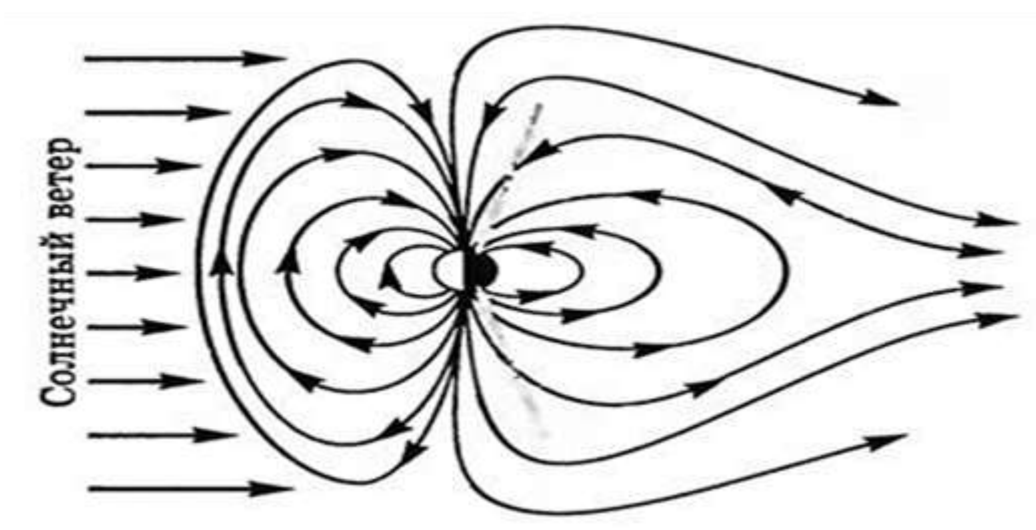


Fig.2

Solar prominences - a charged plasma field, recurring over the surface of the Sun, overcome gravity and the magnetic attraction of the sun, pulled out from the surface of the sun. And partly substance prominences back into the sun, and some in the form of solar wind scatters in different directions. Part of this wind reaches the Earth's ionosphere and charges negative charge. The ionosphere exists the so-called E and F layers [6] located in the region of 90 to 500 km long and having electrons in a concentration range of Ne = (1.5-30) ·105 in one cubic centimeter (3) formed through Sunny wind. The average value of the electron density in them is Ne = 106.

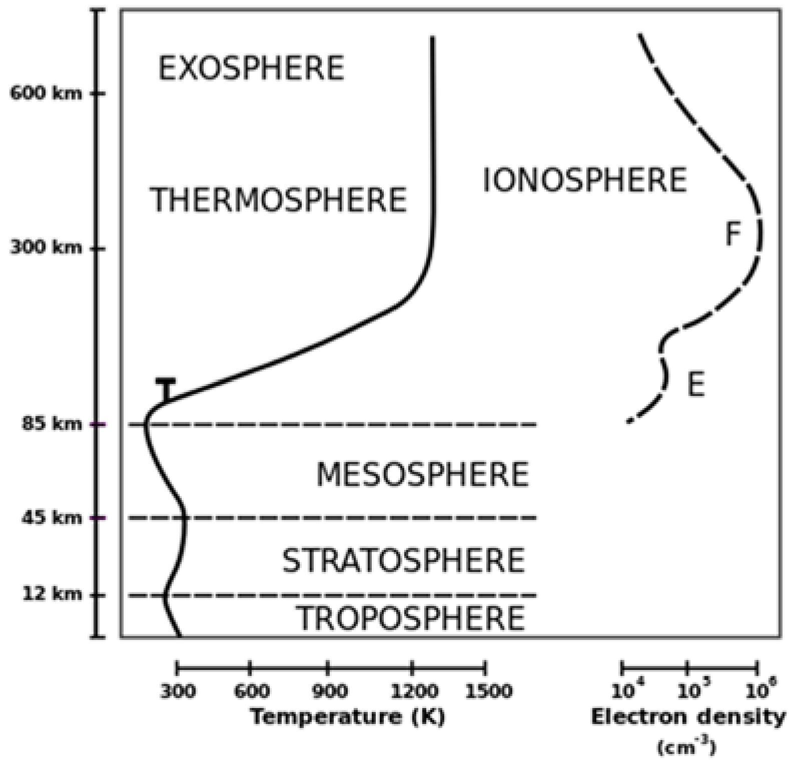


Fig. 3

All thickness of these layers up to H = 500 km. Then it is easy to estimate the total charge of this layer. It is

Qe = Qe · R2 · 4πNe · H = 12.6 · 1.6 · 10-19 · 41 · 106 · 1016 · 5 · 107 = 4.14 · 1013 C

Where Qe = 1.6 · 10-19 C electron charge.

As the assessment conducted by a charge E + F layer of the ionosphere, c considering the effect of the iron contained in the upper layer of the Earth, its size is sufficient to establish, or at least make a major contribution to the formation of Earth's magnetic field.

It should be noted that the constant losing due to the negative charge of the solar wind, the Sun gradually charging excess positive charge. This leads to the fact that periodically, every few hundred thousand years, the sun begins to break out of the positively charged gigantic prominences (predominantly due to their content of positive ions and protons), dimensions reach several thousand kilometers. Therefore the solar wind starts bearing positive charges which reach Earth and recharge its electric and magnetic weeding.

As a result through some period equal several thousand, the Sun again becomes neutral and starts letting out negatively loaded wind again.

The next inversion of the Magnetic Field of Earth results. The recharge of the Magnetic Field of Earth can occur as well as a result collision of Earth with huge comets which can be loaded both is negative, and is positive, depending on a sign of a charge of a star which the comet faced before it.

So process of inversion of the Magnetic Field of Earth can be explained easily on the basis of the offered hypothesis.

8) Now we will stop briefly on other approaches to an explanation of emergence of the Magnetic Field of Earth. First of all we will note that now on the first place for an explanation of emergence of the Magnetic Field of Earth by other authors the mechanism connected with the thermal convention in its liquid magma is considered. Such hypothesis

is based on analogy of the mechanism of emergence and maintenance of a magnetic field of the Sun.

However the simple analysis shows that in the conditions of Earth this mechanism can't work because of a difference of scales and sizes of density and viscosity of the fluids and gradients of temperature existing on the Sun and Earth. It is known that the big gradient of temperatures and existence of an easy non viscous fluid in the studied volume is necessary for the noticeable thermal convention. But change of temperature of terrestrial magma from the top part adjoining on bark and equal 700 degrees, and lower, adjoining on a kernel of equal 6000 degrees at distance about 3000 km, gives the top assessment of a gradient - 2 degrees on kilometer. It is less than in bark of Earth and considering that viscosity of magma, even at a temperature of 4000 degrees the very high – it is possible to draw a conclusion that UNDER THESE CONDITIONS in Earth there CAN not be a CONSIDERABLE THERMAL CONVENTION!

It should be noted also that fact that maintenance of a magnetic field of Earth requires huge energy. As any electromagnetic generator has to use the rotating rotor which role plays the Earth globe. Thus there are forces and inductive currents braking it. It is required or additional the energy maintaining constancy of speed of its rotation, or it has to slow down, losing rotation speed. Practice of supervision shows – the speed of rotation of Earth for millions of years almost didn't change.

So in Earth there are no sufficient sizes of parameters that there were conditions necessary for operation of the mechanism of a hydro magnetic dynamo.

For comparison, on the Sun temperature changes from 6000 to 15 000000 degrees, and the fluid represents plasma (the ionized gas) which density is one hundred times less than magma density, and viscosity of magma one thousand times smaller than viscosity. Under these conditions there can be strong magnetic fields thanks to the mechanism of a hydrodynamic dynamo.

9) It is possible to prove correctness of the version that sources of the Magnetic field of Earth are out of its volume, simpler way. It is known how it was already noted that in Earth bark at depths up to about 15 kilometers where being carried out by a condition of that temperature is less than Curie's point, fields of iron and nickel making about of 5% of bark volume lie. It is known also that the Magnetic Field of Earth measured along its surface, then value of the Magnetic Field of Earth in regions of its bedding. In case of an arrangement of charges and currents over Earth surface, the effect has to be opposite since metal plays a role of the paramagnetic internal core and the magnetic field has to increase around its bedding! As it was mentioned above, practice of measurement of the Magnetic Field of Earth showed names it. Therefore the version about finding of sources of the Magnetic Field of Earth out of Earth surface is fair. And consequently, the version and the carried-out estimates about location of these sources in the atmosphere and an ionosphere of Earth the correct.

10) We will note that by means of the offered hypothesis it is easy to explain discrepancy of a geometrical axis of Earth and an axis of a magnetic field of Earth. (Shift of magnetic poles).

This phenomenon arises because of an inclination of a geometrical axis of Earth to Earth orbit plane on 23.4 degrees. In this connection the solar wind falls on Earth surface at an angle.

11) Thus only the charges brought from the outside (A solar wind or comets) and the charges resulting from formation of drops of a rain in clouds can constantly load the atmosphere and an ionosphere, allowing to create and support the Magnetic Field of Earth.

And the magnetic field of the atmosphere of Earth can serve as a starter of emergence of the Magnetic field of Earth, originally braking and developing electrons of the Solar wind on a tangent to Earth surface.

The carried-out estimates showed that the total charge of Earth, clouds and an ionosphere can provide emergence and existence of the Magnetic field of Earth. And the charges arising in atmosphere clouds constantly are supported by a water circulation in the nature, and an ionosphere charge, is constantly recharged by the streams of charged particles coming from the Sun.

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Development of Oil Well Performance Simulation for Reservoirs Containing Oil with High GOR

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<u>Анотация</u>

В настоящей работе анализируется влияние забойного давления на эффекты, снижающие относительную проницаемость пласта по нефти и увеличение вязкости нефти в призабойной зоне пласта . Снижение коэффициента продуктивности, которое происходит в этом случае, может привести к следующему явлению: когда забойное давление постепенно уменьшается ниже определенного значения, дебит нефти перестает расти и начинает падать, вопреки теории Фогеля, которая предсказывает, что он должен продолжать расти. Это означает, что индикатарная кривая (IPR) фактически имеет максимальную величину дебита нефти при ненулевом давлении забойной скважины.

Ключевые слова:

IPR -Inflow Performance of Relationship, GOR- Gas Oil Relationship, Formation Pressure, Formation Saturation, Skin Effect

Улучшенная матмодель , описывающая работу скважины для пластов содержащих нефть с высоким содержанием газа

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Abstract

A lot of articles were dedicated to researching processes in formations saturated with oil with high gas content, including such classical works as [1,2] by M. Musket, in which he described and analyzed the corresponding unsteady two-phase filtration equations. W.J. West etc. [3] solved those equations on a computer by applying a number of simplifying assumptions. Later W.T. Weller [4] suggested an approximated method, which yielded approximate solutions with good precision. These theories allowed calculating dynamic behavior of oil rate, GOR, formation pressure, saturation at any moment of oil well's life. They also allowed obtaining and analyzing distributions of pressure and oil saturation inside formation vs. distance from the well for any moment of time in dependence from PVT parameters of fluid, relative permeability and properties of formation [2, 5]. J. V. Vogel [6] and later M. B. Standing [7] developed simple theories for building Inflow Performance Relationship (IPR) curves for solution-gas drive

reservoirs. They demonstrated that IPR curves can be described by simple algebra equations (parabolic curve) and its general form is not greatly affected by PVT and other parameters of fluid and formation [5, 6, 7, 8]. According to these theories the oil rate maximum is always achieved when bottomhole pressure is equal to zero. Later some researchers found that these theories did not always yield sufficient precision [9, 10]. M. Hussain [10] noted that skin effect sometimes arises in formation in a zone near the wall of well in solution-gas-drive reservoirs. As a result actual IPR curves can noticeably differ from Vogel curves. Influence of skin effect on IPR curves is analyzed in [5], except it is assumed that skin effect does not depend on the value of bottomhole pressure and maintains a constant value at any pressure. In reality this is not the case because the relative permeability and width of skin zone depend on the bottomhole pressure and saturation. Nevertheless in [5] it is shown that skin effect has very strong influence on productivity index of well and on IPR curve but has no influence on Vogel form of IPR.

