

EDITORIAL

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RESULTS

of the International Scientific and Practical Conference «Hydrocarbon and Mineral Raw Potential of the Crystalline Basement» and meaningful action to accelerate the use of this potential

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The 23rd International Scientific and Practical Conference “Hydrocarbon and Mineral Resources of the Crystalline Basement” was held on September 2-3, 2019 in Kazan (Russian Federation) within the framework of the Tatarstan Petrochemical and Chemical Forum.

Organizers of the Conference: Office of the President of the Republic of Tatarstan, Ministry of Industry and Trade of the Republic of Tatarstan, Russian Academy of Sciences, Academy of Sciences of the Republic of Tatarstan, PJSC Tatneft, CJSC Neftekonsozium, Kazan branch of the Federal State Budgetary Institution “State Reserves Committee”, OJSC “Kazanskaya Yarmarka”.

The conference was attended by 427 specialists, representatives of 98 organizations, including companies of the Republic of Tatarstan – 42, the Russian Federation – 47 (including Moscow, St. Petersburg, Bashkortostan, Tyumen, Samara and other regions), 24 specialists from far and near foreign countries like China, Italy, Canada, Viet Nam, Egypt, Kazakhstan, Uzbekistan, Belarus, Azerbaijan.

Presentations were made by representatives of academic and university science: the Russian Academy of Sciences, the Siberian Branch of the Russian Academy of Sciences, the Academy of Sciences of the Republic of Tatarstan, leading universities and research universities.

36 reports were presented and discussed, including 14 plenary, 22 oral at the round table and 54 poster sessions. A collection of works has been published, which includes 90 reports.

Why did such a conference take place in Kazan?

The answer is simple – the Republic of Tatarstan has had successful half a century of experience studying the role of the crystalline basement (CB) in the formation, reformation and replenishment of the resource base. The problem of studying CB was posed in 1936 by B.M. Yusupov. Why do we turn to this problem today when the world has significant resources of conventional oils (hard-to-recover reserves), unconventional hydrocarbons (HC) (heavy oils, natural bitumen (NB), oil and gas shales, dense rocks, etc.), and the media scare the onset of the era of electric vehicles and a reduction in the consumption of hydrocarbons?

We proceed from the fact that conventional and some non-conventional hydrocarbons that are available for

modern production and use are, firstly, distributed on the planet very unevenly both in area and in section; secondly, a significant part of them is located in difficult geological conditions (large depths of land and sea, complex reservoirs, high pressures and temperatures), in difficult climatic conditions (shelves of the northern seas, deeper objects, remote, uninhabited territories, etc.). All this complicates and increases the cost of their development, making production in some cases unprofitable. In addition, the production capacities of shale deposits and dense rocks are characterized by rapid exhaustion.

As for electric vehicles, unlike electricity, oil, gas, coal are primary energy resources (PER), and electricity does not belong to this category. Its production requires PER. The history of the use of oil and gas shows an increase in the directions of their use by man. So, oil and gas as the most convenient resources for use by a person in his life will always be needed and in an ever-increasing amount.

The main goal of the conference is an in-depth study of the hydrocarbon and mineral resources potential of the bowels and the role of the crystalline basement in replenishing oil and gas deposits of sedimentary cover during the Earth’s degassing.

Conference Objectives:

- consideration of world experience in prospecting, exploration and development of fields confined to the rocks of the crystalline basement;
- generalization of the data accumulated over the past 40-50 years on the role of CB in the formation of oil fields in the sedimentary cover;
- assessment of the CB role in the reformation and replenishment of oil and gas fields of sedimentary cover from the Earth’s bowels and the impact on the development effectiveness of conventional oil fields;
- the genesis of oil and the mechanisms of oil fields formation in the CB and sedimentary cover.

2. World experience in prospecting, exploration and production from deposits in the CB

The world has gained some experience in the prospecting, exploration and development of oil and gas fields in the CB. A.I. Timurzиеv believes that

“A feature of oil fields in the basement, contrary to generally accepted ideas, based on elementary ignorance and suppression by the official science of facts, is the exceptional richness and productivity of accumulations of “basement oil”.

A lot of reports on the oil and gas potential of the CB at the conference were made on the well-known fields of the Vietnam shelf. For these conditions, a set of basic criteria for the oil and gas potential of the basement in the Kyulong basin was identified and justified, including: geodynamic, tectonic, fluidodynamic, structural-geomorphological, petrographic, which allows it to be purposefully used to assess and predict the prospects of such structures in the basement rocks.

