

## Core Drilling Technology Applies in Geological Exploration

With the rapid development of social economy, resources are becoming more and more scarce. By strengthening geological exploration, we can understand the geological conditions of rocks, stratum structures, minerals, groundwater, and landforms. So as to provide a reliable basis for resource mining. Geological core drilling technology is a commonly used technology type in resource exploration. Therefore, understanding core drilling technology and equipment requirements is of great significance for geology and resource exploration.

Why conduct a geological survey?

[Geological exploration](#) is an investigation and research activity that uses various means and methods to survey and detect the geology, determine the appropriate bearing layer, the foundation bearing capacity of the bearing layer, determine the foundation type, and calculate the foundation parameters. Carry out investigation and research work with different priorities on the geological conditions such as rocks, stratum structures, minerals, groundwater, and landforms in a certain area. Its purpose is to find out whether there is any adverse geological action affecting the stability of the construction site, and if it exists, evaluate its impact on the construction of the project. Find out the type of groundwater in the field, the depth of water level and the conditions of burial, and provide the basic law of dynamic changes in groundwater level. Simply put, it is to look at the topography, geological structure, underlying distribution, geological structure, etc. of the area through the geological survey report.



## Methods of geological exploration

Geological prospecting methods mainly include pits, trenches, drilling, geophysical prospecting and other methods.

### 1. Pit and trench exploration

It is to dig pits, grooves, wells, and holes manually or mechanically. In order to directly observe the natural state of rock and soil layers and the geological structure of each layer, and to take out soil samples close to the actual original structure.

## 2. Drilling

It refers to an exploration method that uses a drilling rig to drill holes in the stratum to identify and divide the subsurface strata, and can take samples along the depth of the hole. Drilling is the most widely used exploration method in engineering geological exploration, and it can obtain deep geological data.

## 3. Geophysical Exploration

Referred to as geophysical prospecting, it detects geological conditions such as stratum lithology and geological structure by studying and observing changes in various geophysical fields. Common geophysical prospecting methods include direct current prospecting, alternating current prospecting, gravity prospecting, magnetic prospecting, seismic prospecting, acoustic wave prospecting, and radioactive prospecting.

### Advantages of Drilling Technology

Geological drilling is a process of using specific [mineral exploration drilling machinery](#) and equipment and technology to obtain rock cores below the surface, and then to find out the underground geological conditions. Drilling is an important technical means in geological exploration work. A drilling rig is used to drill down from the surface of the earth to form a cylindrical borehole in the formation to identify and divide the formation. Cores, ore samples, and soil samples can be obtained from different depths in the borehole for analysis and research, to determine the physical and mechanical properties and indicators of rock and soil layers, and to provide design needs.

Drilling (drilling) is an investigation method that uses a shovel to take soil samples to observe underground remains. Its advantage is that it can directly go deep into the ground for sampling and observation, and can directly and accurately obtain cultural accumulation data at a certain location. Compared with excavation, it saves labor and is less destructive, and can understand a large area of underground conditions in a short period of time. It is suitable for understanding the distribution range and thickness of site accumulation, the foundation of large buildings, the shape and layout of large tombs and ancient cities, etc.

### Specific Application of Geological Core Drilling Technology in Resource Exploration

#### 2.1 Rope sampling technology

In resource exploration, rope sampling technology has a wide range of applications, and the rope

sampling technology has strong operability and high accuracy of exploration results. In the application of wireline sampling technology, it is necessary to use the rope to take out the sampling pipe in the drill string. During this process, the drill string does not need to be moved, and generally only the drill string needs to be lifted during the drill bit inspection. The drilling efficiency of the rope sampling technology is relatively high, and the drilling depth is low, which can ensure the quality of the core. In the practical application of wireline sampling technology, the main tools are core pipes and fishing equipment, and the time required for drilling is relatively short. In addition, there is less lifting and lowering of the drill pipe during the drilling process, so the friction force of the drill bit can be effectively reduced, thereby prolonging the service life of the drill bit. Nowadays, rope sampling technology is mainly used in the exploration of oil, natural gas, geothermal and other resources.

## 2.2 Air reverse circulation continuous sampling technology

In the actual application of [air reverse circulation continuous sampling technology](#), there are different drilling tool combinations, according to which it can be divided into two working principles: first, partial positive circulation drilling at the bottom of the hole; second, full hole reverse circulation drilling . If ordinary drilling tools are used for drilling construction, the compressed air can be transmitted to the bottom of the hole through the annular gap of the double-wall drill pipe, and then drive the DTH hammer at the bottom of the hole to make it do work, break the rock, and then pass through the hole wall gap Back up, and enter the central channel of the inner tube through the positive and negative conversion joints, and finally return to the ground. During the drilling process, compressed air can not only be used as a flushing medium, but also provide sufficient power. In addition, if a through-type drill bit is used, during the drilling process, the compressed air can be delivered to the bottom of the hole through the gap between the double-walled drill pipes, and then enter the central channel of the inner pipe through the drill bit, and finally return to the ground.

