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TECHNICAL MEANS FOR TESTING WELLS

Industrial evaluation of any mineral deposit is possible only if all its features are studied in detail. One of the most important indicators found in the process of exploration of deposits is the quality and quantity of minerals, which are determined by researching their main properties. The establishment of these properties is directly related to the test, which is carried out at all stages of exploration and exploitation work. Chemical, mineralogical, technical and technological tests are distinguished depending on the tasks to be solved in the study of the composition and properties of solid minerals. We are primarily interested in technical tests that are carried out to determine the physical and chemical properties of mineral raw materials (size and grade of minerals; size, color and optical properties of crystals; mechanical strength, wearability, viscosity, fire resistance, etc.).

Let's consider Testing and research of oil and gas-bearing formations. To test objects during the drilling process, special devices are used, which can be grouped into three groups:

1. **Devices that are dropped inside the drill pipe column immediately before the start of the test.** They allow you to test the object that is being destroyed at the moment.

2. **Devices that descend into a well on a logging cable.** With their help, it is possible to take a small (5–20 l) portion of liquid (gas) into a sealed cylinder from some local part of the object and register the nature of the change in pressure and temperature in the cylinder during sampling.

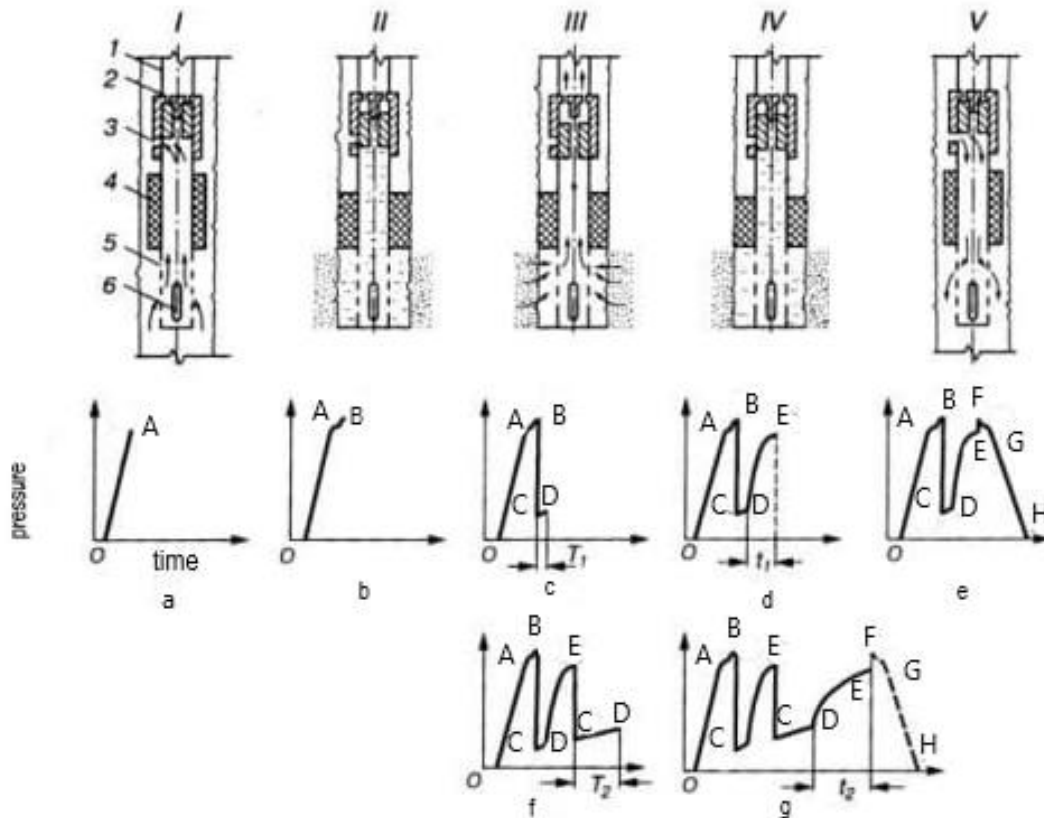
3. **Tubular reservoir testers (VPT), which are lowered into the well with the help of a drill string.** VPTs are most widely used when drilling 210 wells, as they allow obtaining the most complete amount of information about the test object.

I suggest focusing on the 3rd group, because it is the most common and interesting for us. The sequence of operations during the operation of the VPT and pressure diagrams during reservoir testing are shown in pic. 1

The depth manometer 6, installed in the filter zone, records the increase in pressure as the tester descends into the well, which is shown simplified in diagram *a* in the form of segment OA. The BC line on the diagram *c* corresponds to the opening of the intake valve. After a certain time, the flow of reservoir fluid into the drill pipes is stopped by closing the inlet valve. At the same time, the pressure in the closed space of the sub-packing zone increases intensively (curve DE, diagram *d*). To obtain more complete information about the object, a two-cycle, and sometimes a three-cycle test is conducted. For this, there are multi-cycle testers that allow you to repeat open and closed periods (diagrams *f*, *g*) multiple times.

The research results have improved the understanding of the rock breaking mechanism of PDC bit directional drilling, provided a new technical means for bit performance analysis and have also provided a reference for the design of new personalized bits under the discussed working conditions.

"PDC bit rock breaking digital simulation system" is an important technical means developed in recent years for simulating the rock breaking process of the bit under complex work, analyzing the interaction relationship between the bit and the rock, and evaluating the performance [1].



Pic.1 - The sequence of operations and the recording of the pressure diagram during reservoir testing: I – descent of the tester; II – packaging; III – open period; IV – closed period; V – rise of the tester; 1 – drill pipes; 2 – main (inlet) valve; 3 – leveling valve; 4 – packer; 5 – filter; 6 – depth manometer

In terms of fossil energy development, reducing cost and increasing efficiency through management optimization, and improving oil (gas) recovery through technical means are important research directions in this period. Optimizing the development pattern and improving the recovery are the key research directions nowadays in the shale gas field.

The test results show that the combination pattern of time-phased staged fracturing and refracturing can be used to develop each stage more effectively and further improve shale gas recovery. The pressure build-up test is an effective means to obtain reservoir parameters of developed shale gas wells. The gas production profile logging combined with the microseismic monitoring can be used to identify the refracturing potential of the development well [2].

References:

1. Haiping Tian, Haitao Ren, Dongdong Song, Yan Yang «Research on cutting track and working load of directional drilling PDC bit» 2021.
2. Wenrui Shi, Meiyu Guo, Zisang Huang, Zhansong Zhang, Chaomo Zhang, Vuanhui Shi «Study on Development of Shale Gas Horizontal Well With Time-Phased Staged Fracturing and Refracturing: Follow-Up and Evaluation of Well R9-2, A Pilot Well in Fuling Shale Gas Field» 2021.