T.A. Kireeva notes: “In many cases, the oil-bearing basement in the overlying rocks of the sedimentary cover shows a manifestation of hydrochemical inversion. This is manifested both in Western Siberia (Krasnoleninsky and Surgut arches), and on the shelf of South Vietnam, where an inversion of hydrochemical zoning is noted over the oil-bearing granitoids of the White Tiger structure at the bottom of the sedimentary cover, which is absent in the neighboring structures, the basement of which has no or slight oil-bearing (Dragon structure)”.

T.A. Kireeva formulated the hydrochemical characteristics of the oil-bearing basement:

1. The preservation of the hydrochemical inversions zones in the aquifers of the lower sedimentary cover indicates the potential oil basement.

2. In the presence of a normal hydrochemical section in the sedimentary cover, the oil content of the basement is unlikely.

3. The receipt from the basement of concentrated ($M > 200$ g/l) calcium chloride type brines can be considered as a clear sign of the oil absence in the basement, because it has already passed into a sedimentary cover, and endogenous brines have occupied the basement cavities.

A.E. Desyatnikova and P.A. Shakhov offer criteria for the search for basement softening zones in order to increase the efficiency of production drilling.

S.A. Punanova states: “It is worth recognizing that the naturally destroyed crystalline rocks of the basement are a global geological phenomenon. Despite the proven commercial success, the delay in the implementation of many projects stemmed from the fact that the discovery of hydrocarbon fields in the basement historically occurred more likely by chance, and not as a result of targeted exploration programs. Nevertheless, in recent years there has been a successful change in this trend, which leads to numerous discoveries and an increase in the number of developments in the basement”.

M.Kh. Nguyen, E.Yu. Goryunov cites the criteria for oil and gas presence in the CB on the example of offshore fields in South Vietnam.

In almost all CB reports, there is a close relationship between the oil content of the sedimentary cover and CB, when oil was found in the latter. No industrial oil has yet been found in the Republic of Tatarstan (RT), but oil and bitumen occurrences have been, and a close relationship has been established between the features of the geological structure of the basement and the structure of the sedimentary cover. Here, not only the influence of the block structure of the CB on the sedimentary cover is noted, but even the change of some rocks in the CB to others has influenced the details of the geological structure of the deposits in sedimentary rocks (changing the structure of the structural plan of rock thicknesses, etc.).

The connection between the CB and the sedimentary cover was most fully covered by the specialists of Tatarstan: R.Kh. Muslimov, I.N. Plotnikova, L.M. Sitdikova, V.G. Izotov, R.R. Khasanov, R.S. Khisamov, N.S. Gatiyatullin, V.G. Bazarevskaya, D.S. Danilov, L.M. Shirokova and others), as well as specialists from other regions (V.A. Trofimov, E.Yu. Goryunov, N.A. Kasyanova, A.V. Lobusev, M.A. Lobusev, A.V. Bochkarev, Yu. .A. Gutorov).

Unfortunately, most of the conference participants admitted that the discovery of hydrocarbon fields in the CB was largely random. This indicates the importance of research on the development of reliable criteria and methods for the search for oil and gas in the CB. In the meantime, it is necessary to apply methods for searching for fracture zones (reports by G.N. Erokhin, M.Ya. Borovsky, and others).

The discussion showed that it was time to generalize the data according to the search criteria for oil and gas deposits associated with the CB. Then the search for oil in the CB will be conducted on a scientific basis.

3. The origin of oil

The problem of the oil origin sounded in most reports. Discussions on this issue have been ongoing almost from the very beginning of industrial oil production. This was especially characteristic of Russia. The country has taken the path of supporting organics and all kinds of oppression of inorganics (lack of funding, prohibition of publication of scientific papers, conferences, etc.). In those years, a biogenic theory of the origin of oil developed, and abiogenic theory was tried by single scientists – enthusiasts of their craft. This went on almost until “restructuring”. All this naturally did great harm to the development of science. I remember 1968 when, at the All-Union Conference on the Origin of Oil (Moscow, 1968), an outstanding scientist N.A. Kudryavtsev and his supporters – abiologists were obstructed. At many conferences, symposiums, meetings on this issue, these discussions took place according to the same scenario – everyone did not strive for some kind of truth, but

considered his main task to destroy the opponent in any way.

