

# Discussion on the function of logging technology in geological steering of horizontal well drilling

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**Abstract:** Logging technology is the key technology used in modern petroleum resources exploitation. Reasonable application of logging technology is conducive to efficient exploitation of petroleum resources. Therefore, the application of logging technology in oil exploitation has always been the key research target of oil well exploitation technology. This paper discusses the function of logging technology in geological steering of horizontal well. This paper discusses the logging technology and the geological steering work of horizontal well, discusses the specific application and due function of the logging technology. In the process of discussion, in order to ensure the practical research of this paper, a good application process of the logging technology in the drilling geological steering of a horizontal well is put forward.

**Key words:** logging technology; Horizontal well; geosteering.

## 1. Introduction

Petroleum resource is an important resource used in current social development and widely used in social production. Therefore, under the current social development background, petroleum enterprises are stepping up the research of drilling technology, constantly improving the application efficiency of drilling technology, and improving the efficiency of oil resource exploitation. For example, horizontal well is a kind of special drilling technology and is very important in the production of oil drilling. Under the background of continuous technical research, relevant experts put forward the geological guidance in horizontal drilling technology, and also combined with the application of logging technology to ensure the optimal efficiency of horizontal drilling.

## 2. Discussion on logging technology

Logging technology is the key technology used in oil well exploitation. In the process of application, the technology is mainly used to observe, collect and store the data of solid, liquid and gas in the process of oil drilling by rock and ore analysis, physics, chemistry and other related methods. According to the relevant data of logging, the geological profile can be made and the resource evaluation and analysis of oil and gas reservoir can be completed, which can provide guidance for oil exploitation technology. In addition, the completion of logging protection can also provide technical guidance for

drilling engineering and other oilfield construction projects.

In the process of specific application of logging technology, core logging, cuttings logging and other related technologies can be completed. The logging technology of physics principle includes fluorescence logging and nuclear magnetic resonance logging. Chemical principles of logging technology include rock pyrolysis logging, light hydrocarbon logging and other related technologies, different logging process implementation according to the actual situation of different oil fields. However, under the current social development background, in order to ensure the high accuracy of logging and meet more needs, logging technology began to develop in the direction of comprehensive. For example, the application of modern logging technology in the process has begun with integrated logging instrument. The logging instrument integrates drilling time logging, gas logging, drilling fluid logging and other logging methods into one, enabling measurement while drilling, remote data acquisition control and other functions, thus improving the efficiency of comprehensive logging.

Comprehensive logging instrument has comprehensive function in the process of application. Generally, comprehensive logging instruments are used in the application of modern logging technology. The instruments mainly include winch sensor, acoustic sensor, pressure sensor, casing pressure sensor, electric torque sensor, H<sub>2</sub>S sensor, etc., which can collect a variety of information and improve the working efficiency of logging.

### 3. Discussion on geosteering of horizontal Wells

Geological steering of horizontal well refers to the exploitation of horizontal well by geological steering method.

First, a horizontal well is a special well that has a maximum inclination of  $90^\circ$  or close to it (generally not less than  $86^\circ$ ) and maintains a certain length of horizontal section in the target zone. Sometimes a well can be "turned up" at an Angle of more than  $90^\circ$  for a particular need. In general, horizontal Wells are used in thin or fractured reservoirs to increase the exposed area of the reservoir.

Secondly, geosteering is specifically in the process of drilling implementation, formation parameters and well trajectory can be measured and data acquisition, after the completion of acquisition, log curve is drawn, using the log curve to complete drilling control, to realize drilling construction.

Geological steering of horizontal Wells is to carry out drilling records and complete real-time drilling guidance in the process of horizontal well drilling to ensure the best results of drilling construction. At present, our country has been discussing the technology of horizontal well ge-oriented drilling. For example, rotary geosteering drilling system is the research and development direction of modern petroleum enterprises. On November 18 this year, the horizontal geosteering drilling system achieved new success in the direction of development. The cost is 50% lower than that of the same type of international products. The simultaneous hanging technology can withstand downhole high temperature and pressure of 165 degrees Celsius and 140 mpa, with a wide range of adaptability, multi-parameter measurement, measurement, recording and guiding complementary, precise trajectory control, obvious cost advantages, etc.

