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Technological Foundations for Drilling Rapal Deposits under Difficult Conditions

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Abstract – The article discusses the difficulties of drilling salt deposits, their prevention and elimination, the chemicals used, the requirements for the drilling fluid, its preparation, water permeability, density, viscosity, static shear parameters and lubricants, as well as the definition of filtration parameters.

Keywords – Halogen, Syneclise, Tectonics, Gravitational Motion, Salt Pools, Swamp Formation, Rapier Lenses, Complex Works, Geophysical Survey, Drilling Of Swamp Layers.

I. INTRODUCTION

Properties of high pressure formations, formation processes, salt tectogenesis, formation under the influence of temperature, accumulation of oil and gas in tectonic faults, well profile during drilling falls. In this direction, a number of scientists A.K. Aliev, A.I. Aliev, V.V. Bakhtin, N.B. Vassoevich, F.A. Gezalov, V.N. Zelberman, A.L. Kozlov, I.G. Kissin, V.S. Melik-Pashaev, I.I. Nesterev, G.P. Ovanesov, A.A. Orlov, E.M. Khalilov, A.K. Rakhimov and others on the amount of pressure in the process of drilling and development of productive formations cause various complications, the formation of formations, made scientific conclusions about the dependence of properties [1.2.3.4].

The authors present a number of scientific ideas about the occurrence of unusually high reservoir pressures (AHRP) in their paper, which outline the authors' perspectives on AHRP formation. While some studies have accurately proven one theory for AHRP's development, others have indicated that AHRP's birth is dependent on specific geological conditions. The presence of salt water in salt basins means that the layers are buried together or precipitated under gravity, resulting in the creation of salt-layered crystals (brine) between them. It's also worth noting that the rapid compaction of the rock and its subsequent compaction into an impermeable layer leads us to believe that compression occurs not only at the bottom, but also at the top, allowing the amount of brine to reach the bottom of the layer as a result of salt layer compaction.

When a heavy river descends due to gravity, it forms a conical flow. If the surface is flat or sloped, salt water flows over it; if the surface is convex, salt water gathers in it.

Separation of flows occurs as the conical flow flattens and the most concentrated water collects at the base. As a result, salt water is positioned at the bottom of the system.[1.2.3.]

When a heavy leak reaches the impermeable layer, the contact between them is disrupted, and salt water with maximal internal mineralization reaches the impermeable layer in the form of elongated drops, reclaiming the conical flow. Depending on the source of salt water, a direct or reverse vertical hydrochemical zone is formed by the flow's long-term gravitational movement and the presence of impermeable layers at its speed.

When practical data was examined, it was discovered that the samples include 99 percent dissolved sodium, chlorine, potassium, calcium, and magnesium salts. Moisture went out through a round hole to the surface, along the trenches, and did not mix with the solution when wells were halted for a long time. [1.2.3.4]

Surface equipment, drill and reinforcing pipes, and cement stone are all corroded by anhydrite-salt strata.

The rising of the oil-water contact line caused water to rise through perforated holes in fields that had been exploited for a long time, including Northern Urtabulak, Kokdumalak, Western Tashli, Eastern Tashli, and many others.

Brine zones are very common in exploration areas, in areas where oil and gas fields are being drilled. These zones include anhydrite-salt strata, which include Dengizkul (well No.19), Urtabulak (well No.20), Nishan (well No.1), Kultak (well No.1-P), Aloviddin (well No.3), Alkaimok (wells No.1,2,3) is found in the form of Jurassic salts in the deposits of Tashkutan, Kamashi, Feruza, Garmistan.

It was found that the pressure in this layer is high, and the coefficient of anomaly is higher than 2. When this layer was opened, the technical column was lowered for several months and spontaneous crystallization occurred, which caused blockage in a clogged state.

To pass the formation of the brine zone, a drilling mixture of increased rigidity and resistance to salts was prepared. General methods of passing through such zones have not been developed, and heavy washing solutions have been pumped out, which, if possible, has been eliminated, or drilling has been stopped.

For example, at the Kokdumalak field (wells 202, 203, 209, 272, 275), various problems have been eliminated due to complications, or drilling has been stopped at some of them [10.11.12.13.14.].

At well No.275 in the Kokdumalak area, it was reinforced with columns 299mmx362mm and Quaternary Neogene, Paleogene and partially Upper Jurassic deposits were exposed. At a depth of 2225 and 2260 m, a strong brine was formed in the upper anhydrite layer with a flow rate of 50-55 l/sec and a density of 1.13 g/cm^3. Due to difficulties during the drilling period, there was a state of compression of the drill string during the crystallization of brine. A cement bridge was installed to continue drilling and the problem was solved.