What do we have now?

It is proved that HC is synthesized both in an organic and inorganic way.

Synthesis is better at high temperatures and pressures. Therefore, the main oil fields of the Republic of Tatarstan are located in areas with a greater depth of subsurface. However, Zakirov, using polycondensation synthesis of hydrocarbons on the surface of a water-saturated mineral matrix of rocks, succeeded in synthesizing n-alkanes ($C_{12}H_{24}$) from CO_2 and H_2O at room temperature and atmospheric pressure. Moreover, the reaction proceeded at a high speed.

Acceleration of hydrocarbon formation processes in natural conditions will be initiated by catalysts (natural minerals), the set of which is quite large here.

From modern positions, it can be said that these disputes (in the manner in which they were conducted) were unproductive and contributed little to elucidating the mechanisms of this synthesis and the formation of oil and gas fields.

The basis of oil and gas origin is the synthesis of carbon and hydrogen. Today we know that it occurs in both biogenic and abiogenic (mineral) way. There is no other way. Moreover, this synthesis can occur in different geological conditions (both high temperatures and pressures, and lower, when natural catalysts play a large role).

Obtaining abiogenic HC was done in the laboratories by various scientists. In the 30s of the last century B.M. Yusupov explained the variety of oils in the composition and properties as the contacts of hydrocarbons with rocks and fluids along migration routes.

A review of reports and different opinions suggests that both biogenic and abiogenic concepts are correct. Even the fact that a person with his meager (compared to nature) capabilities was obtained experimentally by HC from a biogenic and mineral source indicates the presence of biogenic and abiogenic synthesis. Those scientists (so far not so numerous) are right who recognize both paradigms. This is already a big progress. Therefore A.I. Timurziev in his report “The fundamental oil of sedimentary basins – an alternative to the shale scenario for the development of the Russian fuel and energy complex (on the example of Western Siberia)” did not have to fall upon Academician A.E. Kontorovich for his adherence to the theory of biogenic synthesis, and he should be criticized for the absolute rejection of the abiogenic synthesis of hydrocarbons. This criticism would be fair. Unfortunately, Aleksey Kontorovich himself was unable to attend the conference, but the title of his report was eloquent: “Oil deposits in the crystalline basement and their genesis. I can’t keep silent anymore”. Of course, we know what he wanted

to say on the issue under discussion (from his previous reports and publications). In that dispute A.I. Timurziev and A.E. Kontorovich operates in the “best” traditions of disputes about the origin of oil of the 20th century. The role of bad traditions is great.

Also, Aleksey Emilievich should not be criticized for his new paradigm, based on focusing the industry on the development of small fields, increasing oil recovery factor and developing hard-to-recover oil reserves in exploited fields. RT has been successfully implementing this paradigm since the 80s of the last century, when an intensive decline in oil production began in the supergiant Romashkino field. Now it is time for Russia too. However, the effectiveness of working with the so-called depleted giants would be significantly higher using the reorganization and replenishment mechanism, which was discussed at the conference.

4. Formation (generation) of oil and gas fields

Issues of oil origin at the conference were central. The main emphasis was on abiogenic oil. Although advocates of a mixed (polygenic) paradigm spoke out. Hydrocarbon synthesis occurs only in biogenic and abiogenic ways.

Thus, disputes (discussions) between the two paradigms of the origin of oil were essentially unproductive. They did not bring any benefit to the joint efforts of scientists in the synthesis of oil. And most importantly, they diverted the attention of researchers from the most important scientific and practical problem – the formation of oil and gas fields. That was a mistake. The very form and content of the discussions did not contribute to the progress in solving the most complicated problem – the knowledge of the laws governing the formation of deposits. The joint work of supporters of biogenic and abiogenic theories on the formation (generation) of oil fields (deposits) would be much better.

There are many concepts of the oil origin today. This apparently happened due to confusion in terms: the genesis (called the origin) of oil and the formation of oil deposits. The latter was confused with the origin of oil. But it has already formed by combining hydrogen and carbon. Under certain conditions, an oil field is formed from this compound by migrating it into traps of various origins. The conditions for the formation of deposits are described a lot. Even the laws of formation and distribution of oil and gas fields have been formulated, depending on geological conditions. The latter has nothing to do with the origin of oil.

