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Optimizing Technology of Drilling Fluid for Improving Logging Success Rate of Central Area of Junggar Basin

HE Licheng[a],*; ZHAO Huaizhen[a]; ZHOU Fei[a]; LI Xiuling[a]

[a]Sinopec Shengli Petroleum Engineering Co., Ltd., Dongying, Shandong, China.
*Corresponding author.

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Abstract

The characters of deep wells in the central area of Junggar Basin include the burial depth of the reservoir is deep, the temperature of borehole bottom is high and the middle and the lower formations are developed with hard and brittle mudstones. The Toutunhe Formation and the Badaowan Formation are full of micro fissures which frequently caused sloughing, borehole wall collapse to happen. The average well diameter expansion rate exceeds 15% and logging instruments got blocked frequently. Based on the analyses of mineral composition and physical and chemical properties, Optimized drilling fluid formula was presented after evaluation of different size plugging agents and lubricants in order to heighten tight plugging performance. The result of Pressure Transmission experiment indicates that after optimization drilling fluid can prevent or stay the pressure transmission in mudstone effectively. The formula has been applied in Well Cheng 6 and the high-temperature and high-pressure filtration loss was only 8.0mL, the average well diameter expansion rate was less than 5%. The logging success rate reached 100%, exceeding the research target of 80%. Using this formula, the goals of stabilizing borehole wall and enhancing logging success rate have been achieved.

Key words: The central area of Junggar basin; Borehole stabilization; Logging success rate; Tight plugging

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Completion logging is an important part in the drilling and production process, also known as open-hole logging[1]. In recent years logging instruments sticking often occurred during the logging construction of some deep wells in the central area of the Junggar Basin, resulting in complex downhole conditions such as repeated wiper trip, increased drilling cost and prolonged well construction period. Logging instruments got blocked three times at the same well depth in Well Sha 15. The most positions of obstructing were in the middle and lower sections, mainly including the Toutunhe formation, Xishanyao formation and Sangonghe formation.

Although many kinds of inhibitors, anti-sloughing agents and various plugging materials had been applied in the drilling fluid, the problems of hydration expansion and dispersion caused by micro-fracture seepage and wellbore collapse caused by hydration stress were not solved effectively[2-4]. The formula of the sealing slurry before logging was determined by engineer's experience, lacking formation targeting and systematic performance evaluations. Aiming at low logging success rate of complex deep formations in central area of Jungar Basin, the research focused on improving the micro-fracture plugging ability and high temperature suspension ability of drilling fluid in order to reduce the risk of wellbore instability, significantly heighten the success rate of logging and shortening the well construction period[5-7], which had very important engineering application value and significant economic benefits.

1. CAUSES OF LOGGING OBSTRUCTING AND STICKING IN CENTRAL AREA OF JUNGGAR BASIN

1.1 Analysis of Wells With Obstructing and Sticking

The boreholes below 4000 meters of some deep wells in the central area of Junggar Basin were in the shape of sugar gourd with many steps in 2019. During the logging construction, the instruments got blocked in lowering or lifting progress. The survey of deep wells logging conditions is shown in Table 1. The logging constructions of 50% deep wells could not carry out smoothly, as described in Table 1. The blocked formations included Toutunhe Formation, Xishanyao Formation and Sangonghe Formation.

Table 1
The survey of logging construction of deep wells

No	Well	Success rate	Times of obstructing	Drilling fluid system
1	Zhuang 111	100%	0	water based
2	Zhuang 12	100%	0	water based
3	Yong 301	100%	0	oil based
4	Sha 15	66.7%	3	water based
5	Dong 18	77.8%	2	water based
6	Dong 13	60%	2	water based

Well Sha 15 is a vertical well with design depth of 6280m and drilling depth of 6480m. Logging constructions were carried out 9 times after drilling and the instrument got frequently blocked at 5492m. According to the well diameter curve, the borehole of 5480 ~ 5500m well section is irregular with obvious steps, the lithology of which is sand-mud interbed. Well Dong 18 is an exploration vertical well with drilling depth of 5395m. After drilling, Logging constructions were carried out 6 times in total. The first two logging trips were completed successfully, but blocking phenomena occurred at 5300 ~ 5395m. Nuclear magnetic imaging instrument got blocked at 5064m in the first trip and 5214m in the second trip. From the logging results, the average well diameter of the third section is 241.64mm with 11.9% of enlargement ratio. The large wellbore interval is the upper part of the Qigu formation and Toutunhe formation, which is mainly due to the development of formation microfractures and poor cementation ability. When drilling the formation stress was released, resulting in hole collapse. The long time drill stem test resulted in pumping action at the bottom of the well and leaded to further formation instability. Sidewall coring instrument got blocked in lowering or lifting progress for several times in Well Dong 13. The density of drilling fluid was high (1.95g/cm^3) and the pressure acting on the instrument was relatively large, which indicated the instrument was easy to get stuck when lowered or lifted in the irregular borehole.