The present paper analyzes influence of bottomhole pressure on the effects reducing oil relative permeability and increasing oil viscosity in the zone of formation near the bottomhole. Reducing productivity index, which happens in this case, may lead to the following phenomenon: when bottomhole pressure is gradually reduced below a specific value, oil rate stops increasing and begins to drop, contrary to Vogel theory which predicts that it should continue to increase. Which means the IPR curve actually has a maximum oil rate at non-zero bottomhole pressure.

Introduction

Musket equations [3] were picked as mathematical model which describes main processes of unsteady two-phase filtration in formation; with some simplifying assumptions:

1) formation is one dimensional and there exists only radial flow;
2) porous media is isotropic and uniform;
3) gravity and capillary effects can be neglected;
4) compressibility of rock and water can be neglected;
5) constant pressure exists in both oil and gas phase

These assumptions make it possible to describe the two-phase flow of oil and gas by the partial differential equations [3]:

$$(1)\quad \begin{cases} \frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{K_{ro}}{\mu_o B_o}\frac{\partial P}{\partial r}\right) = -158.064\frac{\varphi}{K}\frac{\partial}{\partial t}\left(\frac{S_o}{B_o}\right) \\ \frac{1}{r}\frac{\partial}{\partial r}\left(r\left(\frac{K_{rg}}{\mu_g B_g}+\frac{R_s}{5.615}\frac{K_{ro}}{\mu_o B_o}\right)\frac{\partial P}{\partial r}\right) = -158.064\frac{\varphi}{K}\frac{\partial}{\partial t}\left(\frac{1-S_o-S_w}{B_g}+\frac{S_o}{B_o}\frac{R_s}{5.615}\right) \end{cases}$$

Zero flow condition on the outsize border of the zone is:

$$\left.\frac{\partial P}{\partial r}\right|_{r=r_e} = 0$$

On the wall of well we set a border condition due to known value of pressure or oil rate:

$$\left.P\right|_{r=r_w} = P_w(t) \text{ or } \left.\frac{\partial P}{\partial r}\right|_{r=r_w} = F_w(t)$$

Initial conditions are also set:

$$(2)\quad P(r,t) = P_0(r,0); \quad S(r,t) = S_0(r,0); \quad .$$

To the system (1) is completed with some PVT data, dependence of relative permeability of different phases from saturation and with other properties of reservoir:

$\mu_o(P)$, $\mu_g(P)$, $B_o(P)$, $B_g(P)$, $R_s(P)$, $K_o(S_o)$, $K_g(S_g)$,

K, φ, P_f, P_{bp}, r_w, r_i, S_w, $S_{g\,crit}$.

The system (1), (2) was solved using finite differences method [11], differs somewhat from the one used in [3]. Firstly the value saturation was excluded from the system and then after some transformations the nonlinear equation relative a pressure was acquired :

$$(3)\quad \frac{1}{r}\frac{\partial}{\partial r}\left(r\left(\frac{K_g}{\mu_g B_g}+\frac{R_s}{5.615}\frac{K_o}{\mu_o B_o}\right)\frac{\partial P}{\partial r}\right)+F(P)\left(\frac{1}{r}\frac{\partial}{\partial r}r\left(\frac{K_o}{\mu_o B_o}\frac{\partial P}{\partial r}\right)\right)=C(P,S_o(r,t))\frac{\partial P}{\partial t}$$

Where F (P), C (P, S_o) are functions depending from PVT data and formation properties.

The equation (3) was made linear by using method of shift along time axis by a small step τ during calculation of functions F (P), C (P, S_o), i.e. for its calculation there were used values P(r, t-τ), S_o(r, t-τ). Further the equation (3) was solved using finite differences method on a grid with variable step.

Numeral Algorithm shown on Appendix A.

<u>Results</u>

As an example, let's take a uniform, radial formation with following properties:

K=0.015 D; P_f=3000 psi; H=50 ft; r_e=840 ft; r_w=0.3ft; φ=0.15

PVT data were approximated by the following simple dependencies:

$$
(4)\quad
\begin{cases}
B_o = 1 + b_o P \\
\dfrac{1}{B_g} = b_g P \\
\mu_{oil} = \mu_{oo} - \dfrac{P}{P_f}\left(\mu_{oo} - \mu_{fo}\right) \\
\mu_f = \mu_{go} + \alpha_g P \\
R_s = R_{so} P
\end{cases}
$$

Where b_o=0.0002; b_g=0.07; μ_{oo}=2 cps - viscosity of oil at formation temperature and atmospheric pressure; μ_{fo}=0.25 cps - viscosity of oil at formation temperature and pressure; μ_{go}=0.015 cps - viscosity of gas at formation temperature and atmospheric pressure; α_g=0.0004; R_{so}=1 - solubility of gas in oil.

The following dependencies were used for relative permeabilities:

$$K_{ro} = \left(S_o + S_w\right)^4 = S_L^4$$

$$
K_{rg} =
\begin{cases}
1.044 - 1.7 S_L + 0.65 S_L^2, & if\ S_g \geq S_{g\,crit} \\
0, & if\ S_g < S_{g\,crit}
\end{cases}
$$

On one hand such choice of simple dependencies allows to take into account main dependencies from pressure, saturation, temperature and on the other hand, because the solution is numeric, to substitute a more accurate dependency if necessary. As it was mentioned already, the main goal of this research is analysis of influence of bottomhole pressure on the dynamics of working formation, including changes in oil rate, formation pressure and GOR versus time or versus recovery index. An additional goal was to study a possibility to direct oil rate and ultimate recovery index by changing bottomhole pressure. The same math model allows to calculate IPR curves for any moment during lifetime of well, to predict how the well will work in the future and to find the current optimum bottom hole pressure P_{bot}^{opt} (t). The IPR curve calculated for our case for initial moment of time is shown on Fig.1, along with the GOR vs. oil rate curve. This IPR curve is different from the traditional Vogel IPR curve, because it has the maximum oil rate when the bottomhole pressure doesn't equal to zero . Thus, contrary to Vogel theory predictions, that the optimum bottomhole pressure always equals to zero regardless from all the properties of fluid and formation, sometimes it may have a certain non-zero value, which depends from various properties of formation and fluids saturating it. Since the formation pressure, saturation and other parameters change with time, value of optimum bottomhole pressure also changes, creating a number of points constituting the curve of optimum bottomhole pressure P_{bot}^{opt} (t). The present math model allows to determine dynamics of changing pressure and saturation inside formation, oil rate, GOR, cumulative recovery index etc, based on the regime of maintaining bottomhole pressure. As seen on Fig.1, curves of oil rate and GOR vs. bottomhole have maximums. When bottomhole pressure is reduced, before the oil rate achieves maximum, GOR gradually grows. After the oil rate achieves maximum value and starts to drop, GOR continues to grow at an even faster rate. Existence of maximums on curves of oil rate and GOR can be explained as follows. In formations containing oil with high GOR, when pressure is reduced below the bubble point, there appears a zone where dissolved gas exits from oil and starts blocking oil from exiting to the well. This eventually causes gas saturation in the zone to increase and relative oil permeability to reduce. Oil viscosity is increased and oil volume is reduced. Conditions for free gas to exit are improved because relative gas permeability is increased, and gas viscosity is reduced. On one hand, reducing bottomhole pressure increases depression on the formation, while on the other hand it reduces productivity index. As a result at first oil rate increases during increasing depression, but after bottomhole pressure becomes below optimal level, productivity index begins to fall fast and oil rate is reduced until the well switches to gas mode. At the same time GOR quickly begins to increase which further accelerates exit of gas from formation, premature reduction of formation pressure thus reducing ultimate recovery index. Many cases similar to what is described here often are observed in practice, but it can not be explained by the Vogel theory. In an example described in [10] by Hassan M. in Abu Daby well formation pressure was slightly above bubble point pressure, but bottomhole pressure was below it. The skin effect appeared in bottomhole zone of formation from liberated gas. The data from [10] was used for building IPR curve on. The fact that it looks similar to the IPR curve on fig.1 proves existence of similar wells.

In [5] M.A. Kline analyzes how skin effect affects IPR curve and determined that it strongly influences it (fig.3). But the Weller math model that was used assumes that skin effect index is constant (S=const). In reality skin effect strongly depends from bottomhole pressure, and significantly increases when bottomhole pressure drops below optimal pressure. If this is true, then when bottomhole pressure is reduced, working point (P_{bot}, Q_{oil}), by moving from one IPR curve with skin effect S_1 to another, $S_2>S_1$ (fig.3), forms a curve similar to fig 1.

Let's note that suggested model could also represent Vogel or Standing [7] IPR curves as special cases depending on properties of fluid and formation. Likewise it is notable that reducing initial GOR reduces optimum bottomhole pressure, and when it nears zero value, the resulting IPR curve starts to look like a Vogel IPR curve.

The Simulator was developed for Determination of Optimum Regime of Production from Reservoirs Containing Hydrocarbons with High GOR. On Fig. 2 shown data screen of simulator with some data's case. Depending on the pressure regime, three different cases were calculated:

I) bottomhole pressure corresponding to optimum regime $P_{bot}^{opt}(t)$ 0.55 $P_{for}(t)$;

II) $P_{bot}(t) = 0.25\, P_{for}(t)$;

III) bottomhole pressure was maintained as in case II during one year, and then switched to regime as in case I .

The third case illustrates what happens when switching bottomhole pressure regime to optimum is delayed. See results of case I solution on figs.4, 5 and 6. Fig.4 shows formation pressure and oil rate vs. cumulative recovery index and time. The limit of production sensibility equals to 5 bbl/day oil rate, in which occurrence case I returns ultimate recovery index of 32.2%. Life time equal 34.1 years , accumulated oil =910.1*10**3 bbl , accumulated gas= 7498.6*10**6 cft . Same figure shows GOR1 and GOR2, which correspond to the values of GOR near the wall of well and near the border of formation. The small difference between GOR1 and GOR2 can be explained by skin effect in bottomhole zone, where oil looses dissolved gas, which increases GOR1. Gradual increase in GOR and later sharp drop when cumulative recovery index increases, is a known fact for formations in solution gas drive regime ($P_f(t)<P_{bubble\ pt}$). Fig.5 shows distribution of pressure vs. distance from well for different times. It also illustrates dynamic behavior of pressure in bottomhole zone of formation with simultaneous fall of formation pressure. Fig.6 shows corresponding distributions of oil saturation vs. distance from well (assuming $S_w=0$). One can note a ring-distribution of saturation until the moment when saturation exceeds value of critical saturation S_{cr} (here $S_{cr}=0.9$). Additionally, on same figure one can see dynamics of forming of skin effect in bottomhole zone where oil saturation reduces sharply (gas saturation increases). Size of that zone is no more than about 3 feet. At the same time saturation in the rest of formation changes only slightly. Overall decrease of oil saturation is affected not only by extraction of oil with dissolved gas, but also by shrinkage of oil due to exit of free gas to well.

