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PHYSICS AND GEOLOGY. SEISMOLOGICAL METHOD OF STUDIYNG THE EARTH'S CRUST

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How can physics help a geologist? Physics and geology seem to be sciences that are very far from each other, but if physics did not help geologists, many deposits of iron, oil, copper and other minerals would not be found. What the eye cannot see underground will be "seen" with the help of sophisticated geophysical instruments. To illustrate it, in this paper some global problems of geology that are closely related to physics are presented:

The origin of the Earth and other planets;
The structure and composition of various geospheres;
Dating the age and stages of the Earth's development;
The thermal history of the Earth;
Development of the theory of rock destruction;
Prediction of geodynamic processes (earthquakes, mountain impacts, sudden gas emissions, etc.).

The purpose of this paper is to present one of the methods of rock research in order to clearly illustrate how this science is closely related to geology. Seismic exploration is based on the study of the features of the propagation of Earth's crust elastic vibrations. Seismic waves are caused artificially. They spread in rocks at a speed of 2-8 km/sec - depending on the density of the rock.

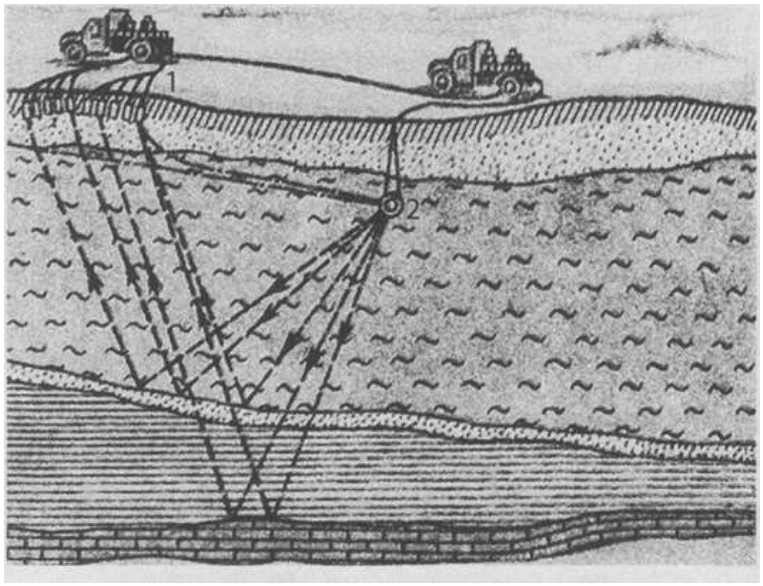

Fig. The scheme of seismic exploration.

1 - reception system; 2 - transmission system.

If we take a look at the picture, we can see that the transmitting system (number 2) creates vibrations, and the receiving system (number 1) receives reflected waves.

At the interface between two media of different densities, part of the elastic vibrations is reflected back to the Earth's surface. The other part overcomes the interface, it is refracted and goes deep into the bowels to the new interface until they finally disappear. Reflected seismic waves reaching the Earth's surface are captured by special receivers and recorded on a special recording tool. Having deciphered the graph, seismic explorers establish the boundary of certain rocks occurrence. According to this data, maps of the underground relief are built.

Previously, explosions were most often used as a source of elastic vibration. Now they have been replaced with a seismic vibrator. It can be installed on trucks and explore a fairly large area in a short period of time. In addition, vibrators allow you to work in densely populated areas.

From the point of view of physics

When a blow is applied to a rock layer, there is not an impulse, but a long process of vibrational harmonic attenuation. In fact, if a harmonic attenuation process occurs as a result of the impact, it means that the object of the impact

is an oscillatory system. The rock layer, which is an oscillatory system, is characterized by frequency. Studies have shown that the frequency F0 of the harmonic attenuation signal is related to the thickness (power) of the resonator layer H by the ratio: **f0 = k / h**, (1) where k is a coefficient with velocity dimension. For rocks, this coefficient, as it turned out, is equal, with an error not exceeding 10 %, 2500 m/s. Thus, by determining the natural frequency of the vibration process resulting from the impact, it is possible to determine the throughput of rock structures located in the studied zone of rock structures.

Drawback

The only drawback of this method is the small depth of the study, which does not exceed 2-3 kilometers. Therefore, explosion energy converters are used for deeper study. The explosion remains the source of the waves here. This explosion no longer occurs in the soil, but in a special explosive chamber. Explosive impulses are transmitted through steel plates to the ground, and a mixture of propane and oxygen is often used instead of explosives. All this makes it possible to significantly speed up the process of probing the subsurface.

Conclusion

Based on the given example, we can conclude that physics and geology are interconnected with each other, forming a single whole. Without knowing the physical laws and phenomena, such a science as geology would not exist. Without these laws, we would not be able to study minerals, rocks, the structure of the Earth's crust, and even more to search for minerals. Without these sciences, the world would be completely different.

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THE IMPORTANCE OF PHYSICS IN THE WORK OF A DRILLING ENGINEER

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The purpose of this article is to analyze the role of physics in the professional activity of a drilling engineer. To achieve this purpose it is necessary to solve several problems:

1. to give a concept of the drilling engineer activity;
2. to consider the laws of physics that are necessary for a drilling engineer.

Physics tells us about the laws of motion, equilibrium, the attraction of the earth, electricity and others. With the help of physics, people have learned what lightning, thunder, light, rain are. Physics is life itself, nature itself [5].

Richard Feynman in his lectures on physics said: "Physics is the most fundamental of all sciences, the most comprehensive; its influence on the entire development of science has been enormous. Indeed, after all, the current physics is quite equivalent to the long-standing natural philosophy, from which most of the modern sciences arose. It is not for nothing that students of all kinds of specialties are made to study physics; it plays a major role in many phenomena." Physics is a science that has a connection with many other sciences: mathematics, astronomy, biology, geology, chemistry, etc. [4].

Any machine, even the most complex computer works according to physical laws, thanks to accurate calculations of highly qualified specialists. Any applicant can become such a specialist by choosing a profession

for which physics is needed. It is quite difficult to cover the whole physical science [1]. The duties of a drilling engineer include drawing up a drilling schedule, forecasting the results of this process, coordinating work and necessary equipment, analyzing data on nearby wells, performing calculations for fixing wells, calculating the risk of well collisions, etc. [4].

Oil is not found in underground caves but exists in microscopic pores of sedimentary rocks. There are many interesting physical quantities, including hydraulic permeability, resistivity. A hydrocarbon collector is a rock containing voids and is capable of containing and filtering fluids (oil, gas, water). The vast majority of reservoir rocks are of sedimentary origin. One of the most common types of reservoir rock is quartz sandstone. To measure resistivity, there are three common methods that are currently used:

Electrodes;

Electromagnetic induction;

Propagation of electromagnetic radiation.

Resistivity does not distinguish oil and natural gas but neutron scattering occurs. Hydraulic permeability is another key physical characteristic of the reservoir rock. The greater the hydraulic permeability is, the easier it is to extract oil from the reservoir [2].