1.2 Analysis of Rock Samples of Blocked Formation

Aiming at the borehole instability in the central area of Junggar basin, some representative rock samples were selected for X-ray diffraction mineral analysis to determine the whole rock mineral composition and the relative content of clay minerals. The analysis of whole rock minerals and clay minerals of Sangonghe Formation of well Dong 13 and Toutunhe Formation of well Dong 18 are shown in Table 2 and Table 3.

Table 2
Total mineral analysis results (%)

Formation	Quartz	Potassium feldspar	Plagioclase	Calcite	Ankerite	Siderite	Pyrite	Hematite	Clay minerals
Sangonghe	38	−	30	2	−	−	2	−	28
Toutunhe	33	4	14	8	5	2	−	3	31

Table 3
Analysis of clay mineral composition (%)

Formation	Kaolinite	Chlo-rite	Illite	I/S	%S
Sangonghe	0	29	28	43	15
Toutunhe	3	27	34	36	20

According to the analysis results, the rock minerals of deep stratum in the central area of Junggar basin were mainly composed of quartz, plagioclase and clay minerals, each of which accounted for more than 25%. Illite and illite/smectite mixed layer, accounting for more than 70% of the whole clay mineral content on average, are easy to absorb water and expand. Clay hydration will not only reduce the cementation strength of the rock, but also reduce the support strength of the upper stratum. In addition, the content of illite/smectite mixed layer in clay minerals is relative high and the expansion degree of illite and montmorillonite after water absorption are different, resulting in different stress on the surrounding rocks, which causes wellbore instability under the action of external force.

1.3 Morphology Analysis

In order to further understand and analyze the wellbore instability mechanism in the central area of Junggar basin, the rock surface morphology was analyzed by scanning electron microscope, as shown in Figure 1 and Figure 2.

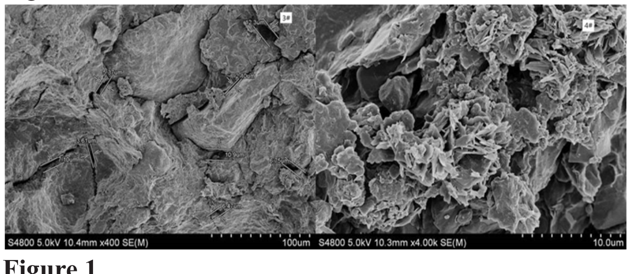

Figure 1
SEM photos of Sangonghe formation rock sample

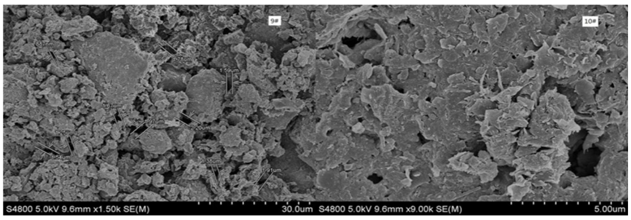

Figure 2
SEM photos of Toutunhe formation rock sample

From SEM photos, it can be seen that the stratum bedding and pores were developed and micro fractures were obvious. The most developed mudstone is massive bedding and horizontal bedding. The pore size of Toutunhe formation is in the range of several nanometers to more than ten micrometers. When the pore size of mudstone is at nanoscale, it is difficult to form filter cake on the borehole wall surface because the solid particles in drilling fluid are difficult to form effective plugging. While the drilling fluid filtrate still can enter the nanopores of mudstone, resulting in the change of the properties of mudstone micro interface, which leads to the instability of hydration expansion. Therefore, matching sealing nanomaterial is necessary to effectively seal nanopores.

1.4 Hydration Swelling and Dispersion Property

The hydration swelling properties of rock samples of Sangonghe Formation and Toutunhe Formation in the central area of Junggar basin are investigated by shale swelling tester. The results are shown in Table 3.