Figs. 7, 8 and 9 show results of solution of case II in the same fashion as figs.4, 5 and 6. Here oil rate and formation pressure reduces quicker because gas exits faster. As a result ultimate oil recovery index achieved in this case is only 24.8% , Life time equal 30.24 years , accumulated oil =705.1*10**3 bbl , accumulated gas= 8035.6*10**6 cft . The difference between GOR1 and GOR2 is more than in case 1, especially at early stage. This is explained by a stronger skin effect in bottomhole zone, which blocks oil from exiting and accelerates gas exit from formation ($GOR=Q_{gas}/Q_{oil}$). Figs.8, 9 show distributions of pressure and saturation vs. distance for different moments of time. The difference of ultimate oil recovery index equals nearly ~7.4%, or about 205,000 bbl, which demonstrates that by keeping bottomhole pressure near optimum, the ultimate oil recovery was increased to 29% and gas recovery was about the same.

The results of solution for case III are shown on fig.10,11, 12. The ultimate oil recovery index in that case equals 27.3%, or 2.5% more than in case II. Life time equal 33.6 years , accumulated oil =761.8*10**3 bbl , accumulated gas= 7773*10**6 cft . Fig. 10 illustrates how after switching the well to the optimum regime the oil rate increased more then 12%, GOR slowered, and reduction of formation pressure was decelerated.

Conclusions

1. Using Musket equations in the math model allowed acquiring new results for solution of optimization problem of oil production from well with high GOR.
2. Analyzed influence of bottomhole pressure regime on dynamics of oil rate, formation pressure, saturation, GOR and oil recovery index.
3. Found special kind of IPR curves, which achieve maximum oil rate when bottomhole pressure is not zero.
4. Analyzed dynamics of appearance of skin effect zone when bottomhole pressure is below bubble point pressure.
5. It was shown that sometimes GOR isn't constant along radial direction.
6. Created simulator allowing acquiring IPR curves including Vogel and Standing kinds as special cases, for any moment of time during well operation.

7. The math model allows analyzing and predicting future behavior of a well, depending on previous history and properties of system; including calculation of ultimate oil recovery index and life time of well.

8. As a result, it allows determining optimum work regime for well by keeping the bottomhole pressure at optimum level, so that it gives maximum oil rate and enhanced oil recovery.

Appendix A

From system of equations (1)-(3) by excluding So and applying the time shifting method for a small value τ, we receive one linear equation relative to P(r,t):

$$(I)\quad \frac{1}{r}\frac{\partial}{\partial r}\left(r\left(\frac{K_g}{\mu_g B_g}+\frac{R_s}{5.615}\frac{K_o}{\mu_o B_o}\right)\frac{\partial P}{\partial r}\right)+F(P)\left(\frac{1}{r}\frac{\partial}{\partial r}r\left(\frac{K_o}{\mu_o B_o}\frac{\partial P}{\partial r}\right)\right)=C(P,S_o(r,t-\tau))\frac{\partial P}{\partial t}$$

From equations (4)-(5):

$$\begin{cases} F(P)=\left(\dfrac{B_o}{B_g}-\dfrac{R_s}{5.615}\right)=P\left(b_o b_g P+b_g-\dfrac{R_o}{5.615}\right) \\ C(P,S_o(r,t-\tau))=158.064\left(\left(b_g(1-S_o-S_w)+\dfrac{(S_o+S_w)R_o}{B_o b}\right)-\dfrac{(S_o+S_w)bb_g}{B_o}P\right) \end{cases}$$

The equation (I) was approximated using finite differences on a grid with variable step: hi=ho**(qi-1), where: ho=0.3 ft, q=1.07, i=1÷75

Then (I) becomes a system of algebraic equations forming a three-diagonal matrix:

$$(II)\quad X_i^n P_{i-1}^{n+1}-Y_i^n P_i^{n+1}+Z_i^n P_{i+1}^{n+1}=-W_i^n$$

Where coefficients Xin, Yin, Zin, Win are determined from grouping of members in following equation:

$$(III)\quad \begin{aligned} &\frac{1}{r_i}\frac{1}{\bar{h}_i}\left(r_{i+\frac{1}{2}}E_{i+\frac{1}{2}}^n\left(\frac{P_{i+1}^{n+1}-P_i^{n+1}}{h_i}\right)-r_{i-\frac{1}{2}}E_{i-\frac{1}{2}}^n\left(\frac{P_i^{n+1}-P_{i-1}^{n+1}}{h_{i-1}}\right)\right)+\\ &F(P_i^n)\left(\frac{1}{r_i\bar{h}_i}\left(r_{i+\frac{1}{2}}G_{i+\frac{1}{2}}^n\left(\frac{P_{i+1}^{n+1}-P_i^{n+1}}{h_i}\right)-r_{i-\frac{1}{2}}G_{i-\frac{1}{2}}^n\left(\frac{P_i^{n+1}-P_{i-1}^{n+1}}{h_{i-1}}\right)\right)\right)=C(P_i^n,S_i^{n-1})\frac{P^{n+1}-P^n}{\tau} \end{aligned}$$

Where :

$$\bar{h}_i = \frac{h_i + h_{i-1}}{2};$$

$$(VI)\quad \begin{cases} G_i^n = \dfrac{K_o\left(S_o^n\right)}{\mu_o\left(P_i^n\right)B_o\left(P_i^n\right)} \\ E_i^n = \dfrac{K_g\left(S_o^n\right)}{\mu_g\left(P_i^n\right)B_g\left(P_i^n\right)} + \dfrac{R_s\left(P_i^n\right)}{5.615}G_i^n \end{cases}$$

And after grouping members in (III):

$$(VII)\quad \begin{cases} X_i^n = \dfrac{r_{i-\frac{1}{2}}\tau}{r_i\bar{h}_i h_{i-1}}\left(E_{i-\frac{1}{2}}^n + F\left(P_i^n\right)G_{i-\frac{1}{2}}^n\right) \\ Y_i = \dfrac{r_{i+\frac{1}{2}}\tau}{r_i\bar{h}_i h_i}\left(E_{i+\frac{1}{2}}^n + F\left(P_i^n\right)G_{i+\frac{1}{2}}^n\right) \\ Z_i = X_i^n + Y_i^n + C\left(P_i^n, S_{oi}^{\ n}\right) \\ W_i = C\left(P_i^n, S_{oi}^{\ n}\right)P_i^n \end{cases}$$

A solution of (II) is searched for in after solution is expressed in recurrent form :

$$(VIII)\quad P_i^{n+1} = \alpha_i P_{i+1}^{n+1} + \beta_i$$

Where and are coefficients. Substituting (VIII) into (II):

$$(IX)\quad X_i^n\left(P_i^{n+1}\alpha_{i-1} + \beta_{i-1}\right) - Y_i^n P_i^{n+1} + Z_i^n P_{i+1}^{n+1} = -W_i^n$$

After grouping in (IX) we can find αi and βi:

$$(X)\quad \begin{cases} \alpha_i = \dfrac{Z_i^n}{Y_i^n - \alpha_{i-1}X_i^n} \\ \beta_i = \dfrac{W_i^n + \beta_{i-1}X_i^n}{Y_i^n - \alpha_{i-1}X_i^n} \end{cases}$$

Initial border conditions on the wall of the well α1, β1 are acquired. Then a forward run yields a sequence of coefficients {αi}, {βi}, i=2…I-1. Then the border conditions on the outside border of formation are used to calculate values of Pin+1 for all i=1…I.

After Pin ,Soin are computed for time t=τn, by solving system of equations {(III)-(X)}, we first compute pressure distribution P(r, t) for

$t=\tau(n+1)$, and then from (1), determine distribution $So(r, t)$ for $t=\tau(n+1)$. This process continues until solution is calculated for the whole necessary time interval.