### 4. Discussion on the application and function of logging technology in geosteering

In the process of horizontal well drilling, the application of geosteering technology is very important. It can be found through the study of geosteering technology that the specific application of logging technology in geosteering is actually to use advanced logging technology to measure relevant parameters, obtain data, and conduct downhole mining guidance, so as to ensure that various technologies reach the highest standard and improve the drilling effect of horizontal Wells.

#### 4.1 Specific application of logging technology

First of all, logging technology is used to select drilling methods during the implementation of geosteering in horizontal Wells. The application of drilling method is very important in drilling operation. However, in the implementation process of traditional horizontal well operation, the application effect of logging technology is relatively poor, and the selection of drilling methods is

relatively extensive, which is difficult to form a good effect, affecting the entire production. In the case of gesteerable drilling with logging technology, in the actual construction operation, the personnel need to investigate the geological environment, logging and reservoir volume of the area where the horizontal well is located, and then obtain the investigation data and data, and then use these data as the basis to reasonably design the drilling path and provide guidance for the subsequent drilling. However, in the traditional geosteering process, it is impossible to accurately analyze well trajectory and reservoir location. Modern logging technology has been developed into a comprehensive logging technology that can complete multiple information acquisition of horizontal Wells, so as to implement comprehensive logging control and ensure the best drilling process implementation. In the application process, logging technology can be used to complete a number of horizontal well information acquisition, so as to ensure the best drilling process implementation.

For example, in the process of logging technology application, cuttings logging, core logging and other methods can be used to complete the collection of horizontal well related data, and then select the drilling method. The application of cuttings logging technology is mainly to directly use the drilling process of energy-saving logging, after drilling according to the color of cuttings and related parameters to choose the best drilling method. In addition, the cuttings in the reservoir can be stained with oil, which can be used to complete the comprehensive analysis of oil and gas resources. For example, in the course of the study, the relevant experts found that the oil-bearing cuttings are generally brown gray and brown yellow, but also give off the initial aroma of crude oil, and depending on the weight of the cuttings, it can be specific to determine the level of oil in the formation. Cuttings logging method is a relatively stable and reliable logging method, which can be used in the background of geosteering implementation of horizontal Wells to select the drilling method, which is more in line with the drilling requirements of horizontal Wells, as well as the drilling process quality, to ensure the best drilling results.

Secondly, the application of logging technology in ge-guided drilling of horizontal Wells can make drilling adjustment. Guided by the relevant data obtained by logging technology, drilling control of horizontal Wells can be completed, thus ensuring that logging achieves the best objectives. In the process of drilling implementation, the comprehensive logging technology can be used to collect related parameters.

For example, the study found that the integrated logging technique was significantly more dominant than the actual drilling with LWD parameters. In the application study of horizontal well logging technology, it is found that the well interval is 189-191m water and the average drilling time is 16min. In general, gamma logging while drilling is used. Under these parameters, the drilling time is 16X13min, and the natural gamma value begins to decline after drilling is completed. The integrated logging technology can be shorter than the integrated logging technology 188min, proving the efficiency of the

integrated logging technology announcement. The resistivity logging while drilling technology also has a lag of 135min compared with logging to ensure the best drilling results. The following is a comprehensive analysis and research on the application of comprehensive drilling technology to ensure the best drilling results [1].

The application of comprehensive logging technology can also optimize and supervise geological logging parameters in horizontal Wells. In the process of gesteerable drilling in traditional horizontal Wells, it is difficult to accurately describe the data and grasp the data imaccurately, so it is difficult to judge the relevant technical parameters of drilling, which affects the specific implementation of drilling technology. Therefore, in the process of drilling technology application, the underground structure of some horizontal Wells is also relatively complex, which is affected by geology to some extent. By applying comprehensive logging technology, comprehensive parameters of logging can be collected, data analysis and protection can be done well, and real data and effective mining technical guidance can be provided for horizontal Wells [2].