Table 3
Linear expansion performance of rock samples

Time min	5	15	20	25	30	40	50	60	Linear expansion rate %
Toutunhe	0.49	0.53	0.60	0.68	0.72	0.76	0.80	0.84	16.8%
Sangonghe	0.52	0.56	0.60	0.69	0.74	0.81	0.90	0.94	18.8%

It can be seen that the swelling performance of formation rock samples was not very strong and the swelling rate was low, which indicates that although the content of clay minerals in deep rock is high, due to being buried deeply, the clay minerals had fully transformed into illite and other non-expansive clay minerals lessening expansibility of formation rocks.

Take the rock cuttings from the lower formation of well Dong 13 and well Dong 18 and roll them at 150 ℃ for 16h in clean water. After ageing, measure the rolling recovery of rock samples, as shown in Table 4 below. Combining the literature reviews, it can be seen from Table 4 that the rolling recovery rate of rock samples in the same formation in the central area were low, and the highest rate of Sangonghe Formation is 74.6%, indicating that the rock samples had not strong expansibility at room temperature, but had certain hydration ability after high temperature and high pressure.

Table 4
Results of shale rolling recovery experiment

Well	Formation	Ageing condition	Rate of recovery, %
Dong13	Sangonghe	150℃/16h	52.45
Dong18	Toutunhe	150℃/16h	56.86

2. OPTIMIZATION OF DRILLING FLUID FORMULA

2.1 Improvement of Plugging Performance

The plugging property of drilling fluid directly affects the effect of drilling fluid on stabilizing wellbore and protecting oil and gas reservoir. In order to improve the plugging performance of drilling fluid, the optimization of plugging materials was carried out for field drilling fluid samples.

2.1.1 Optimization of Micron Particle Plugging Agent

Calcium carbonate has a wide range of sources and low price, having the characteristics of stable chemical properties, high strength, high temperature resistance and non-hydration deformation. It has appropriate particle size distribution, high compressive strength and the acid solubility is close to 100%, which is fit for the main component of plugging material. Ultrafine calcium carbonate with different particle sizes is always used to adjust the reasonable distribution of particles in the drilling fluid to form thin, tough and dense mud cake, further to reduce the permeability of mud cake, formation pores and improve the anti-collapse effect. Firstly, the particle size grading of ultra-fine calcium carbonate was carried out, then the dosage of ultra-fine calcium carbonate was determined.

Combined with the research of shielding temporary plugging technology and ideal filling theory, the particle size distribution of ultrafine calcium carbonate is compounded. The particle size distribution ranges from 0.1 μm to 200 μm with average particle size 4.819μm, as shown in figure 3.

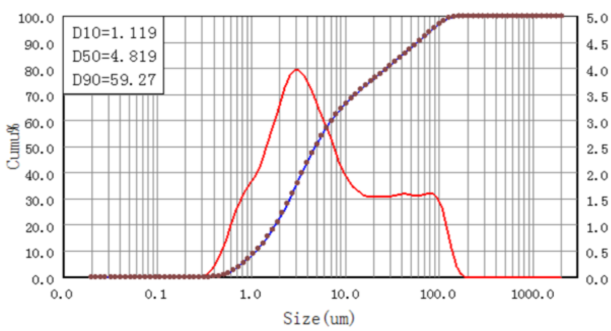

Figure 3
Particle size distribution curve of compound calcium carbonate

Add different amounts of compound superfine calcium carbonate into the field slurry and evaluate its rheology and filtration loss. The results are shown in Table 5. The experimental results show that with the increase of the dosage of compound ultrafine calcium carbonate, the viscosity and shear force of drilling fluid increased, the plastic viscosity increased obviously, and the API filtration decreases gradually. When the dosage is 5%, the filtration of drilling fluid can be effectively reduced.

Table 5
Results of rheological properties and filtration of drilling fluid

Sample	*AV* mPa·s	*PV* mPa·s	*YP* Pa	*FL* mL
Field drilling fluid(A)	40	29	11	5.8
A+3%Compound superfine calcium carbonate	47	33	14	4.2
A+5%Compound superfine calcium carbonate	49	35	14	3.8
A+8%Compound superfine calcium carbonate	56	40	16	3.6

2.1.2 Optimization of Nanometer Plugging Agent

Applying nanotechnology and unique properties of nanomaterials can solve the problem of wellbore stability in micro fractured formation. Due to large specific surface area and strong polarity, nanometer plugging agent is prone to aggregation and agglomeration in the process of use, increasing the particle size and not effectively plugging the micro pores. Therefore, nanometer plugging agents that can be stably dispersed in the drilling fluid system should be preferred. The effects of nanometer plugging agent A, nanometer plugging agent B, nano-silica and nano-emulsion on the rheology and filtrate loss of drilling fluid were evaluated in laboratory. The experimental results are shown in Table 6.