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Nomenclature

P - pressure, psi

S_o - oil saturation

S_g - gas saturation

S_w - water saturation

K - permeability, md

K_{oo} - relative oil permeability

K_{go} - relative gas permeability

□ - porosity

□$_o$ - oil viscosity

□$_g$ - gas viscosity

B_o - oil volume factor

B_g - gas volume factor

R_s - solution gas ratio, cft/bbl

P_f - formation pressure, psi

P_{bp}- bubble point pressure, psi

t - time, sec

r - radius, ft

r_w - well radius, ft

r_I - outlet radius, ft

H - formation width, ft

$S_{g\ crit}$ - critical gas saturation

Q_o - oil rate, bbl/day

Q_g - gas rate, cft/day

P_{opt} - optimal pressure, psi

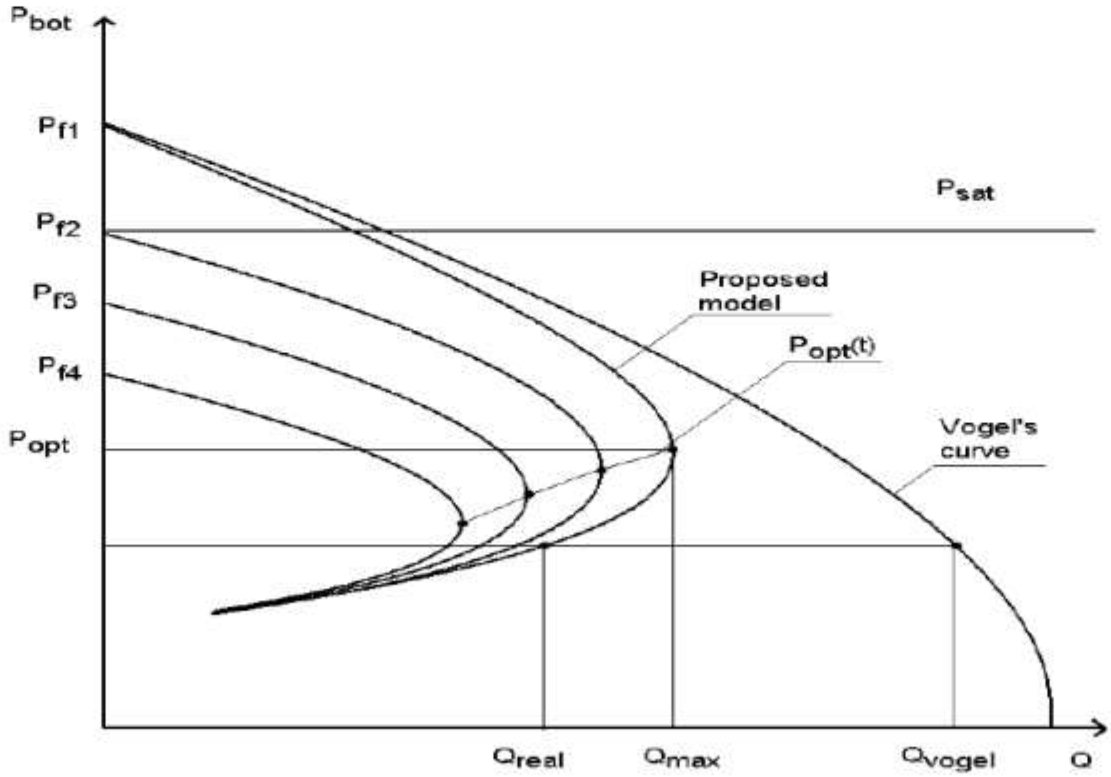