For example, modern horizontal drilling is beginning to use new integrated logging instruments, which are able to complete multiple data acquisition while completing multiple data acquisition with high-precision horizontal logging tools. Taking SK-DMS logging while drilling instrument for horizontal well logging in some oilfields in China as an example, the instrument is equipped with 3Q04/3Q05/3Q06 field fast chromatograph to realize high reliability storage of data and provide guarantee for post-analysis. It can withstand 1h in 950°C high temperature environment and 10h in 260 °C medium temperature environment. In addition, the maximum operating temperature of the instrument is 150°C and the maximum pressure is 135MPa, which is suitable for exploration and development of deep and ultra-deep Wells. In the process of specific application, the geological parameters, data parameters and other parameters of the oil well can be collected to understand the geological information, to ensure that the collection work to achieve the ideal effect, but also to improve the application effect of logging. Table 1 below shows the specific working parameters of the equipment.

**Table 1** Comprehensive application parameters of logging technology

Technical specification	Specific parameter
Indoor positive pressure	50Pa~120 Pa
Indoor operating temperature	0°C~30°C
Power input	220V/380V/440V/480V ±5% 3P
frequency power	50Hz/60Hz±5% 20KVA

#### 4.2 Application effect of logging technology in geosteering logging

The proper function of logging technology in geosteering logging has been proved by time and has a good effect. The following is an analysis of the application of logging technology in horizontal well geosteering logging.

The application of well logging technique in geologic steering well is able to improve the accuracy of geological steering data. Modern logging technology includes different technologies such as physics, chemistry and lithology. Different technologies obtain related parameters according to different scientific principles. The parameters obtained by scientific principles are more accurate. In particular, under the current technical background, the application of comprehensive logging technology can realize the accurate collection of a number of technical parameters, which can be stored and analyzed after completion of collection, so as to provide accurate data for geosteering and ensure the best results of geosteering logging [3].

In addition, the late time can be encrypted during the implementation of horizontal well logging. On the one hand, the late time of the comprehensive logging instrument belongs to the category of calculation, which needs to provide a theoretical value, but because of the complexity of the external environment, it is difficult to determine the theoretical value. Therefore, there is often a large difference between the late time of the logging instrument and the calculation time of the theoretical value, which requires the prediction of the late time to be encrypted to ensure the accuracy of the cuttings retrieval time, which has a positive promoting effect on the project [4].

#### 5. Empirical analysis

In the process of research, this paper analyzes the logging data of a horizontal well, so as to complete the mining guidance. For example, in the process of the horizontal well logging application, the formation treatment method of logging has been applied to carry out the logging correlation study. In the drilling design of 63# of this well, comparing the logging data of adjacent well with that of this well with reference data of adjacent well, the thickness and pure thickness were converted, and real-time comparison of drilling process was realized. Finally, it was confirmed that the top of the target layer of this well was -1722m, 5m lower than the original design, and logging analysis was carried out according to this parameter. Ensure the best effect of technology application [5].

#### 6. Conclusion

This paper summarizes the specific application of logging technology in horizontal well geo-guided drilling, hoping that the research in this paper can be helpful to the application of horizontal well geo-guided drilling.

## References

1. Jiao Xuesong. Discussion on how to apply reservoir prediction and monitoring technology in geosteering drilling of horizontal Wells [J]. *Petrochemical Technology*, 2020, 27(2):2-2.
2. Peng Ye Realgar for Liang Li Shifang Jia Hao Fang Tiejuan Liu Fangfang. Comprehensive application of various logging techniques in the optimization of horizontal well perforating interval [J]. *Logging Engineering*, 2022, 33(1):60-64.
3. Yan Ronghui, Huang Zijian, Fang Tiejuan, et al. Application of logging technology in geological steering of shale oil Wells [J]. *Logging Engineering*, 2020, 31(3):5-5.
4. FANG Yunfeng. Discussion on key technologies of geosteering logging for horizontal Wells [J]. *West China Exploration Engineering*, 2020, 32(2):2-2.
5. GUO Zhengfeng. Application of logging technology in geosteering of offshore oil drilling [J]. *Chemical Engineering Management*, 2021(8):2-2.