Table 6
Results of nanometer plugging agent on rheological properties and filtration

Sample	*AV* mPa·s	*PV* mPa·s	*YP* Pa	*FL* mL
Drilling fluid(B)	49	35	14	3.8
B+1% nanometer plugging agent A	51	37	14	3.0
B+1% nanometer plugging agent B	52	38	14	3.2
B+1% nano-silica	56	36	20	3.8
B+1% nano-emulsion	55	38	17	4.0

The filtration reduction effect of nanometer plugging agent A was better than the other agents. Nano-silica cannot reduce filtration loss obviously because of agglomeration of it in drilling fluid. The analysis results of laser particle size analyzer showed that the average particle size of nanometer plugging agent A is 12.5nm, which make it can enter the micro pores and fractures of formation and form solid physicochemical adsorption on clay particles and treatment agent molecules. Plugging agent A can improve the plugging effect of drilling fluid and slow down the penetration of drilling fluid into the formation, so as to reduce the tendency of expansion and block falling after water absorption, improve wellbore stability. Meanwhile, the drilling fluid can form thinner and denser mud cake, and the filtration reduction effect is obvious.

2.1.3 Optimization of Film-Forming Plugging Agent

The film-forming plugging agent is a kind of polymer emulsion dispersion. It can form a dense polymer membrane on the surface of porous media (such as porous formation) through filtration. This polymer membrane has the characteristics of impermeability and deformability. It forms a dense sealing layer in the pores and fractures of the formation, preventing the filtrate from invading the formation and the hydration of mudstone pores or fractures. Furthermore polymer materials are involved in the formation of mud cake, which greatly improves the quality and lubricity of mud cake.

The effects of different amounts of film-forming plugging agent on drilling fluid filtration and mud cake quality were investigated. The experimental results are shown in Table 7 and figure 4. It indicates that the film-forming plugging agent can further reduce the filtration of drilling fluid and improve the filtration and wall building of drilling fluid. It can be seen from the surface of the mud cake that the surface of the mud cake becomes flat and dense, forming a dense whole.

Table 7
Effect of film-forming plugging agent on drilling fluid performances

Sample	*AV* mPa·s	*PV* mPa·s	*YP* Pa	*FL* mL
Drilling fluid(C)	51	37	14	3.0
C+1% film-forming plugging agent	53	39	14	2.0
C+2% film-forming plugging agent	56	41	15	1.6

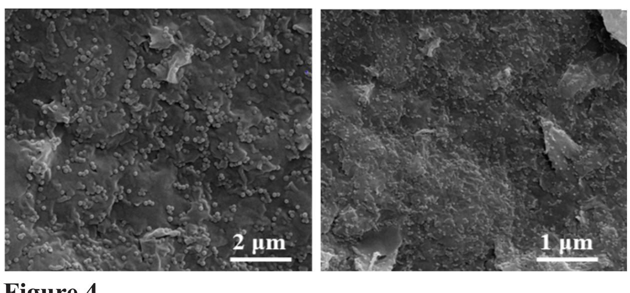

Figure 4
Mud cake surface formed by 2% film-forming plugging agent

2.2 Optimization of Lubricity

In deep well drilling, generally, the open hole section is long and the wellbore annulus is small. Therefore, the lubricity of drilling fluid is required to be strong. In addition, the higher the solid phase in the drilling fluid, the higher its viscosity and shear force, which makes the lubricity of the drilling fluid worse. Deep well drilling fluid generally has high solid content, which will inevitably affect its lubricity. Therefore, in order to ensure the normal downhole drilling, it is necessary to add excellent lubricant to high-temperature water-based drilling fluid to improve its lubricity. The research focuses on the influence of lubricants on the extreme pressure lubrication coefficient of drilling fluid before and after high-temperature aging. The amount of lubricant is 1% and the aging condition is 150°C/16h. As Table 8 shown, before high temperature aging, the lubrication coefficient of drilling fluid added with ester based lubricant was the lowest, but after high temperature aging, the extreme pressure lubrication coefficient was the largest, indicating that the temperature resistance of ester based lubricant was poor and degraded under high temperature conditions. High temperature aging had little effect on white oil lubricant.