### Equipment requirements for core drilling process

When using the core drilling process for exploration, the equipment used needs to meet the following requirements:

#### 1. Requirements for drilling rigs

1) The drilling depth of core drilling is relatively large, generally hundreds of kilometers. The borehole diameter is small, generally ranging from millimeters in time to hundreds of millimeters. The stratum to be drilled is mainly bedrock, and the strata are varied and complex; in addition, the road environment at the core drilling site is poor. Therefore, it requires the technical performance of the drilling rig to meet the requirements of the drilling process. The gyration of

the drilling rig requires a high speed, and the feeding force and speed of the feeding mechanism should be able to meet the pressure required by the drill bit and the instantaneous drilling speed of the drill bit; the lifting capacity and speed of the elevator should minimize the time spent in the lifting process etc.; In addition, the drilling rig should have good guiding performance and variable angle construction function.

2) The drilling rig must be equipped with necessary detection and indicating instruments (or drilling parameters) for the operator to understand and master the drilling parameters and the situation in the hole, so as to control and select the drilling parameters.

3) The drilling rig should have sufficient strength, rigidity, durability, good stability and dynamic balance; simple structure, convenient maintenance and low cost.

4) The drilling rig has high transmission efficiency and can transmit sufficient power to ensure the normal operation of the working mechanism and short-term overload operation, so as to meet the needs of special work such as handling accidents in the hole.

5) The degree of mechanization and automation of the drilling rig should be high, and it should be small in size, light in weight, good in disassembly, easy to transport and install, so as to improve production efficiency and reduce labor intensity of workers.

## (2) Requirements for mud pumps

The performance requirements of the mud pump for drilling construction are related to the conditions of use of the pump (such as drilling technology, drilling depth, caliber, formation, etc.), mainly as follows:

1) The displacement of the pump should have a large adjustment range, and it is best to realize stepless adjustment. When drilling in complex formations, it is necessary to design a multi-caliber drilling structure. In order to remove the rock powder at the bottom of the hole in time, it is required to have a flushing fluid flow rate suitable for different calibers, and the change of the flow rate is achieved by changing the flow rate. Therefore, The flow rate of the pump is one of the important parameters for effective rock breaking and safe drilling.

2) The discharge pressure (pump pressure) of the pump must meet the requirements of the drilled hole depth. The resistance of the flushing fluid in the circulation system during the drilling process is the discharge pressure of the pump. With the change of the hole depth, diameter and conditions in the hole, the resistance in the hole will also change, so the allowable discharge pressure of the pump must be related to the flow rate, match the hole depth.

3) After the flow rate of the flushing fluid is determined, the pressure and flow fluctuations output by the mud pump are required to be small. The fluctuation of pump volume and pump

pressure during the drilling process will produce water hammer, which will affect the wall protection effect of the drilled hole, reduce the ability to carry rock powder, cause vibration of the ground circulation system and the pump body, and shorten the life of parts.

4) During the drilling process, due to some reasons, the phenomenon of "suffocating the pump" in which the pump pressure suddenly rises sometimes occurs, causing the pump to run under the overloaded state of the pump pressure. When the overload operation exceeds a certain limit, the pump may be damaged. Therefore, the pump is required to have a certain (short-time) overload capacity, and also has a protection device for automatic unloading when excessive overloading occurs.

5) The working conditions of the pump are very harsh, and the pump is required to have good corrosion resistance and wear resistance, reliable operation, long life of wearing parts, and easy maintenance.

### (3) Requirements for drilling towers

1) The height of the drilling tower should be reasonably selected according to the depth of the drilling. Appropriately increasing the height of the drilling tower is conducive to increasing the length of the vertical root of the drill pipe, reducing the number of times of unscrewing and unloading the drill pipe during the lifting operation, and saving the tripping time; Inconvenient to move. Therefore, a reasonable drilling tower height must be determined on the basis of comprehensive consideration.

2) With the deepening of the drilling depth, the length and weight of the drilling tool increase, coupled with the influence of the friction between the drilling tool and the hole wall, all the forces act on the drilling tower when the drilling tool is lifted. Therefore, it is required that the drilling tower must meet the full bearing capacity required by the design hole depth, and ensure sufficient safety factor and stability.

3) In order to adapt to the harsh environment of the drilling construction site and the characteristics of frequent relocation, the drilling tower is required to be light in weight, good in disassembly and transportation, so as to reduce the physical labor intensity of workers.

4) Drilling equipment and drilling operation processes are concentrated at the bottom of the drilling tower. The bottom of the drilling tower should meet the reasonable layout of drilling equipment and meet the requirements of ergonomics to ensure the safety of operators and equipment.

### (4) Requirements for power

1) It can meet the total power requirements of the entire drilling process, such as drilling rigs, water pumps, auxiliary equipment (pipe twistors, mixers, water supply pump stations, hydraulic pump stations, etc.), electric welding, lighting, etc.

2) If a fuel engine is used as power, it is required to be mobile, with low energy consumption, low

noise, and low pollution.

3) If the grid is used for power supply, the distance between the transformer and the drilling rig is required to be short to reduce line power loss.