Fig.1 - Inflow Performance Relationship (IPR) curve

Fig.1a, Inflow Performance Relationship corves

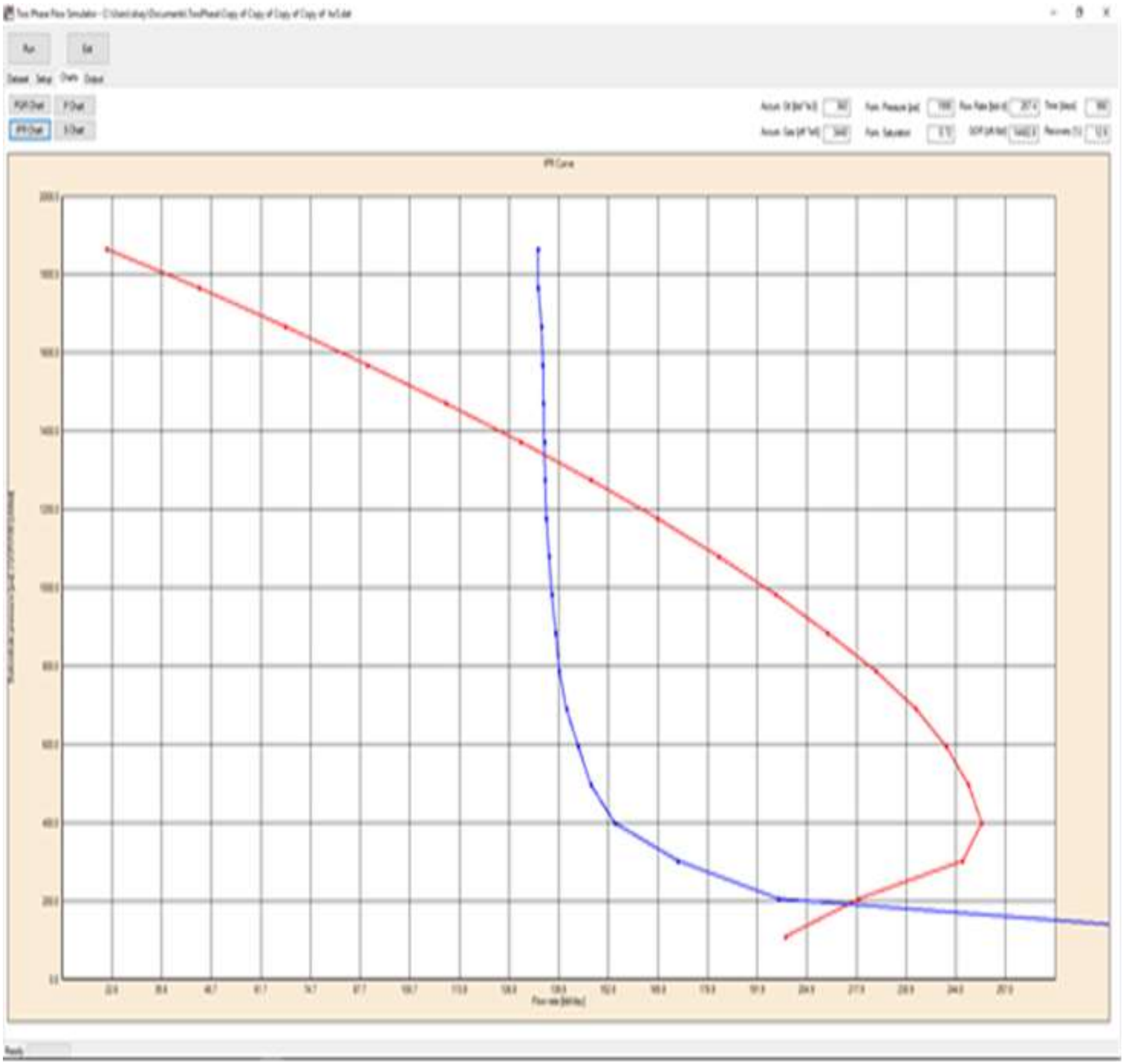

Fig.1b

IPR(----) and GOR (----) from bottomhole pressure , as result simulation

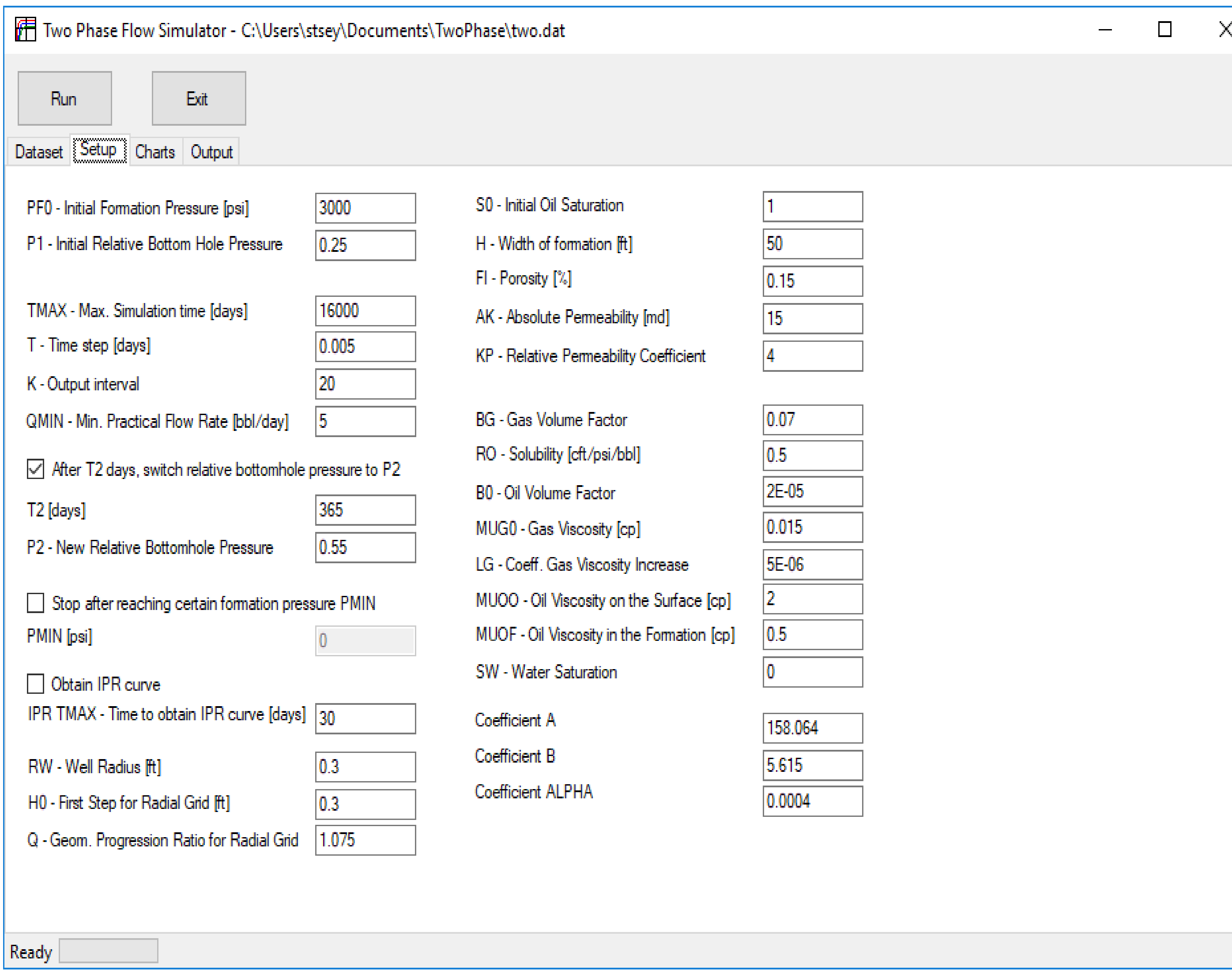

Fig. 2 Data Screen of Simulator

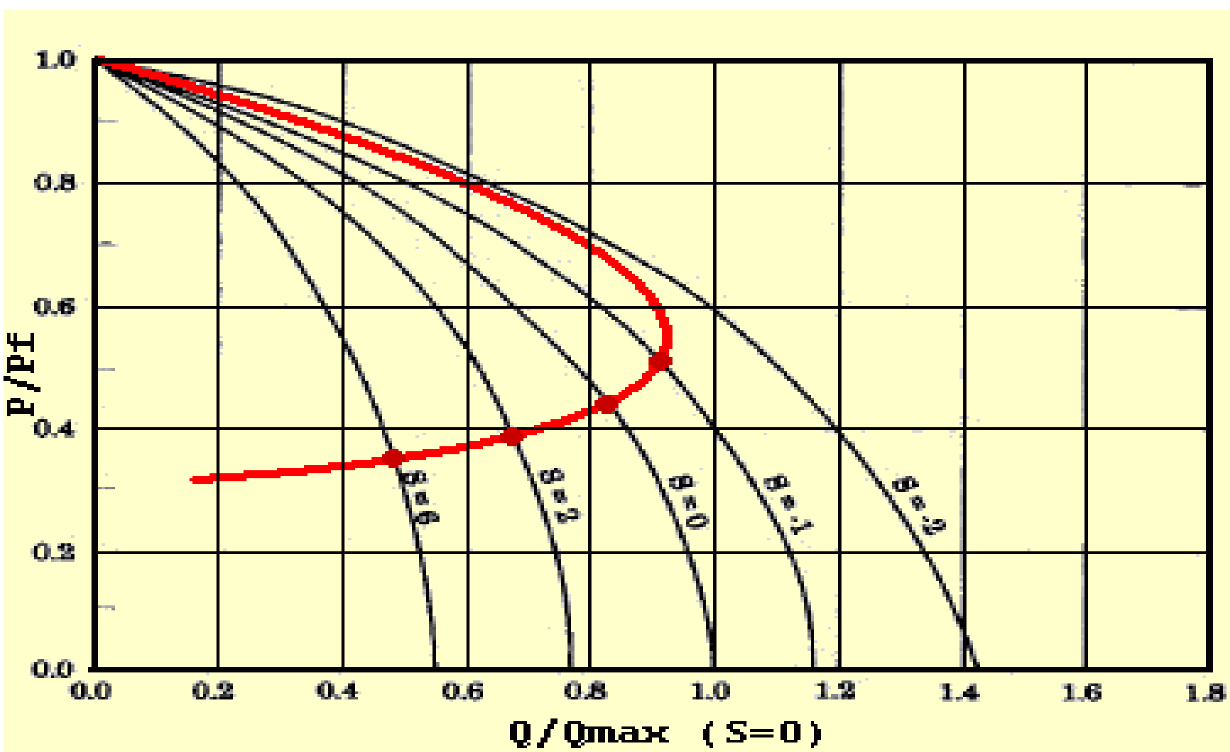

Fig. 3, Real IPR measured from Abu Daby well

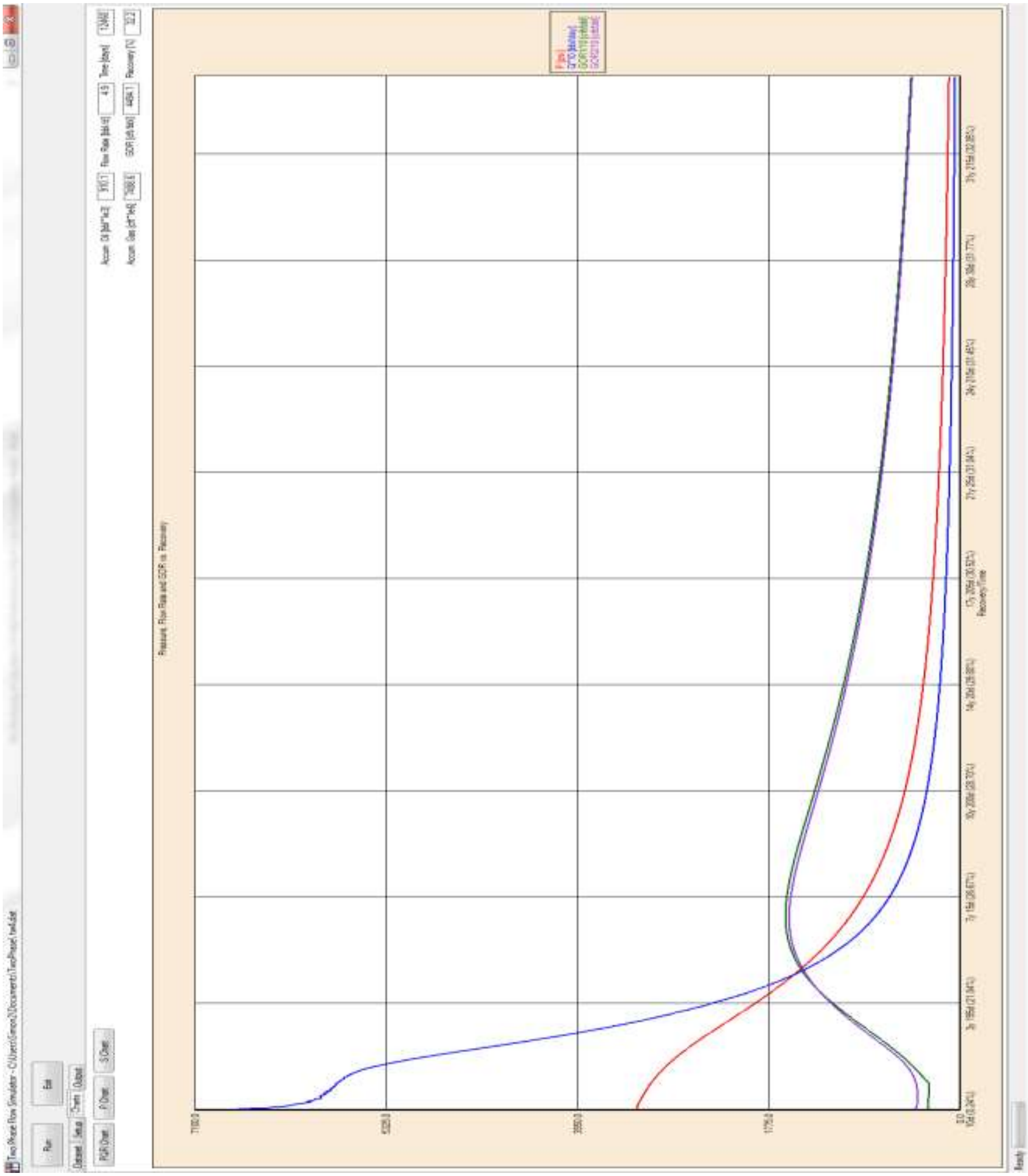

Fig. 4 , formation pressure, GOR and oil rate vs. cumulative recovery index and time

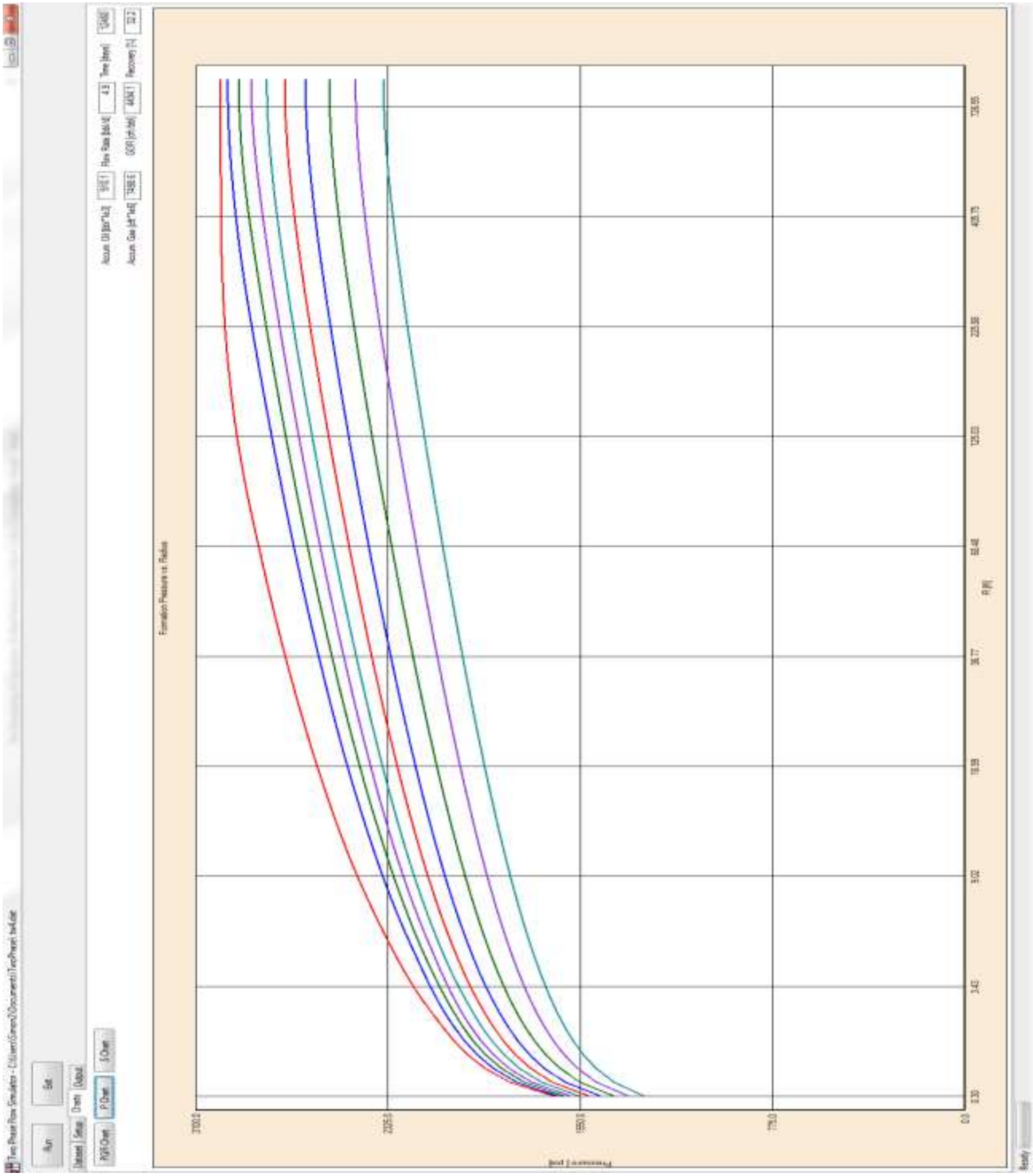

Fig. 5
distribution of pressure vs. distance from well for different times.

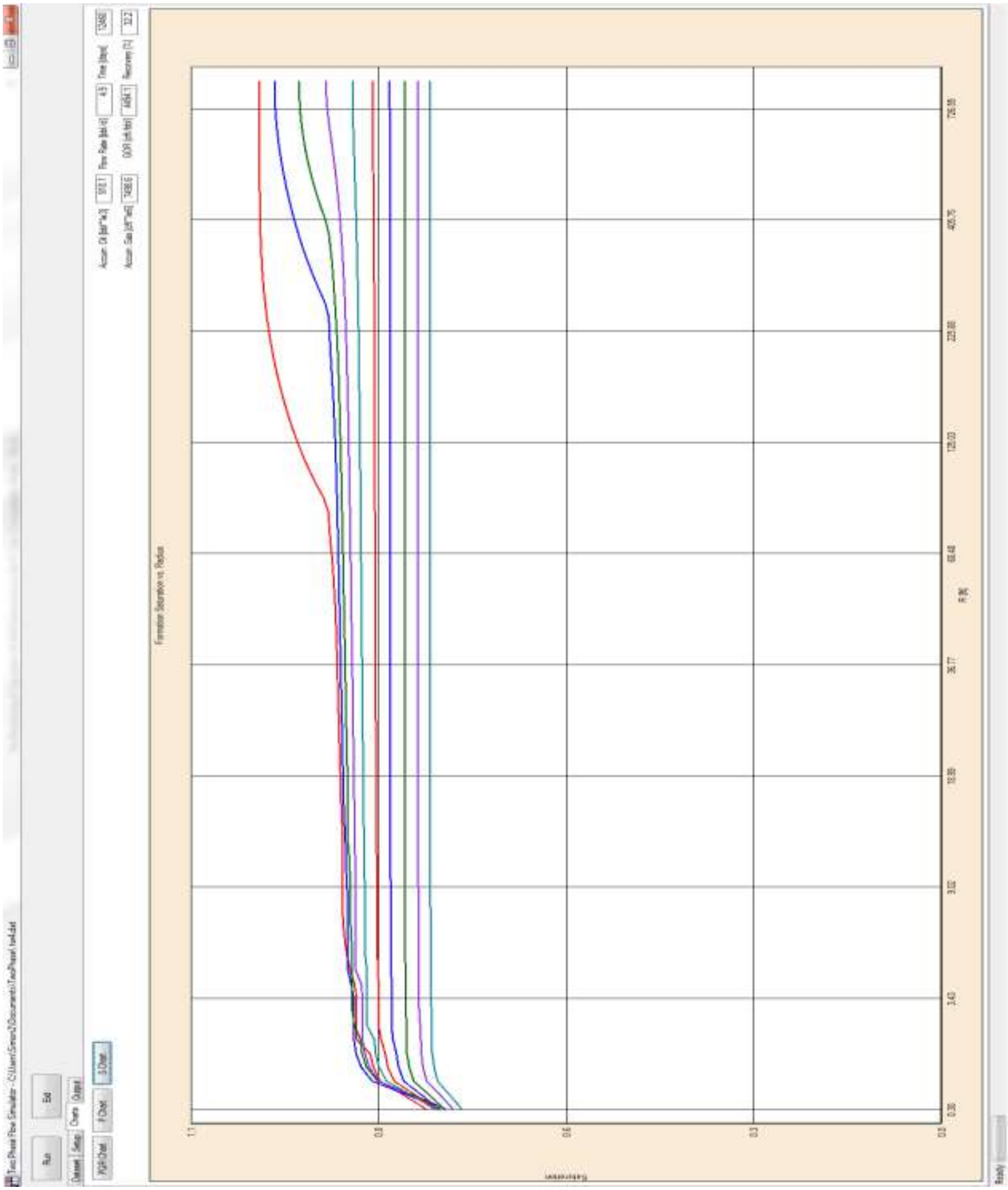

Fig. 6
distributions of oil saturation vs. distance from well for different times (assuming Sw=0).