The most complete problem of the origin (synthesis) with the formation of oil and gas fields is described in the report of A.A. Barenbaum: “The scientific revolution in the problem of oil and gas formation: deep degassing and the hydrocarbon potential of the subsoil in the light of new ideas”. The author proposes biosphere concept

of oil and gas formation as a most comprehensive one. He classifies oil and gas as the planet's minerals replenished during the exploitation of deposits, and considers the deposits themselves to be traps of mobile carbon circulating through the earth's surface in three cycles of the cycle of $\sim 10^8$ - 10^9 , $\sim 10^6$ - 10^7 and ≈ 40 years. The rate of replenishing hydrocarbon deposits in this cycle is determined by development technologies and generally depends on the level of modern production and consumption of oil, gas and coal in the world.

It should be noted the main point of the new biosphere concept – the circulation of carbon and water through the earth's surface into the interior (into the mantle) and into the biosphere. This cycle, obviously, takes place in most concepts of the formation and reformation of oil deposits. This is the universality and greatest appeal of the new paradigm of A.A. Barenbaum. In his paradigm, he tried to combine the genesis of hydrocarbons and the formation of deposits. A.A. Barenbaum gives the main role in replenishing reserves of exploited deposits to the third biosphere cycle, which, according to the author, is 40 years. But this statement is not confirmed by the facts of long-term exploitation of oil fields. If the biosphere cycle was mainly used to replenish the reserves of the long-exploited Romashkino field, then for 70 years of its operation we would have produced 1.7 times more oil (than in fact) or the remaining reserves here would be 23.6 times more than today on the official balance sheet. What is the matter?

The fact is that the recharge processes, we believe, go through the existing oil supply channels in the CB, and the rates of natural recharge are tens, hundreds of times less than the production rate. If everything went along to Barenbaum paradigm, then we, the geologists working at the Romashkino field, would have seen this process visually 40 years ago. But we sensed the existence of the recharge process (rather than determined). Then, analytical geological and geophysical and geophysical studies were carried out to identify this process on the Minnibaevsky area of the Romashkino field. These works were successful.

A.A. Barenbaum believes that the rate of replenishment is determined by development technologies and the level of oil consumption. In Soviet times, they took everything they could give from the field, using the most advanced technologies in the world, but they could not fix the reserves. In order to fix this feed, it is necessary to apply special technologies that provoke this feed. But we did not have them then and do not have them today. There are ideas on how to do this, but given the current state of the industry and the attitude of oil companies, this is not yet possible. Too complicated and expensive.

Thus, it is impossible to consider the process of replenishment of exploited oil fields in the third cycle of A.A. Barenbaum. Apparently this cycle is not related to

replenishment. We need to study the question of where the hydrocarbons of this cycle disappear. And the big doubt is that this cycle is so short. Too seductive and unrealistic.

The question of the duration of all three cycles of A.A. Barenbaum obviously needs additional research and justification.

The report of V.K. Utoplennikov "The geodynamic conditions of mixtgenetic formation of oil fields in the basement of South Vietnam" was of great interest. It talks about the conditions for the formation of deposits.

The author identifies three oil generation zones: mantle-asthenospheric – abiogenic synthesis; subduction-dissipative – biomineral synthesis; stratospheric – biogenic synthesis.

The mechanism outlined by the author seems to be the most realistic in the specific conditions of South Vietnam. It falls under the organic and inorganic synthesis of hydrocarbons and shows their role in the formation of deposits in CB.

S.A. Punanova in her report "Oil and gas potential of the crystalline basement and the formation of non-structural traps of a combined type in it" gives another mechanism of formation.

In the Cuu Long basin of Viet Tam, through the contact of protrusive granites of the pre-Cenozoic basement with the Cenozoic sedimentary cover, lateral migration of fluids took place from the oil-source strata of the Oligocene age to the basement – into voids and zones of increased fracturing, into the formed fissure-cavernous reservoir of a combined type.

Other geochemical features of the oils occur in the erosion protrusions of the crystalline basement, however, the genetic proximity of the oils from the basement and from sedimentary formations also appears. Here the oil forms a zone of hypergenesis. S.A. Punanova writes: "It is worth recognizing that naturally destroyed crystalline rocks of the basement are a global geological phenomenon".

V.R. Shuster and S.A. Punanova made an attempt to investigate the prospects of oil and gas potential of the pre-Jurassic deposits and basement formations in 25 exploratory areas with gas and gas condensate deposits.