According to the map compiled by geophysicists, the presence of rapeseed in the thicknesses of wells in the Kokdumalak region was shown, but their efficiency was low. Brine was observed in 9 (36%) of the 25 observed wells. At the same time, brine dips were found in wells 111, 125, 143, 144, 249, 275 of the field.

In the area under consideration, when drilling oil and gas fields, a large layer of the rapal zone is encountered. When drilling anhydrite-salt strata, the strongest brine zones are mainly Dengizkul (well No.19), Urtabulakskaya (well No.20), Nishanskaya (wells No.1,No.3), Kultakskaya (well 1-P), Aloviddinskaya (well No.3) and Alkaimok (wells No.1, No.3), and their origin corresponds to the rock of the Upper Jurassic salts of the Jurassic age.

Table 1

№	Rapal zone, block	Total wells	brines	without brines	Exit Confirmation %
1	Southern	13	5	8	38%
2	Western	2	1	1	50
3	Medium	1	-	1	0

4	Northern	7	2	5	28
5	Eastern	2	1	1	50
Total:		**25**	**9**	**16**	**36**

We know that the brine-containing areas are mainly the formation of a crystalline state due to the process of cementation of salt water from the upper layer under the action of gravitational forces. These rapal layers enter the lenticular layer and form crystals. The color of the lens is the appearance of a reddish cloudy sandy form. When drilling a single well in the Beshkent bend, it was found that the sample is rich in coarse-grained red clay. In addition, the geophysical data of the Beshkent slope show that gray rock salts, anhydrites, clays and, in some places, potassium salts are also found. Solonchak formations are also found in the Beshkent, Dekhkanabad, North Guzar, South Tandyrchi, and Karlik massifs.

According to the methodology, lenses containing brine have a high anomalous coefficient. (KA>2). Wells Dengizkul No.19, Kutlug No.1P, Alkaimok1, No.13 were drilled for several weeks. As a result of self-crystallization, a salt plug was formed.

During the passage of the rape zones, very heavy salt-tolerant solutions are pumped into the upper water layer under high pressure.

It is known that when drilling with heavy fluids, gas or oil is released due to the opening of the reservoir channel of the formation due to mud absorption in the lower sections of the well and causes complications in the wellbore. Overcoming complications is time consuming and costly, and well test results deviate from the actual size. AHRP increases the energy resource of the reservoir, and its presence is one of the positive factors in the operation of oil and gas condensate deposits. [4.5.6.]

There are a number of features of the use of high-pressure gas fields. Examples of such fields are Zevarda, Cholkuvar, Pomuk, North-Shurtan and other gas condensate fields. One of the main causes of anomalies in the work is the increased deformed state of the productive reservoir. In this case, at high internal pressure, part of the rock pressure is transferred to the reservoir skeleton. Often in the deposits of AHRP formations, carbonate, fractured-porous. As a result of a gradual decrease in reservoir pressure, the fractures merge, and the runoff in the rock compaction matrix increasingly loses its reservoir properties. In the case of the Zevarda field, we have considered such an interesting set of issues in a comparative direction, since they correspond to the location of the Cholkuvar field.

In AHRP and hydraulic fracturing, absorption pressure is close to reservoir pressure, which in practice also complicates drilling and well maintenance in such conditions.

It is much more difficult to detect abnormally productive formations in conditions of abnormally high reservoir pressure (AHRP) and geologically complex below hydrostatic pressure. In the first case, when drilling with weighted drilling fluids, a large amount of filtrates and aggregates enter the pore zone of the formation, worsening the reservoir properties of the formation and causing skin factors. [7.8.9].

Exploratory drilling showed that the appearance of strong waters always led to the closure of the well. Wells were drilled at the Cholkuvar field in 2006, well No.8 in 2008, and well No.10 in 2013, after which an accident occurred. At the same time, the appearance of hydrochloric anhydrite liquids in the well was observed.

In many cases, work was suspended because it was difficult to continue with normal drilling operations and provide reliable reinforcement when opening wetlands.

Due to the fact that this type of work requires a large amount of material and labor, it is recommended to take into account the possibility of moisture formation during the preparatory stages of deep drilling, exploration and earthworks, and as a result, dig wells outside the zone [10.11.].

Water is present in fractured anhydrites in brine lenses and porous phases, as well as in hydrochloric anhydrite contact formations. In order to combat brine formation, it is proposed to install a cement bridge over the formation zone and drill a second column[12.13.14].

Our assumption is based on the fact that, since the lens has a limited area, the second column of the well is replaced by a zone of moisture formation. The experience of drilling wells No. 10 in the Zevarda area showed that this proposal had not been finalized.