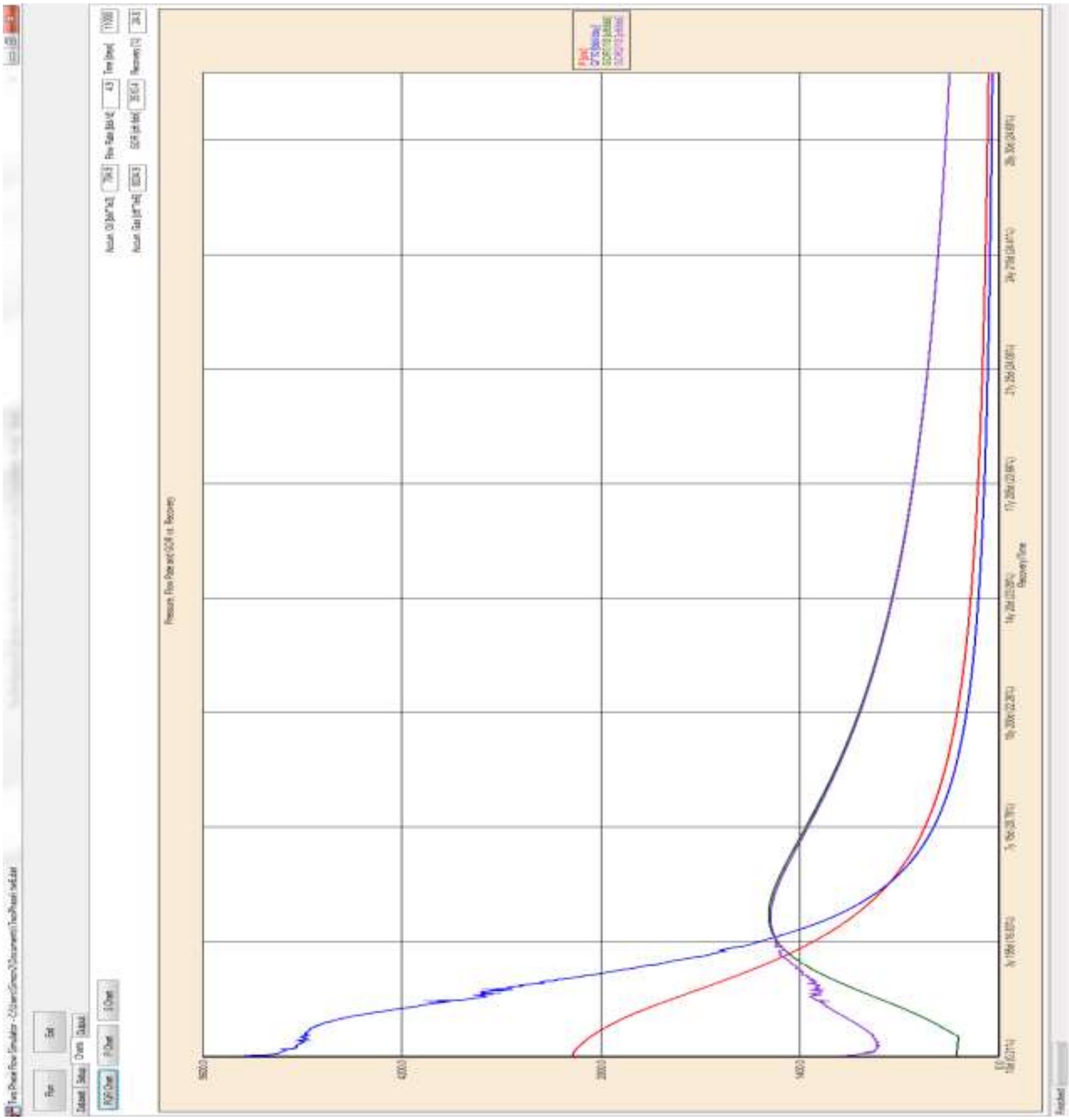

Fig. 7 formation pressure, GOR and oil rate vs. cumulative recovery index and time

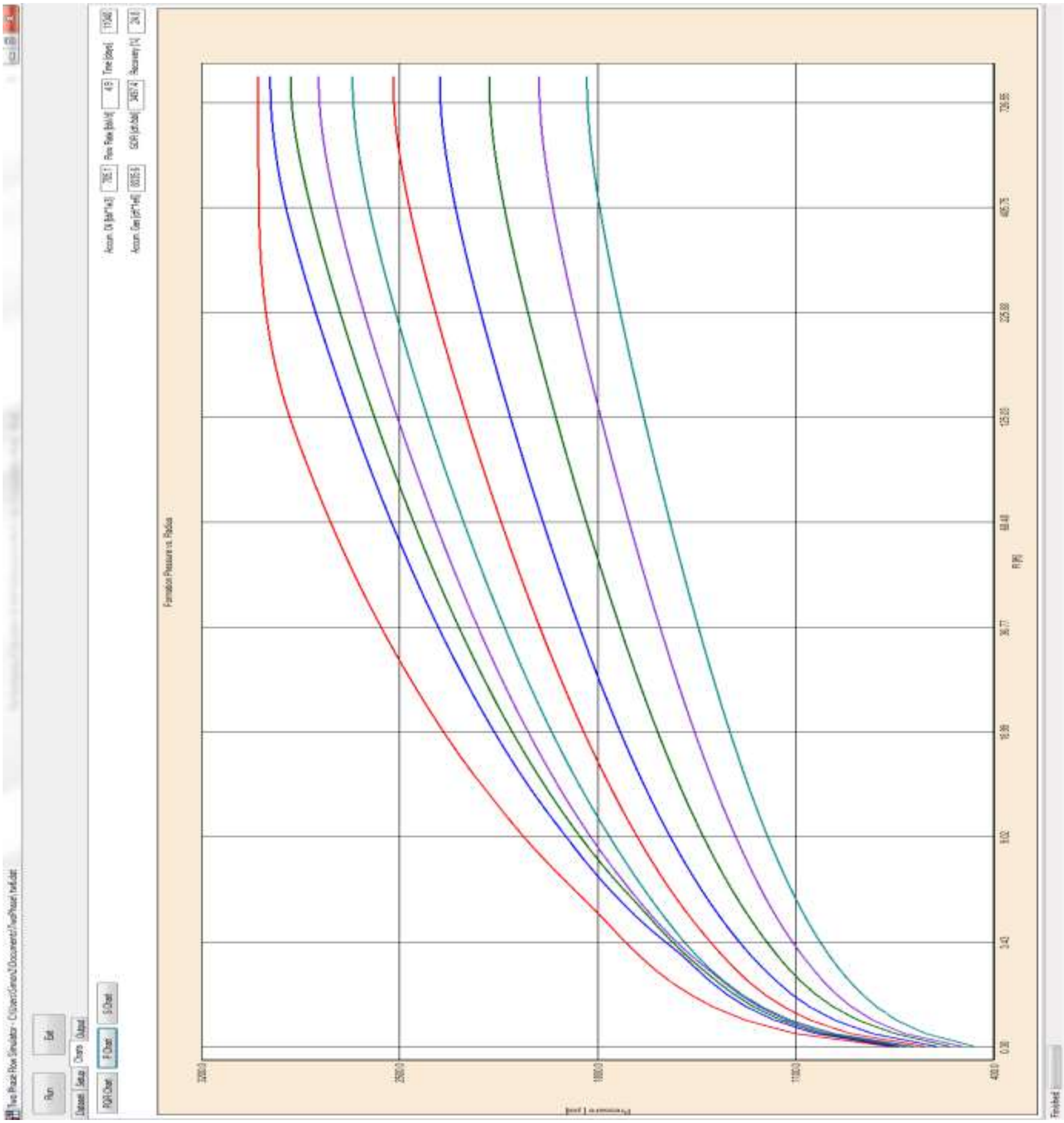

Fig. 8 , distribution of pressure vs. distance from well for different times.

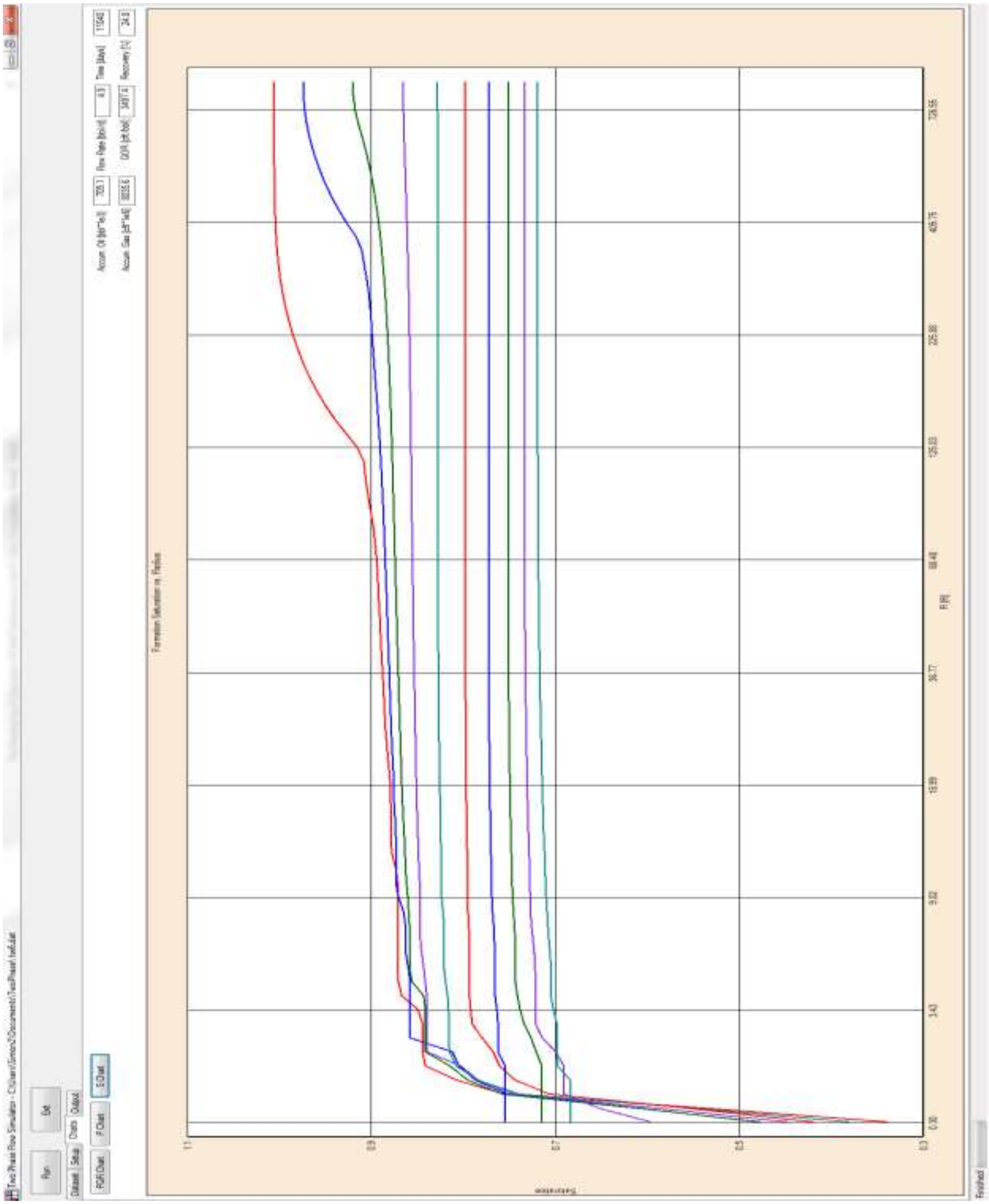

Fig. 9, distributions of oil saturation vs. distance from well for different times. (assuming Sw=0).