To identify promising objects, taking into account the high probability of detecting complex (non-structural) type traps in deep-seated sedimentary deposits and basement formations, it will be necessary to use modern seismic exploration technologies of CDP 3D waveforms using scattered waves, which are especially effective in the basement formations, where stages are still distinguished at the pre-drilling stage zones and areas of distribution in the context of unconsolidated reservoir rocks.

L.E. Zagránovskaya and O.A. Zakharova lead various types of deposits in the CB.

A.P. Zapivalov leads deposits in CB in rift systems.

If the processes of hydrocarbon synthesis are more

or less clear, then the processes of formation of oil and gas deposits are diverse and depend on a variety of geological conditions. Knowing them requires high technology, geological and geophysical, laboratory and other studies, a high level of analysis and generalization of natural processes. This is the complexity of the problem. The variety of geological conditions for the formation of deposits should be the subject of a detailed study, especially in complex areas and unconventional objects such as shale deposits in the United States, Bazhenov deposits of Western Siberia, Domanic of the Volga-Ural oil and gas province.

5. Reformation, re-feeding, replenishment of reserves of exploited fields

The pivotal issue of the conference was a discussion of the consequences of discovered a quarter of a century ago an important natural phenomenon by the Russian scientists – replenishment of oil and gas in fields at the late stages of their development. Currently, in oil and gas geology, a scientific revolution is taking place that has led to the idea that oil and gas are indestructible minerals of our planet, the replenishment of which in field depends on the technology of field development.

Most scientists today associate this phenomenon with the flow of hydrocarbons from the basement. Therefore, many reports focused on an in-depth study of the crystalline basement as a supplier of oil and gas to sedimentary cover deposits.

The facts show that the use of this phenomenon in practice, with a careful attitude to traps, will open the possibility of exploiting oil and gas fields as inexhaustible sources of hydrocarbon raw materials. The transition to such field development technologies is one of the most urgent tasks posed by modern geological science to the country's oil and gas industry today.

Tatarstan geologists have been involved in the hydrocarbon potential of the CB for about 50 years. During this time, they moved from the idea of oil searches in the CB near the South Tatar Arch to the necessity and expediency of a priority study and assessment of the role of the crystalline basement in the formation, reformation, replenishment of oil and gas fields due to the inexhaustible hydrocarbon potential of deep degassing of the Earth.

It was proved that the crystalline basement plays a role in the constant “recharge” of oil deposits in the sedimentary cover with new resources due to the inflow of hydrocarbons through hidden cracks and gaps from the depths of the Earth. It was shown that the South Tatar arch has a single source of oil generation for oil and natural bitumen deposits, as well as the formation of deposits due to vertically ascending migration of oil and gas fluids through faults that cut through the crystalline basement and lower horizons of the sedimentary cover.

Subsequent in-depth seismic studies of the CDP, presented on regional profiles in the Samara region, in Udmurtia and, most importantly, on the Tatseys geotraverse, which crossed almost the entire Volga-Ural oil and gas field, led to the most important conclusion that the structure of the earth's crust and upper mantle beneath large oil accumulations is fundamentally different from other territories.

Subvertical anomalies are observed under most of the fields listed by the geotraverse, but most of all under the Romashkino and Novo-Elkhovsky giant fields.

Based on the data with a large number of oil and gas fields of the world discovered in the rocks of the CB, and our research, it is possible to consider the CB of the Russian Platform as an object of independent search. But it is extremely expensive and technically difficult to carry out conventional oil and gas exploration work in the CB. The lack of search technologies and drilling techniques in the extremely difficult geological conditions of the CB has led us at the present stage to abandon the immediate implementation of this idea. In its place the idea came of getting oil from CB through sedimentary cover deposits, using the mechanism of “feeding” sedimentary cover fields.

The most convincing argument in favor of the natural replenishment of oil reserves in the developed fields is the numerous facts of oil production excess in a number of fields over the estimated balance and recoverable oil reserves, which we wrote in the book “The role of the deep degassing of the Earth and the crystalline basement in the formation of the Earth and natural replenishment of reserves of oil and gas fields”. Over the years, this difference increases. For some fields, it becomes difficult to justify the volume of oil production due to their constant depletion (in this case, it is necessary to raise the estimated parameters – porosity, oil saturation, oil recovery factor, to the maximum theoretically possible). On such objects, the perception of completion has gone through all stages: hypothesis-theory-experience-observation.