Our recommended methods against the appearance of saline:

1. Close the mothballed well with a cork to quickly protect it from salts.

2. Blocking the appearance of water with cement materials does not give the desired result.

3. Covering the salt-anhydrite section with a casing string is also ineffective: no matter which casing pipe is tight, either a leak occurs behind the pipe, or highly mineralized water forms. When closing such zones, a solution of the required density was used, as a result of the deterioration of drilling due to the formation of water at the level of the head of the column during covert lowering of the pipes. Many times the casing has bulged between potassium and magnesium salts.

4. Flow suppression by heavy drilling fluids.

This basic method does not provide results for intervals prone to hydraulic fracturing in the reservoir section. Loss of drilling fluids leads to a decrease in pressure at the bottom of the well and the formation of moisture in the wellbore. [1.2.3.4.]

Abnormally High Reservoir Pressure (AHRP) remains important in the early stages of oil and gas well operation. In particular, when the pressure in the formations of the fields (AHRP) decreases to hydrostatic, which is associated with swelling, compression and erosion of the wellbore in saline and clay layers, it is necessary to pass through such layers with heavy drilling fluids. , and sometimes with chemically treated alloys. Therefore, reinforcement with a combination of reinforcing pipes is required when opening halogen, clay and other formations subject to erosion and drilling in difficult conditions. In turn, drilling continues with conventional unweighted fluids and the well is successfully run downhole.

Data on the geological structure, reservoir pressure, reservoir properties, well results and deposits near the Cholkuvar field (Aknazar, Northern Aknazar, Beshkent, Kamashi, Kultak, Northern Nishan, Ghirsan, Pomuk, Zevarda, Kokdumalak, etc.) No. 2 at the bottom of the face by the presence of Kimmeridgian-Titanium salt deposits. An 80-90-meter anhydride bundle was drilled to open the productive formation (XV). The opening of the brine is formed by the precipitation of water in its entirety, resulting in the formation of natural gas.

Thus, in the Cholkuvar area No.2, No.10 wells, the reason for the formation of brine-gas is that the geology of the mouth is not well understood, the unpredictable brine-lens and the structure are damaged. Even when a mud solution with a density of 2.20 g/cm^3 was injected into the well, brine formation could not be prevented, and gas leaked during pumping through the wellhead equipment. [10.11.12.13.14.15]

The fact that the well crosses tectonic faults in salt deposits is interconnected with the underlying reservoir, such a situation in oil and gas geology is very rare, it is unpredictable, the formation of brine-gas is a geological challenge.

Geothermal conditions in the field of oil and gas are one of the main factors in the formation of AHRP. The increase in temperature in the reservoir is associated with tectonic movements and falls over large areas and causes a sharp change in temperature from the surface layer of oil to shallow. The formation of catagenetic processes of intrusive massifs, volcanogenic-sedimentary complexes, fissure systems, solonchaks, as well as organic matter increases the temperature of the layer at the boundary of the clean zone and affects the formation of AHRP. [18.19]

Salt tectogenesis is widespread in the Amudarya delta of the Chardjou depression and in the Bukhara-Khiva oil zone, as well as in other regions. Salt domes and rock salts play a large role in the formation of oil and gas field handles. Such formations can be observed in the geological location of the Zevarda, Alan, Pomuk, North-Shurtan and Cholkuvar areas. These deposits are characterized by deformation of sedimentary deposits, shear penetration into solonchaks, active penetration of salts and simultaneous uplift of layers. The specifics of salt diapirism led to the rise of salt emissions through the intervals of deposits above them. Leverson scientifically substantiates his theory of the plastic flow of salt by the fact that salt presents itself in the form of a highly viscous liquid or in the form of a plastic substance, and also has the property of readability. This can be seen from the composition of the products produced during the drilling and operation of the Kokdumalakskoye field. If we observe the accidents that occurred during the drilling of wells No.2, No.10 and No.13 at the Cholkuvar field, then the high pressure gas appeared at the initial stage of the eruption, and then the salt mixture was released, is proof of this. [10.11.12.13.14.15]

Due to the lack of inspection data on gravitational motion, it was neglected in practice. A systematic study of these problems began in 1938 at Moscow State University (MSU) [1.2]. Exploration data show that highly mineralized waters are located at the top of low-mineralized deposits, redistributing them by specific gravity.

II. Conclusion

A scientific analysis of data on predicting promising technology was carried out before the start of drilling operations under AHRP conditions and during drilling. Selection of the optimal well drilling mode at the beginning of deep drilling under conditions of abnormally high reservoir pressures, determination of physical and mechanical properties and parameters (density, viscosity, water cut, SNA, sand composition, etc.) to prevent erosion of the formation, well wall, it is important to predict the delay drilling tool, eruptions and open fountains.

The presence of experienced and highly qualified teams and the availability of modern drilling equipment, the preparation of high-quality flushing solutions and the timely provision of the necessary materials and reagents are of great importance for the successful drilling of reservoirs with the AHRP complex in difficult conditions.

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