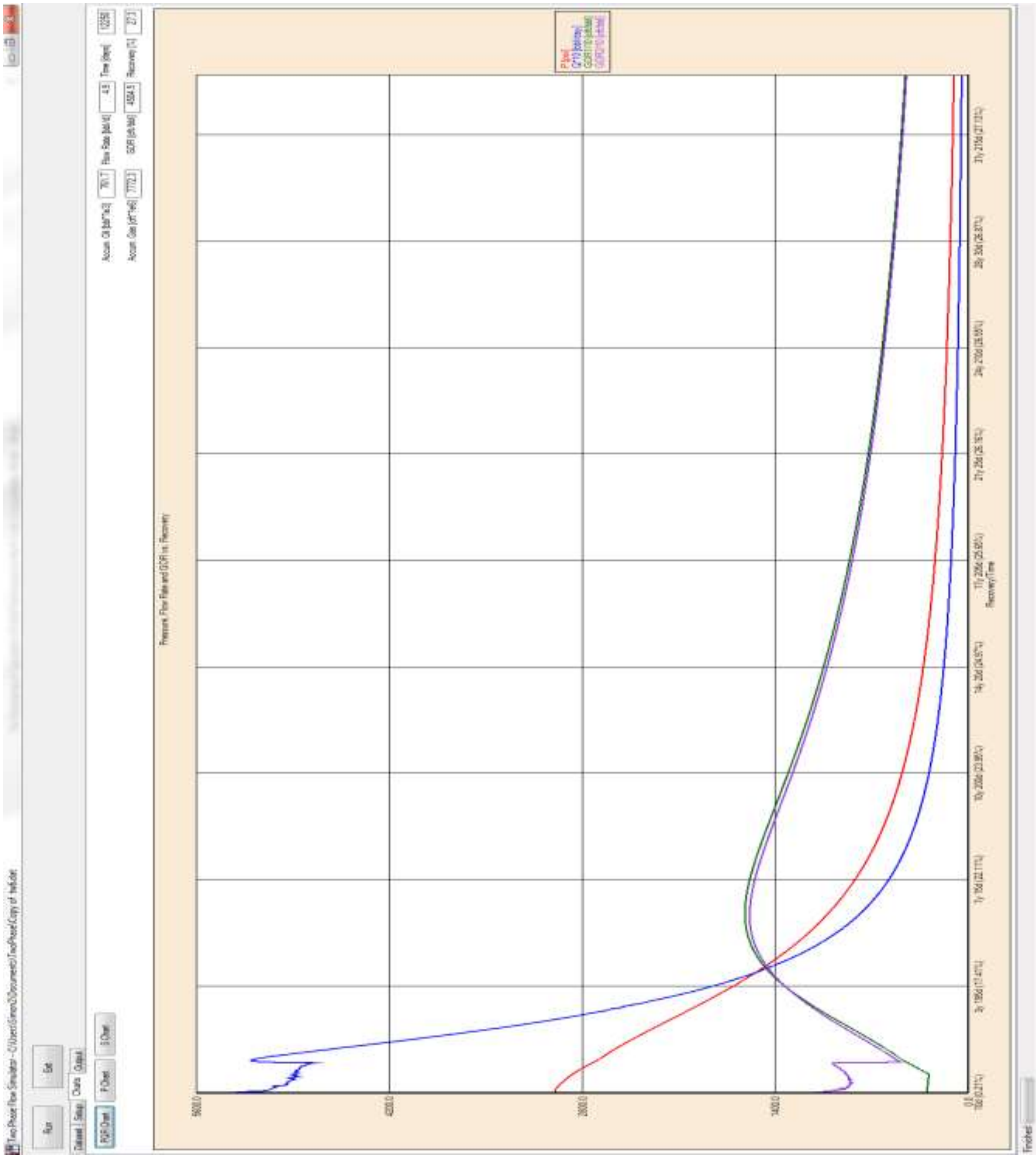

Fig. 10, formation pressure, GOR and oil rate vs. cumulative recovery index and time

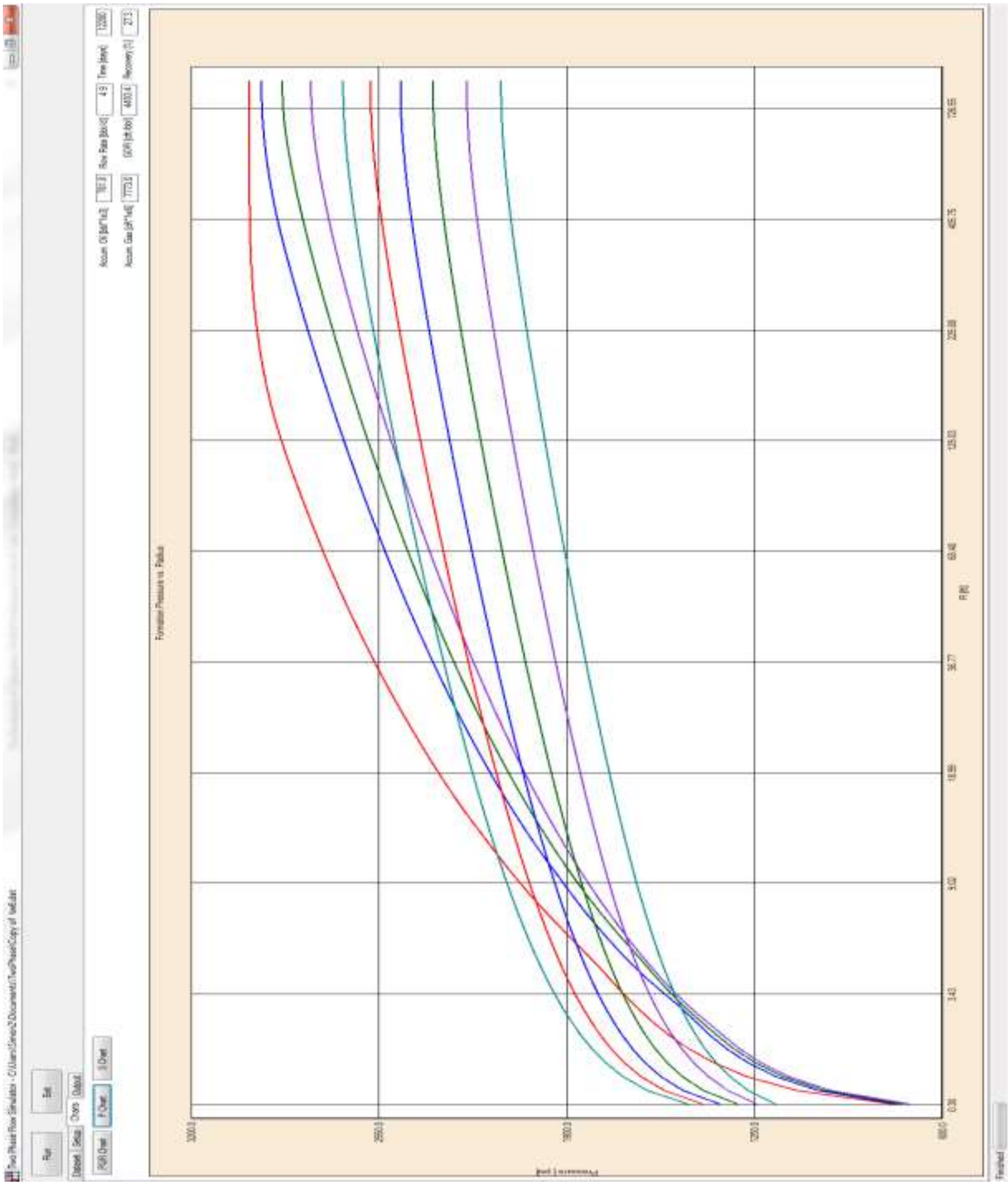

Fig. 11, distribution of pressure vs. distance from well for different times.

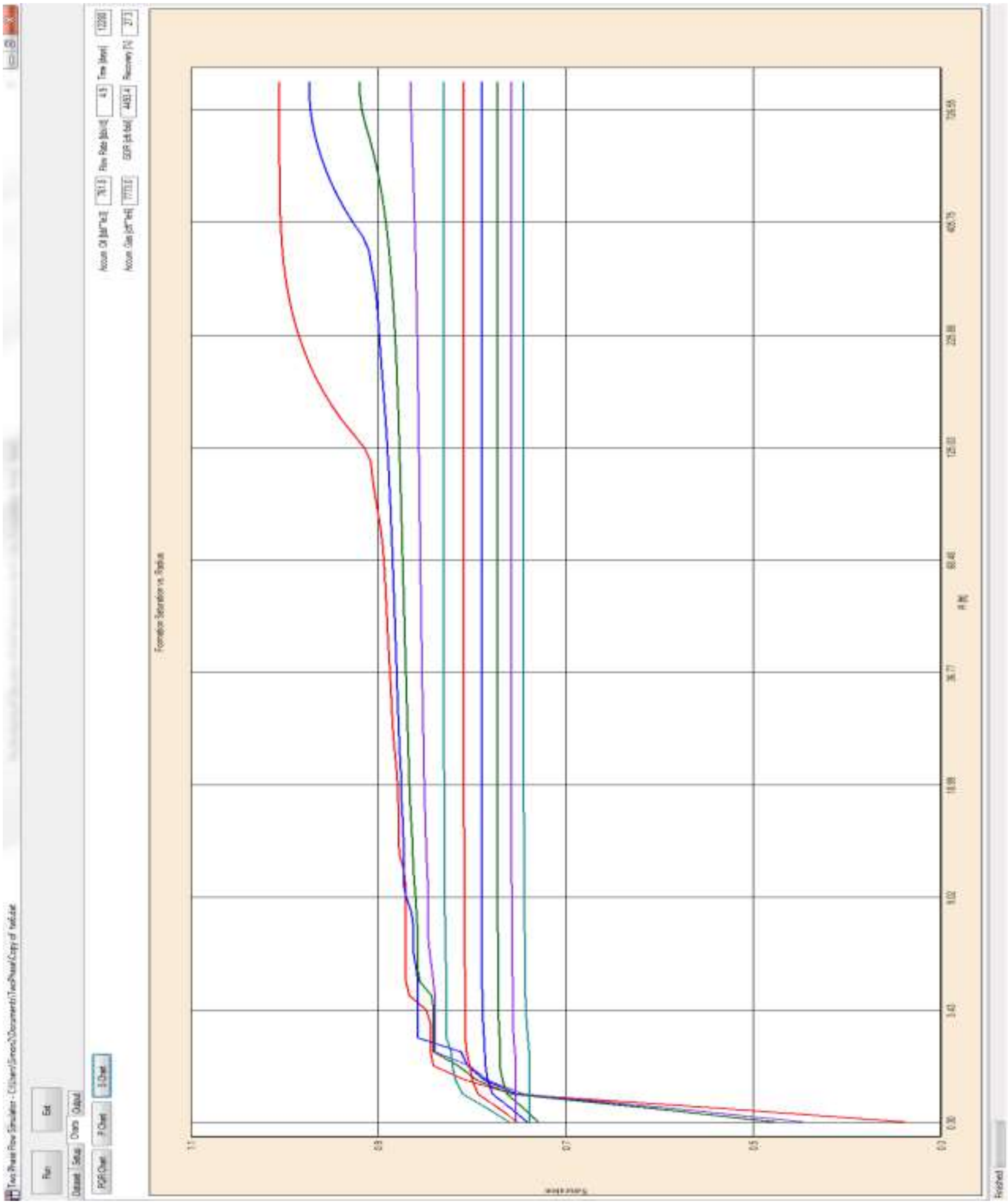

Fig.12
distributions of oil saturation vs. distance from well for different times

Стихи автора

Эпитафия Тиму

Мой бесконечно славный и любимый верный пес!
Нет слов, чтоб выразить всю горечь мне моей утраты,
Величину которой я сравнить бы только смог
С той радостью, что в жизнь мою ты внес,
И что исчезла из нее с тобою без возврата…

Я не забуду никогда и преданный твой взор,
И чудный рыжий цвет твоей груди могучей,
Стремительный твой бег среди долин и гор,
И странную любовь твою к навозной куче…

Умчался в небеса, меня оставив здесь
В печали и слезах из глаз моих текущих,
И обновившись там душой и телом весь,
Охотишься теперь наверно в райских кущах.

6.6.2001

Монолог

Быть или не быть, вот в чем вопрос?
Что лучше, покориться и в брак вступить?
Иль ополчась, остатьтся одиноким волком.
Жениться! Жить вместе и видеть дев других
Во сне лишь только?! Вот в чем вопрос!

Какой пикантный сон приснится в этом сне.
Вот в чем причина того,
Что жизнь холостяка так долговечна!

Кто б снес оковы брака и жены глумление!
Гнет бесконечный тещ, насмешку всех друзей!
Боль от побоев, секса перегрузку!
Когда бы мог себя легко удвлетворить,
Найдя любовь у девы благосклонной на улице,
Запудрив ей мозги и обещав жениться!

Кто плелся бы с тяжелой ношей брака,
Чтоб охать и стенать под нудным прессом.
Когда бы страх чего-то перед смертью.
Безвестный госпиталь откуда нет возврата
Земным мужчинам разум не смущал,
Внушая им терпеть невзгоды эти
И не спешить к другим от них сокрытых...

Так трусами нас делает женитьба
И так решимости блудить природный пыл
Хереет перед страхом одинокой смерти
И вгляд блуждающий и ищещий кругом
Забавы легкой
Вдруг кротким став,
К подруге устремляется своей,
Предпочитая маленькую птичку в своей постеле
Журавлю в чужой...