A.P. Shilovsky tried to connect the oil content of the sedimentary cover with the trap inflow of magical substance into the sedimentary cover. The report is interesting, but in RT the question remains unstudied.

Many reports were devoted to search criteria for decompression zones and methods for their detection (A.E. Desyatnikova, P.A. Shakhov, T.A. Kireeva, S.A. Punanova, M.V. Rodkin, M. Emanuel Hossein, G.P. Kayukova, R.R. Lukyanova, etc.).

Thus, the constant replenishment of production deposits is an indisputable fact. But it has not yet received universal public recognition.

V.A. Trofimov makes recommendations for searching for sites where recharge is most likely possible: “It has been established that fields with accumulated production

volumes exceeding geological reserves are confined to: the boundaries of large tectonic blocks; to areas of reduced sulfur, tar and asphaltenes". Detailed work on the localization of feeding centers is detailed in the reports of R.Kh. Muslimov and I.N. Plotnikova.

Currently, in matters of abiogenic oil, RT specialists have adopted as a priority the concept of feeding sedimentary cover fields from the depths of the Earth through the CB rocks through oil supply channels, crushing zones, and fractures of different generations. Despite the global scale of these processes, there are many ambiguities, mechanisms, scales, paths and driving forces. All this is due to the lack of reliable methods of localization and study of the mechanisms of these processes. Seismic data show zones of fracture, crushing, channels, but there is no guarantee that they really are hydrocarbon transport channels (can be healed, filled, fracture products, etc.). From observations of long-exploited fields, it can be concluded that processes are relatively slow, which usually pass by our attention.

The development of the field's reserves by modern methods is carried out by temps significantly larger than the recharge.

The slow refueling process against the background of the rapid extraction of oil makes many doubt the very possibility of refueling (report by R.Z. Mukhametshin "The facts of the renewability of reserves in the developed oil and gas fields").

Moreover, we are doing everything against the functioning of these processes, developing these areas together with the entire reservoir using intensive waterflooding systems at relatively high reservoir pressures. On the other hand, if we tried to initiate the processes of replenishment by artificial pressure reduction, we would (as shown by many years of research at the Romashkino field by M.V. Belonin, R.S. Sakhigareev) contribute to a decrease in the permeability of the reservoirs. This is especially harmful for fractured formations. All this speaks of slow-running recharge processes and the need for targeted measures to intensify this process (hydraulic fracturing, the use of crack fixers, optimization of pressures and fluid withdrawals). This contributes to the fact that we do not visually see the results of this recharge and cannot quantify it. However, for a number of deposits (sites) we know reliably how much oil was taken. If more recoverable reserves, and especially balance reserves, were selected, then the recharge mechanism works. All of the above indicates the complexity of the problem. The disbelief in the very existence of the recharge processes is even greater difficulty. I'm not talking about supporters of biogenic synthesis (they will always be opposed). But even some researchers who do not so abruptly deny abiogenic synthesis introduce a spirit of doubt into the theory of fueling.

6. Practical steps for using the recharge processes of exploited oil and gas fields in development design

With the development of civilization and geological exploration, hydrocarbon production on Earth is growing, but at the same time, the proven and so-called initial potential resources (IPR) of HC are growing. Thus, by the beginning of the last century, oil IPR was estimated at about 5 billion tons (this is not much more than modern annual oil production). The Earth itself provides us with HC and, obviously, will provide further.

Since we do not know all the processes of their synthesis, all possible ways to obtain hydrocarbons, why not assume the reverse carbon production from the rocks of the earth's crust? In addition, when using HC as a fuel, carbon remains as a combustion product (CO₂, CO) and can, according to A.A. Barenbaum, create man-made deposits.

At the conference, the role of CB and recharge in the formation of oil deposits in shales and dense (currently considered non-reservoirs, but oily) rocks in the sedimentary cover (reports by R.Kh. Muslimov and I.N. Plotnikova) was weakly sounded. Despite the extremely poor knowledge of this problem, it becomes (against the backdrop of the shale revolution) particularly important.

Given this important direction, we have to admit that in-depth study of CB becomes the most important task of science today and in the future.

The conference identified priority areas of work on CB:

- the study of the fields relationship of sedimentary cover with a crystalline basement, understanding that knowledge of the geological structure of the CB is the key to the search for oil in the sedimentary cover;
- study of the oil and gas generated and oil conducting role of CB;
- study of the established phenomenon and the role in the constant "feeding" of oil deposits of sedimentary cover with new resources due to the inflow of hydrocarbons through hidden cracks and gaps from the depths.