Table 8
Comparison of different lubricants' performance

Lubricant	Lubrication coefficient	
	Before ageing	After ageing
polymeric alcohol lubricant	0.12	0.14
polyether lubricant	0.14	0.13
white oil lubricant	0.11	0.10
ester based lubricant	0.08	0.15

2.3 The Research of Organic Salt Plugging Anti Sloughing Drilling Fluid Formula

Based on the optimization of key treatment agents, combined with the on-site drilling fluid formula, the organic salt plugging anti sloughing drilling fluid formula was formed through performance optimization, whose high temperature resistance, high temperature plugging, high temperature lubrication and high temperature inhibition wre evaluated. The formula: 3%~5% bentonite + 0.6%~1% coating agent + 5%~8% potassium chloride + 8%~10% potassium formate + 0.5%~1% amino polyol + 2%~3% filtrate reducer + 1%~3% nanometer plugging agent + 3%~5% wellbore stabilizer + 4%~5% compound calcium carbonate + 1.5%~2% film-forming plugging agent + 2%~3% SMP-3 + 1%~2% organosilicon stabilizer + 1% lubricant

2.3.1 High Temperature Resistance Evaluation

Prepare the high-density drilling fluid system according to the formula, put it into the aging tank ageing at 180℃ for 16h, measure the rheological properties, medium pressure filtration and high temperature and high pressure filtration. The experimental results are shown in Table 9. For different density of drilling fluids, the rheology before and after aging was excellent, and the high-temperature and high-pressure filtration loss was also low, which could meet the need of deep well logging.

Table 9
Evaluation of temperature resistance of drilling fluid

Density g/cm^3	Experiment condition	*AV* mPa·s	*PV* mPa·s	*YP* Pa	*GEL* Pa/Pa	FL_{API} mL	FL_{HTHP} mL	pH
1.50	25°C	38	29	9.0	2.0/6.0	0.8		9.0
	180°C/16h	41	30	11	7.0/11	1.6	9.0	9.0
1.80	25°C	62	50	14	2.5/8.0	1.0		9.0
	180°C/16h	51	39	12	3.5/14.5	1.6	8.6	9.0
2.00	25°C	92	68	24	6/15	1.2		9.0
	180°C/16h	85	70	15	9.5/21	1.8	9.0	9.0

2.3.2 High Temperature Plugging Evaluation

High temperature pressure transfer experiment is used to evaluate the plugging effect of optimized drilling fluids. Pressure transfer experimental technology is an advanced simulation experimental method to evaluate the performance of drilling fluid in retarding pressure transfer and filtrate invasion. WSM-01 high temperature and high pressure wellbore stability simulation experimental device was used for pressure transfer experiment. The test conditions are 150 °C, the upstream pressure level is 2MPa and the confining pressure is 15MPa. The experimental results are shown in figure 5.

It can be seen from the figure that compared with the pressure transfer rate of original field drilling fluid, the downstream pressure rise rate of the optimized drilling fluid was significantly reduced. This showed that after the optimization, due to the joint action of a variety of plugging materials, it can seal the micro-fracture of the rock sample effectively, making it difficult for the liquid to further penetrate into the core, so as to reduce the downstream pressure and significantly slow down the pressure transmission in the core.

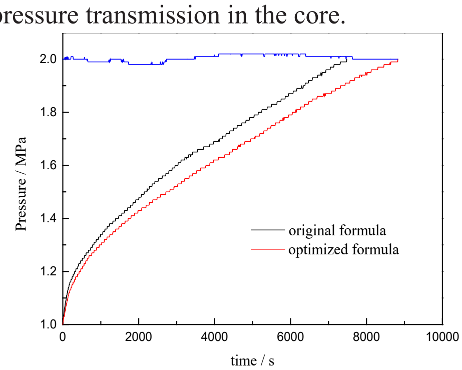

Figure 5
High temperature pressure transfer curves of drilling fluids

2.3.3 High Temperature Lubricity Evaluation

Prepare optimized drilling fluid with a density of 1.8g/cm^3, and use LEM-4100 lubrication evaluation simulation device to measure the high temperature and high pressure lubricity of drilling fluid. The test conditions are: the rate of flow is 5000mL/min, rotating speed is 60 r/min, test temperature is 150℃, test pressure is 3.5MPa. The metal-filter cake friction coefficient of the optimized drilling fluid was tested, and the experimental results are shown in figure 6.

