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A investigation of complications that occurred during the drilling of an exploration well in the Bulla-Sea field

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Abstract

The analysis of the depth of layers in the top section opened while drilling the well and the reprocessing-interpretation of seismic data showed that this part of the uplift related to the Bulla-Sea field was directly complicated by the influence of the mud volcano, the elements of the layer changed sharply compared to other areas, and a small saddle-shaped depression was formed inside the anticlinal fold. Therefore, after the well has reached the design depth, all the geological-geophysical data collected and the actual cross-section have been analyzed, according to the purpose of the well, finalization of the works, determination of the project horizon of the wells to be drilled in the tectonic block, and preparation of an addition to the drilling project to open the project horizon in order to correctly direct the development at the next stage, it was decided to continue drilling up to the project horizon and the project depth of the well was increased.

Keywords: Bulla-Sea, drilling, exploration well, the horizon, structure, production zone.

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1. Introduction

Although the preliminary seismic-exploratory works carried out in the Bulla-Sea field revealed that the structure is not complicated by any fault, deep drilling revealed that the field has a very complex single structure. The "Bulla-Sea" structure has a brachyanticlinal fold extending from the northwest to the southeast, according to the structural map constructed according to the ceiling of the VIII horizon of the productive zone. The length of the structure is 27 km, the width is 9 km (according to the VII horizon of PZ), the height of the fold in the north-eastern wing is 1400 m. The fold has an asymmetric structure, the NE pericline is short, and the SE pericline is continuous. The extension direction of the NE periclinal gradually turns towards the east. According to PZ VII horizon, the lying angle of PZ sediments varies between 10-12° in the north-east wing and 20-22° in the south-west wing. The zone close to the arch and the southwest wing of the fold were complicated by two longitudinal faults running northwest-southeast. The arch part of the fold is complicated by fault-type fracture faults. The northeast flank is divided into

blocks by numerous transverse faults. The South-West wing is divided into 3 blocks by two transverse cracks. This wing of the fold is broken compared to the North-East wing. It was not possible to review the tectonic structure of the southwestern wing due to the fact that it is very difficult to carry out deep drilling works and due to the lack of sufficiently accurate seismological data due to the complex conditions of the formations in the southwestern wing.

The structure is complicated by numerous transversal faults, which fade mainly in the sediments of the upper part of the PZ. The structure is further complicated by a mud volcano in the zone close to the southeastern periclinal along with longitudinal and transverse tectonic faults along the arch. According to the data of the drilled deep exploration wells, the sedimentary complex including the "Kirmaki" stratum of the PZ is present in the section from the modern period.

2.Methodological part

Although 558.8mm hanger casing was provided as a spare option in the main well construction in the project of this well, it was necessary to lower this casing during the well drilling process. So that, after the 609.6 mm casing was lowered to 1205 m and cemented, while drilling and increasing the location of the 473.1 mm casing in the well (120 - 2750 drilling interval), there was a case of loss of the drilling mud. In the below the shoe zone, loss of the drilling mud has occurred many times, cementing operation has been carried out, LCM has been injected. While drilling the location of the 473.1 mm casing, cementing works were carried out repeatedly in the lower intervals.

In the initial project of the well, it was planned to lower the 339.7 mm II Intermediate casing to 50 m above the horizon ceiling due to the increase of sand near the ceiling of the PZ V horizon. During drilling, based on the data of a small number of surrounding wells drilled in I block and stratigraphic correlation, the possibility of an increase in the percentage of sand in the cross section starting from approximately ± 300 m above the ceiling of the PZ V horizon was determined.

PZ V and VII horizons were planned to be drilled together. During the actual drilling in the well, the PZ V horizon was fully opened, drilling operations were stopped taking into account the cases of gas mixing with the drilling mud during the subsequent drilling, gas percentage rising to upper limits during the circulation time and differential stuck of the tool. The purpose of the research work is to investigate the difficulties encountered during the drilling of an exploratory well in the Bulla-sea field. Therefore, solutions to overcome the difficulties have been investigated.