Но тише! Ленка кажется из Бруклина вернулась!
В своей молитве нимфа, все в чем грешна ты, помяни...

Я Вам пишу чего же более…
Готов я сам к тебе лететь,
Но злобный рок сильнее воли,
А крылья бог не дал иметь…

Как часто сидя и звоня тебе домой,
Я думаю о нашей скорой встрече,
Но ты не хочешь видеться со мной,
Хотя о близости не может быть и речи.

Как эскимос, согретый солнцем
И рюмкой водки, выпитой пред тем…
Так я, согретый вашим взлядом,
Презренный раб лелеющий порок,
Хотел бы быть с тобою рядом
И умереть у ваших ног…

Сонет 222

Мой кроткий ангел любящий зверят
На склоне лет моих мне встретившись случайно
Округлостью лица ты привлекла мой взгляд
Который перед тем конечно оценил твой зад…

Сраженный наповал столь редким сочетанием
Достоинств тела и души
Я робость поборов спросил
Готова ль ты делить свою любовь к котам
С любовью к драным пожилым скотам…

И чудо совершилось
Гром грянул посреди двора
И ты в меня влюбилась…

Возрадуйся Киприда
Бей в бубен Купидон
Попался в ваши сети
Затасканный гиббон…

Сонет 444

Совсем не ангел ты ! Скорее злая баба
Мою израненую ты терзаешь плоть
То ненавистью жжешь меня с садисткой болью
И пьешь мою испорченную кровь,
То жжешь мои кишки своей иступленной любовью...

Не верил никогда твоим словам и чувствам,
Не так я глух и глуп чтоб фальш их не понять
И строя клетку мне с коварством и исскуством
Ты часто забывала маску злобы с морды снять...

Мой кроткий дух, рядящийся в шута
Восстать годов и крылья распустить,
Но тело бренное, закованное страхом,
Не позваляет мне над плотью воспарить,
Пугая будущим концом и запахом тлетворным праха...

Но верю я, что жизнь моя, которую я загубил беспечно,
Пробудит сострадание твое
И ты поможешь мне покинуть этот мир конечный
И обрести среди лучистых звезд покой мне вечный...

Сонет 555

Опять настало чудное мгновение
И птицы в небесах приветствуют его.
Их щебетанье трель во мне пробудет гения,
Который сможет вновь воспеть день твоего рождения...

Земля и Звезды радостно поют, приветствуя твое чудестное
явление,
С которым я могу без скромности сравнить
Венеры из воды лишь чудное рождение...
Хотя причину этого придеться мне забыть...

Всей жизнью своей ты заслужила дар
Бриллианты перед чем лишь блеклые игрушки.
Я этот дар тебе вручаю от души,
Возми меня к себе на чистые подушки...

И если ты откажешь в этом мне,
Мой хладный труп найдешь ты на озерном дне...

Сонет 123

Опять звезда удачи светит мне в глаза,
Я носом чувствую успеха приближение.
Промчался мимо сплин, как вешняя гроза,
И вновь играет радугой мое воображение…

Мои колени больше не дрожат,
И выя согбенная снова распрямилась,
Мой острый мозг опять готов стихи рождать,
И женщины сменили гнев на милость…

Моя любовь, как старое вино
Становится с годами терпче и сильнее,
Мой внешний вид ,как датское парно
Во всех желанье пробуждает все острее.

И пусть Фортуны зад не будет омрачать
Тот жизни новый путь, что я готов начать.

Сонет 111

Мой бедный щедрый друг, обиженный мною,
Тепло любви которого так чудно грело душу.
Я чувствую себя виновным пред тобою
И чувство горечи утраты горло душит...

Быть может, после расстования со мною
Найдешь себе достойней кандидата,
Который сексуальней и тупее,
Которыми Земля наша богата...

Я ж горемыка старый и нечуткий
Остануся один с своею болью,
Имея множество своих изьянов жутких,
Которых не исправишь ты своей любовью...

Однако чувствую, что Бог мне не изменит.
Не даст погибнуть в одиночестве и муке.
Мне радость творчества твою любовь заменит,
А лапы Тимины твои крутые руки!

Сонет 146

Шекспир – Цейтлин

Моя душа, живущая в потемках,
Находится в плену желаний и утех
И, изнывая от духовной жажды,
Растрачивает жизнь на роспись внешних стен…

Гость временный, зачем всю силу духа
Ты тратишь, укрошая сей убогий дом,
Который вскорости пойдет червям на корм
С другим имуществом, накопленным с трудом…

Воспрянь душа и жажду утоляя
Копи клад знаний в череде бегущих дней
И выбрав этот трудный путь,
Живи богаче духом, телом же бедней…

Пусть божий дух в тебе в сей жизни быстротечной
Поможет воспарить над смертью вечной.

Сонет № 333 (к дню рождения Ленки)

Уж скоро года три как, встретил я тебя
И зелень твоих глаз проникла в мою душу,
Посеяв в ней зерно любви большой,
Которое недавно лишь дало росток наружу…

Твой хрупкий образ вместе с добротой,
Дополненый игрою моего воображения,
Очаровали чуткий разум мой
И сделали тебя предметом вожделения…

Я счастлив быть рабом, служа тебе во всем,
То в клюве принося соломку в норку,
То унося все лучшее к себе
Без звука вынося затем очередную порку.

И верю я, что вскоре ты найдешь во мне
Все то, что я давно уже нашел в тебе.

Сонет на Новый 2003 Год

Опять покинул Землю Старый Год,
И Новый наступил неся с собой надежду.
Сменяя череду событий плавный ход,
Как модница меняет каждый день свою одежду…

Собравшись вместе, люди славят Новый год,
Стараясь позабыть скорей о грустном в Старом.
Пурпурное вино искряся льется в их открытый рот,
Врачуя раны нансенные судьбы ударом…

Земля несется вдаль средь звездных россыпей
Законам подчинясь строителей Вселенной.
И я, как дикий лев, внезапно пробудясь,
С покорностью припал к ноге богоподобной Лены…

Но вскоре на Востоке вновь взойдет Заря,
Свет месяца и звезд гася своим багрянцем.
А я иступленно любви желанием горя,
Останусь как и был для всех простым засранцем…

Сонет 11

Опять тоска кольцом мое мне душит горло,
И соль скупой слезы жжет веки красных глаз.
Наташка, взяв шмотье и бросив всех позорно,
Покинула наш двор, уехала от нас!!

Остался я один, покинутый ею.
Нет утешенья мне, и жизни смысл исчез.
Цементною стеной меж нами встал внезапно
И возраст юный твой и плата за проезд…

Но для любви моей не может быть преграды,
Которую преодолеть не мог бы мой Пегас,
И дав ему пинка и поцелуй в награду,
Могу достичь на нем и Лефрак и Парнас…

Мамане стихи к 80 летию от сына Семы

Трубите херувимы в трубы, пойте громче горны,
Сегодня празднуем мы день рожденья Оли,
Которая нам бабка, мать и друг,
Которую мы крепко любим все согласно Божьей Воле
И даже много крепче, чем своих подруг…

Кто энергичней всех сидящих в этом зале,
Кто бескорыстней и добрей к чужой беде,
Кто жизнь прожил в трудах покорный своей доле,
Кто равнодушней всех всегда к любой еде.

Как должное мы принимаем все ее заботы,
Нам не хватает времени ее благодарить.
Всегда уставшие и злые от работы
Мы не считаем нужным ей вниманье уделить.

Однако, пользуясь возможностью и рифмой,
Хочу прощения у мамы попросить,
И обещаю впредь любить ее сильнее
И разрешать меня по попке чаще бить.

Сонет 2

Мой юный друг, верней подруга,
Чей чудный образ осветил мой тусклый путь,
По мнению других мы не подходим друг для друга,
Мне ж чувство нежности теснит седую грудь.

Когда тебя я вижу на рассвете,
Грядущую среди цветов, нагой в росе,
Я чувствую, что никого на свете
Нельзя сравнить с тобой по красоте.

И если вдруг тебя внезапно тронет
Мой скромный образ и могучий ум,
Стань для меня Кальпурнею на троне,
Я ж буду Цезарем твоих девичьих дум.

Трилистник четырехлистный

Луч солнца осветил поляну на опушке,
И свет его сверкнул в брильянтике росы,
Напомнив мне алмаз сережки в твоем ушке,
Когда еще была в расцвете ты красы.

Теперь, когда пожухла зелень в поле
И даже резеды опали лепестки,
Остался я один, свободный, но в неволе,
Читая вновь и вновь стихов своих листки.

Но вдруг босой стопой внезапно я наткнулся,
Еще не веря в то, что счастье светит мне,
В густой ботве свеклы трилистник подвернулся
Четыре лепестка, испачканных в дерьме.

Сонет 13

Разрушен храм моей души,
Колонны рухнули, и свод изъеден тленьем.
И там, где некогда в таинственной тиши
Были слышны слова божественых молений,
Теперь лишь запах гнили и забвенье…

Вдоль покосившихся позеленевших стен
Поток воды заплесневшей струится,
И стая жирных крыс иступленно резвится,
Вздымая над собой клубами затхлый тлен…

Вой волков на заснеженных полях,
Скрип окн без стекол в заржавленных петлицах,
И группа трупов на завядших тополях
С следами крови на изможденных лицах…

Голубка глупая свить вздумала гнездо
Средь кровли обветшалой,
Как видно отказали ей и разум и чутье.
А может быть за ветхостью портала
Она чудесных белых два крыла души моей
И силу слабости моей внезапно угадала!

Всю жизнь свою я посвятил исканьям,
Ища среди сует смысл жизни и любви.
И лишь в конце пути, устав от истязаний,
Я на закате жизни встретил Натали.

И вот теперь, когда я цель свою достигнул
И мог бы счастлив стать в объятьях девы молодой,
Я с горьким удивленьем в зеркале увидел
Помятое лицо и волос свой седой…

Но к счастью мудрости накопленной годами
И чувству юмора с которым я живу,
Позволили смеяться мне над нами
И полностью плевать на холодность твою…

Сонет 14

Посветлело небо над погостом,
Поднялся туман над гладью вод,
Крик раздался кулика над мостом,
На него откликнулся удод.

Девушка, обиженная другом,
Утопиться вздумала в пруду,
Всплеск воды, и волны разошлися кругом
К ней на тризну люди не придут.

Лишь русалок стая белоглазых
Извлечет из ила хладный труп,
Осенив чело венком из белых лилий
Под аккорды скорбных звуков труб.

Вновь сижу я у камина
Устремив свой взгляд в огонь
Саламандры мчася мимо
Страстно лижут мне ладонь.

Так Сцивола легендарный
Обжигая длань огнем
Доказал царям и людям
Сколько мужества есть в нем ...

Но никто не представляет
Как мне внутренности жжет
Поминутно отравляя
Дрянь, что рядом здесь живет.

В ней не совести, не чести,
Тупость, жадность и дерьмо.
С ней живу в квартире вместе,
Не стряхнуть с себя ярмо...

Но снесу я много больше,
Чтобы видеть по утрам,
Справившись с сердечной болью,
Как сынок резвится там...

Сонет 432

Звезда любви, звезда печали,
Зачем, едва взойдя на небосвод,
Ты даришь лучезарный свет свой грязной глади вод
И освещаешь мрачное болото,
Где лишь ползучий гад пьет свет твоих лучей…
Мне ж сердце жжет стрела жестокого Эрота…

Как червь земной, слепой и скользкий,
Ведущий жизнь в грязи земной,
Лишь солнце выйдет, выползает греться из земли сырой,
Так я, согретый Вашим взглядом,
Презренный раб лелеющий порок,
Хотел бы быть повсюду с Вами рядом
И умереть у Ваших стройных ног…