It can be seen that the friction coefficient of the original drilling fluid formula is about 0.20, which gradually increases with the extension of time and basically remains about 0.22. The friction coefficient of the optimized drilling fluid formula is about 0.19, which gradually increases with the extension of time, but basically remains about 0.20. The results show that the optimized drilling fluid formula could form high quality mud cake and had fine lubrication effect.

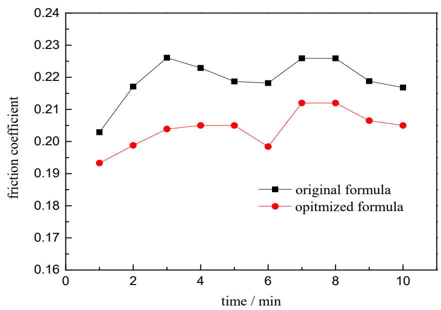

Figure 6
The curves of friction coefficient as a function of time

2.3.4 High Temperature Inhibition Evaluation

The inhibition performance of drilling fluid formulation was investigated through the rolling recovery of rock cuttings. Weigh rock cuttings of a certain quality and add them to the drilling fluid. After aging at 150 ℃ for 16h, use 40 mesh sample sieve to recover the rock cuttings and dry them to constant weight. The ratio of the weight of the recovered cuttings to the weight of the initial cuttings is the rolling recovery rate. The experimental results are shown in Table 10.

Table 10
Recovery rate of rock cuttings in different fluids

Sample	Initial mass, g	Recovery mass, g	R40, %
Original drilling fluid	50	42.6	85.2
Optimized drilling fluid	50	45.4	90.8

The recovery rate of rock cuttings in the original drilling fluid was only 85.2%. The recovery rate of rock cuttings is 90.8%, which is higher than that of the original drilling fluid. The optimized drilling fluid had a strong ability to inhibit the high-temperature dispersion of rock cuttings and effectively inhibited the high temperature dispersion of cuttings.

3. FIELD APPLICATION AND EFFECT EVALUATION

According to the lab evaluation results, the optimized drilling fluid formula has been applied in well Cheng 6 and achieved good implementation effects. Well Cheng 6 iThe well is an pre exploration vertical well with design well depth of 5950m and actual completed drilling depth of 6950m.

3.1 Technical Difficulties of Drilling Fluid

3.1.1 Difficulty of Rheology Regulation

The viscosity of the drilling fluid should not be too low. If the viscosity is too low, turbulence will be formed, which has strong scouring ability to the well wall and easily cause collapse. At the same time, the suspending and carrying capacity of drilling fluid will be weakened. If the borehole collapses, the falling block cannot be carried out in time, resulting in incomplete tripping and serious sticking. If the sticking shear is too high, the structural force of drilling fluid is too strong, and the fluctuating pressure increases when moving the drilling tool or tripping out, which easily cause the loosening of wellbore rock blocks. Reasonable rheology can not only meet the requirements of sand carrying, but also reduce the adverse impact on wellbore stability.

3.1.2 Difficulty of High Temperature Stability

According to the measured temperature of adjacent wells, the bottom hole temperature exceeds 150℃. When drilling high-pressure oil and gas reservoir, the required drilling fluid density and the borehole bottom temperature are both high, this will bring great difficulty to the operation and prolong the completion period. Under high temperature and high pressure for a long time, it is a challenge to maintain the high temperature stability of drilling.

3.2 Drilling Fluid Maintenance and Treatment Measures

Before the third section drilling, replace all vibrating screens with 180 mesh screen cloth.

3.2.1 Replenish bentonite slurry regularly

The soil phase of brine drilling fluid decreased rapidly, and the pre-hydrated high concentration bentonite slurry was supplemented irregularly. Prepare pre-hydrated high concentration bentonite slurry with bentonite content of 15%. After full hydration, add 1.5% SF-4, 1% SPNH and 1% SMP-1 to disperse and maintain the colloid. In order to maintain the inhibition of drilling fluid, potassium formate and amino polyol were continuously supplemented to maintain good inhibition of drilling fluid.