It is emphasized that the data obtained on the reorganization of deposits and replenishment of exploited deposits of sedimentary cover allow at the present stage to begin the practical implementation of fundamentally different approaches to the development of oil fields. The experience of the Republic of Tatarstan shows that this must be done through innovative design of development processes.

7. Innovative approaches to the development of oil fields based on the process of Earth degassing and replenishment of hydrocarbon reserves

Such design should be based on a mixed (polygenic) theory of the origin of oil and gas, the formation and

reformation of industrial accumulations of oil and gas.

A lot needs to be done to move from modern development design (without reformation and recharge) to design with these processes in mind.

First, science and oil companies need to develop a methodology for constructing geological and geological-filtration models of long-exploited oil and gas fields, taking into account the processes of reorganization and replenishment of hydrocarbon reserves by feeding them from the depths of the Earth due to degassing of the bowels.

Secondly, the Academy of Sciences of the Republic of Tatarstan, together with the oil companies of Tatarstan have to develop appropriate instructions based on the provision that the monitoring system should be two-level. The first level is the analysis of geological and field data and the identification of potential areas of migration of hydrocarbons into the deposits based on the use of geological and field anomaly criteria established earlier in the Republic of Tatarstan. The second level is the geochemical studies of oils and gases dissolved in them both within the wells with signs of anomalies and in adjacent areas of the reservoir.

Thirdly, it is necessary to envisage the use of proven technologies for field exploitation in full (at the level achieved) of enhanced oil recovery methods, bottomhole zone treatment and regulation of development processes in areas where there is no recharge. And where it is, create conditions for its activation (pressure reduction, acceleration and increase in the volume of recharge) by artificial means.

It is also necessary to begin work on modeling the processes of reformation and replenishment of oil reserves in the long-term developed major fields of the Russian Federation and the Republic of Tatarstan.

Currently, scientific organizations of the Republic of Tatarstan are scientifically ready for such work. The case is oil companies, organization and financing of these works.

8. The world's growing interest in the study of CB

The growing interest in the world should be noted on the problems of hydrocarbon search and the assessment of the role of CB in the formation, reformation and migration of oil and gas fluids. Particularly noteworthy is a review report by T. Köning (Calgary, Canada), "exploring in Asia, Africa and the Americas for oil & gas in naturally fractured basement reservoirs: best practices & lessons learned".

The reports on the prospects in Kazakhstan (M.N. Babasheva, S.N. Nursultanova: "Prospects for the oil and gas potential of the basement of the South Turgai basin"), in Uzbekistan (E.S. Abdulaev et al., "Show great interest in the topic under discussion"). The hydrocarbon

potential of the Paleozoic formations of the basement of the oil and gas regions of Uzbekistan"), in Azerbaijan (V.Sh. Gurbanov, N.R. Narimanov: "The forecast of the oil and gas potential of the basement of the South Caspian megabasins"). The latter focuses on the study of the relationship between CB and sedimentary cover.

9. Priorities

Unfortunately, the management of the country's geological service practically did not take part in the issues discussed at this conference. There was only one report of the General Director of the State Reserves Committee I.V. Shpurov. In his report, he did not speak at all on the issue at hand.

The following statement by A.A. Barenbaum is very alarming.: "The lack of a universally recognized paradigm regarding the origin of oil and gas – and this is a key issue in oil and gas geology, according to paragraph 3 of T. Kuhn's theory, casts doubt on the fundamental ability of oil and gas geology to solve this problem. Kuhn's verdict that in such a situation "All members of the scientific community seem to be engaged in science, but the combined result of their efforts hardly resembles science in general," is convincingly confirmed by the years of irreconcilable struggle of supporters of organic and mineral hypotheses on oil and gas formation".

First, the origin of oil in petroleum geology is not the only key problem. We have a lot of them. These are the problems of prospecting, exploration, development of oil fields, oil displacement and enhanced oil recovery processes, the mutual influence of CB and sedimentary cover, etc.

Secondly, the struggle of supporters of biogenic and mineral theory was not useless. Those and other scientists made a great contribution to the development of science, which allowed today to come to the recognition of both synthesis, which contributes to this direction to move forward in the formation and reformation of oil deposits. The disadvantage was the manner of these discussions and the error in the substitution of concepts – the synthesis of hydrocarbons and the formation of deposits.