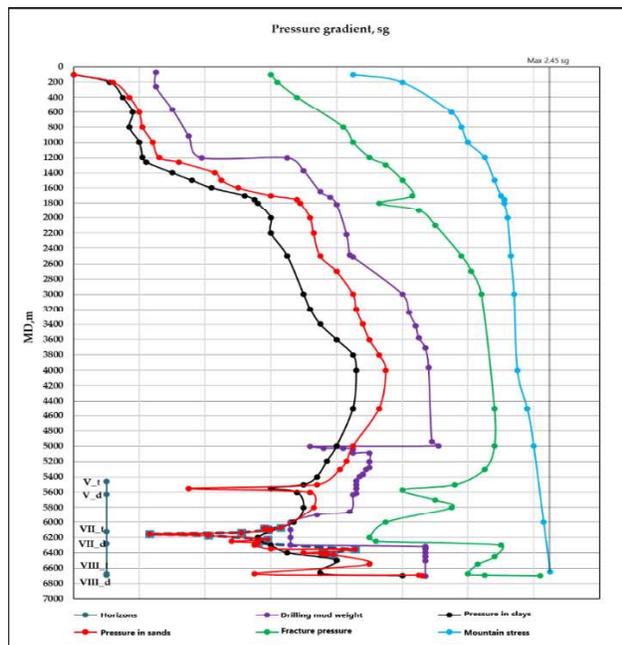


Figure 1. Pressure gradient ,s.g

3.Results and discussion

So that, while drilling the location of the 473.1 mm casing, a cement bridge was placed several times in front of the sandy-siltstone layers that are likely to be absorbed in the lower part of the Absheron floor and at shoe of the previous casing (609.6 mm) and then the 558.8 mm casing was lowered and cemented. This situation shows that when drilling a well in the lower part of the Absheron floor, while the sandy-siltstone layers in the intersection are drilled and expanded together with the relatively lower high-pressure water layers, absorption is experienced due to ECD.

MD ,0 – 2007 m	According to the logging diagram of the opened IV Period + Absheron floor + Agcagil floor sediments, the value of the resistivity curve mainly varies between 1.5 - 2.0 ohmm, and it is characterized by clays according to the Gamma correlation curves.
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Based on the data and stratigraphic correlation of the small number of surrounding wells drilled in block I during drilling, the possibility of an increase in the percentage of sand in the section starting from about ± 300 m above the ceiling of the PZ V horizon was determined and based on the lithological analysis of the cuttings samples raised during the drilling process of this well, the percentage of sand+sandstone+siltstone was determined and showed itself with the increase. Therefore, in the next wells to be drilled in the I block, it is considered appropriate to lower and cementation the II Intermediate casing about ± 300 m above the ceiling of the PZ V horizon.

In the initial design of the well, it was planned to drill the PZ V and VII horizons together. During the actual drilling, the PZ V horizon was fully opened, and taking into account the mixing of gas with the drilling mud during the subsequent drilling, the gas percentage rising to upper limits during the circulation time, and the differential stuck conditions of the tool, drilling operations were stopped and the PZ V horizon and PZ VII horizon were closed separately. Considering this, in the next wells planned to be drilled in I block , while the 339.7 mm casing is lowered ± 300 m above the ceiling of the PZ V horizon, drilling should be carried out as close as possible to the PZ VII horizon and cemented with a casing.

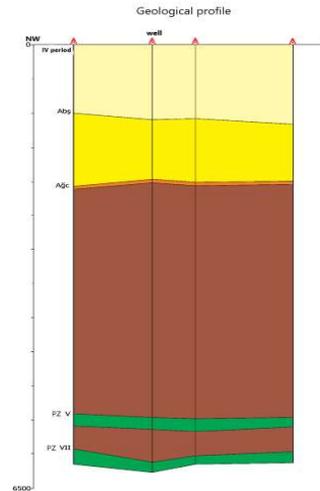


Figure 2. Geological profile

4. Conclusion

Since the Absheron floor consists of sandy-siltstone layers prone to absorption, it is considered appropriate to lower the 558.8 mm hanger casing in order to prevent loss of drilling mud.

The lithological analysis of core samples showed an increase in the percentage of sand+sandstone+siltstone. Therefore, in the next wells to be drilled in the I block, it is considered appropriate to lower and cementation the II Intermediate casing about ± 300 m above the ceiling of the PZ V horizon.

As a result of the research, it was determined that while the 339.7 mm casing was lowered ± 300 m above the ceiling of the PZ V horizon, it is advisable to carry out the drilling works as close as possible to the PZ VII horizon.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research

5. References

1. Mitchell, R.F., Miska, S. & Aadny, B.S., 2011. Fundamentals of drilling engineering, Richardson, TX: Society of Petroleum Engineers.

2. Jeffery, W.H. "Deep Well Drilling: The Principles and Practices of Deep Well Drilling and a Hand Book of Useful Information for the Well Driller"
3. George, H.D., and Stephen. J.R. "Structural Geology of Rocks and Regions"
<https://www.sanfoundry.com/best-reference-books-structural-geology>
4. Ehlig-Economides C.A., Mowat G., and Corbett C. (1996) Techniques for multibranch well trajectory design in the context of a three-dimensional reservoir model. Soc Petr Eng Petroleum: Paper 35505.