3.2.2 Supplement of high temperature resistant materials

According to the temperature data of adjacent well Cheng 3, the formation temperature of 6950m was predicted to be 162℃. With the increase of well depth, timely supplement SMP-1, SPNH, DSP-2 and other high-temperature resistant materials to ensure the temperature resistance and colloidal stability of the mud. Control the high-temperature and high-pressure water filtrate loss less than 10mL. Before drilling Karamay formation, supplement of 1%~2% drill-feeding plugging material, 2%~3% ultra-fine calcium, 1%~2% film-forming plugging agent can block the micro fractures of mudstone and coal seam, reduce collapse and block falling, appropriately improving the shear force and dynamic speed ratio to enhighten the rock carrying capacity.

3.2.3 Reasonably Control the Density of Drilling Fluid

Well Cheng 6 was a pre-exploration well, and the design density range of the third section was 1.75~1.95g/cm^3. To protect the oil and gas layers and ensure the safety of well control, it was necessary to adjust the density of drilling fluid according to field construction.

3.2.4 Improve the performance of sealing slurry

Before tripping out, the open borehole shall be sealed using sealing slurry. The formula of sealing slurry is: bentonite slurry + ultra-fine calcium carbonate + film-forming plugging agent + SMP-2 + DSP-2 + acid soluble expansion plugging agent. Several short trips and tripping had been carried out in the third section which were smooth every time. There was no sticking phenomenon, and the tripping can be carried out smoothly to the end.

3.3 Analysis of Application Effect

3.3.1 Filtration Control

The drilling fluid performance parameters of the third sections of well Cheng 6 are shown in Table 11. It can be seen that due to appropriate measures, the minimum high temperature and high pressure filtration loss of drilling fluid is only 8.0mL.

Table 11
Drilling fluid performance parameters of well Cheng 6

Depth m	Density g/cm^3	*FV* s	FL_{API} mL	*PV* mPa·s	*YP* Pa	*GeL* Pa/Pa	MBT g/L	pH	FL_{HTHP} mL	Cl$^-$ mg/L
5358	1.66	64	**1.6**	42	12	3/14	50	9	**8.0**	85760
5552	1.63	69	**1.4**	44	12	3/14	52	9	**8.0**	85080
6272	1.63	70	**1.8**	38	13	3.5/15	52	9	**8.4**	81535
6950	1.85	68	**1.0**	46	15	3.5/14	53	9	**8.0**	67555

3.3.2 Wellbore Stability

The borehole diameter curve of the third section of well Cheng 6 is shown in Figure 7. The main target layer of the third section is 5358~6272m with the average well diameter expansion rate of 3.03%, which meets the requirement that the well diameter expansion rate of the main oil layer section shall not exceed 10%. The non-target intervals are 5103~5357m and 6273~6950m with the average well diameter expansion rate of 3.58%, which meets the requirement that the borehole expansion rate of non-target layer shall not exceed 15%. There were 5 times logging constructions in the third section of well Cheng 6. There was no obstruction. The logging success rate reached 100%, exceeding the target of 80% of the subject.

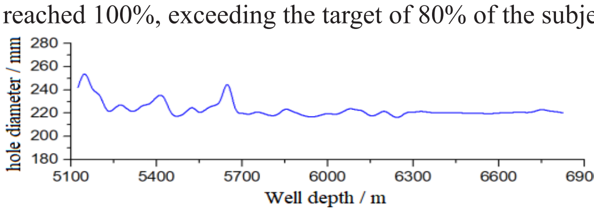

Figure 7
Borehole diameter curve of the third section of well Cheng 6

4. CONCLUSION

4.1 The main reason for logging obstruction in the central area of Junggar basin lies in the irregular wellbore formed by wellbore instability. The objective factor lies in the relatively high clay mineral content and pore fracture development, and the subjective factor lies in the insufficient temperature resistance of drilling fluid and the lack of plugging performance.

4.2 Through the optimization of key treatment agents such as plugging agents and lubricants, the organic salt strong plugging anti-sloughing drilling fluid were formed with stable high temperature performance. The high-temperature and high-pressure filtration loss is only 8.0mL.

4.3 The field application shows that the optimized drilling fluid formula is conducive to maintaining wellbore stability, small well diameter expansion rate and high logging success rate. The wellbore stability drilling fluid technology in the central area of Junggar basin was preliminarily formed.

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