Thirdly, petroleum geology as a science has constantly evolved. It simply could not fail to develop, as it deals with specific objects of research. The fact is that all deposits are unique in their structure. There are not even two identical deposits in the world. Each field is individual and requires individual approaches to its development and development of reserves.

Therefore, here scientists who offer their opposite recommendations are often right. So a grid of wells of the same density for one object may be excessively dense, and for another very rare. Or, the use of surfactants to increase the oil recovery factor in one case gives a positive effect, in the other – a negative effect, and in the third – no effect. It all depends on the clay component

in the rock. There are hundreds of such examples. There is nowhere without science. Therefore, oil science must not be criticized. It should not be proposed to remove the concepts of “abiogenic” and “biogenic” carbon (of course, both are just carbon, but separation is necessary for understanding the source), CB, oil source formations, degassing. All this exists and is used to understand each other. The concept of “initial potential resources” is necessary, but the concept of geological reserves is even more necessary. This is the start from which we have to begin if we want to determine the future effect of recharge.

According to Alexander Losev, member of the Presidium of the Council on Foreign and Defense Policy, financier and mathematician, “technological degradation is occurring in the world and, in essence, the destruction of science. Everywhere. Everything is replaced by technologies that allow you to quickly recoup costs. Project financing triumphs in science, grants are allocated for a period of 2-3 years. If scientists do not give returns in 3 years, funding will cease”.

But in general, any real science finds a way out of any impasse.

In the regions, they better understand the issues of studying CB and deep abiogenic oil and are ready to work scientifically on these problems. Of course, it would be good to draw up an all-Russian program on the problems of deep oil. But today, the management of the geological service of the industry is not at all ready for this.

The conference considers it necessary:

- The State Reserves Committee to change the methodology for calculating reserves, which includes both conditioned and substandard reservoirs and interlayers in the reserve calculation object;

- ask the Central Reserves Commission to develop a methodology for identifying and accounting for additional hydrocarbon resources through reformation of fields and replenishment from the depths of the Earth's bowels;

- the Central Reserves Commission to create a methodology for innovative design of oil field development at a late stage of operation, taking into account additional resources obtained through the reformation of deposits and replenishment of hydrocarbons from the depths of the Earth;

- The Ministry of Natural Resources should ensure the development of instructions on methods for research and monitoring the processes of reformation and replenishment of hydrocarbons from the depths of the Earth at a late stage in the exploitation of an oil and gas field.

Naturally, it is necessary to provide centralized funding for the development of these documents.

A.I. Timurzиеv considers fundamental oil an alternative to shale. However, it would not be worth raising the question. The resources of shale oil and gas are huge. True, this includes hydrocarbons of dense rocks, the resources of which are greater than those of shale origin. But these are extremely difficult geological conditions, the development of which is difficult and expensive.

What the United States did to mine these hydrocarbons is worthy of all praise and respect. However, they did a technical miracle, not an attractive development of these resources. Indeed, the design oil recovery is 8-10%, which extremely small. Mastering these resources will always be expensive. Technique and technology will develop, and geological conditions will be continuously complicated (this is the law in the geological part of the development of deposits in any region). It is necessary to deal with these objects. But not all countries can do this.

The resources of abiogenic deep hydrocarbons are inexhaustible. They are designed for the entire life of planet Earth. Therefore, we call them renewable. Many people know this, but this is not visible in the foreseeable future. The reason is that the current situation with oil and gas prices (as it is considered non-renewable) suits everyone (oil industry workers, gas workers, producer countries and even hydrocarbon consumer countries, for which price stability is most important).

This situation may continue indefinitely. But the problem of prospecting and searching is very complex and long, and the use of reorganization and replenishment processes is also very complex, knowledge-intensive and costly. But the theory of renewability and the ability, due to these processes, to provide all the needs of an ever-growing and demanding comfortable life of the world's population is too attractive. They need the usual and most convenient types of resources – oil and gas. This is not only energy, but also much more necessary for the life of the population.

The conference was successful, with the benefit for the further development of the issues of in-depth study of CB.

Unfortunately, it failed to adequately cover the problems of using the processes of formation of oil fields in the design of field development systems. This direction was most significant in the report of R.Kh. Muslimov, a little in the report of S.N. Zakirov, in a report by A.F. Yartiev and V.A. Iktisanov, as well as at V.A. Trofimov.