

Design of multi-function and intelligence of geological hammer

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Abstract: With the development of geological research, geological tools are playing an increasingly important role. In order to improve the working efficiency of geological workers and reduce their burden. This paper investigates and analyzes the traditional geological hammer, points out the limitations and improvement measures of the traditional geological hammer, and proposes to design a multifunctional intelligent geological hammer, in order to provide help for the relevant geological workers.

Keywords: Multifunctional, Intelligence, Geological Hammer, Geological Tool

1. Introduction

Geology is the study of the formation, evolution and development of the Earth. The Earth is a solid planet made of solid rock, and the lithosphere is a major component of the Earth's sphere, Even the water in the sea and the air in the atmosphere are closely related to rocks. As the main body of the earth, rocks naturally become the first direction for geologists to study the earth. A geological hammer is a necessary tool for geologists in field exploration. But the traditional geological hammer has simple design, single function and lack of intelligence, so this paper proposes to design a new multifunctional intelligent geological hammer.

2. Traditional geological hammer

2.1 Abroad

The traditional geological hammer is moderate in size, about 30cm long, flat at one end and square at the other, and its function is field observation. At present, there are a lot of popular types of geological hammer abroad. The geological hammer led by the Estwing brand of the United States includes claw hammer, axe, special tools and pry bars to provide geological workers with the necessary tools for field exploration, as shown in Fig 1. American Estwing geological hammer is mainly divided into the following categories:

(1) Flat head geological hammer with flat mouth can effectively control the direction of rock splitting to avoid knocking samples into fragments. Especially suitable for soft or cleaved rocks (shale, SLATE), easy stratification of rock samples.

(2) Pointed geological hammer, suitable for striking hard rock minerals (such as quartz dolomite or pyrite).

(3) Round head geological hammer, Johnny Dragon plastic handle, protective shock absorption design, comfortable and durable.

(4) Geological chisel, percussion cover using solid reinforced polymer materials, chisel lengthening to make the impact surface larger, extreme high temperature and cold weather can still comfortably hold the use of wild chisel hard rock tools.

(5) Geological pick is a geological and fossil excavation tool, is also the most ideal professional tool for geologists and archeologists. It has a strong and durable alloy steel structure, and the hammer body and handle are forged together. The handle is made of high quality rubber material, which makes it comfortable to hold and strong shock absorption. Applicable to all geological and archaeological digs.

(6) Geological steel, multi-functional geological crowbar, pointed flat head combination. The combination of pointed and flat heads is very destructive.

2.2 Domestic

Domestic general selection of high quality steel. At present, the common geological hammer end on the market presents many forms, such as rectangle, square, pointed, wedge or crane shaped. The geological hammer has a flat protruding end and is used to strike the rock until it cracks or breaks; The other end is flat - headed or pointed, and the flat - headed can be used to clean rock coverings or to pry open rocks along cracks. Prongs are generally used to split hard rocks such as volcanic rock, because they transfer more pressure to the rock, but this requires a high degree of hardness of the droplet itself. Therefore, the choice of geological hammer should be based on the characteristics of different projects and the lithology of the working area to decide whether to carry the pointed or flat head geological hammer. The weight of a geological hammer is critical for geologists who have to trek long distances or even climb rocks, so a lighter, flat-headed geological hammer would be an excellent tool for most geologists. If possible, it would be more convenient to have one of the pointed and one of the flat. The length of the handle of a good geological hammer has been designed to be more appropriate for the weight of the hammer head. In general, the greater the weight, the longer the hammer handle, the greater the ability to break rock. This balanced design makes it easier to break hard rock, while effectively reducing the impact of percussion vibrations on the arms and wrists, providing a greater degree of protection and comfort. And in the wild, when you need to sample large, hard rocks, a bow-tipped hammer is a good choice.

2.3 Use

An important work of field geological exploration is to observe rocks, such as the color of rocks, minerals, structures and fossils in rocks, which need to be observed in the fresh section and different direction of rocks. However, natural rocks in the field are badly weathered and the observation surface is not ideal, which requires the use of geological hammering [1].

2.4 Disadvantages

However, the current geological hammer used by geological workers often has some shortcomings, such as relatively simple design, too simple function, different kinds of geological hammer need to be changed in different situations, and the working efficiency is too low when carrying and using. In addition, geological workers often work in a relatively harsh environment, travel with geological hammer, geological compass, magnifying glass and many other necessary items, will lead to very inconvenient movement.



Figure 1: American estwing geological hammer

3. Design of multi-function intelligent geological hammer

Through relevant investigation and research, it is found that geologists expect that the traditional geological hammer can be integrated with a variety of geological tools to achieve "multi-purpose with one hammer", which increases the versatility of tools and reduces the burden of carrying tools for field geologists [2].

After research, calculation, design, model and trial, we improved on the original basis. The multi-functional intelligent geological hammer can automatically recommend the geological replacement head suitable for the rock through the tail section, which solves the shortcomings of the previous geological

hammer design, such as simple, can be better applied to explore the nature of the rock, easy to collect rock samples. It carried as many tools as it could without overburdening geologists.

3.1 Multi-function

A multi-functional intelligent geological hammer is designed, which is mainly composed of nut, hammer head, hammer rod, handle, magnifying glass, tape measure, utility knife, compass, LED light belt and button switch and other related components. When the geological hammer is used, the hammer head and hammer rod are combined by screws, and the hammer head is further reinforced with nuts, so as to ensure the feasibility of the geological hammer work to a large extent. By means of tools such as magnifying glass, utility knife and tape measure, geotechnical properties can be analyzed and studied. The working efficiency of geologists can be improved and the working process can be shortened greatly.

The remarkable results of this design are: The hammer head and hammer rod can be assembled by screws, which solves the problem of single function of traditional geological hammer. The use of nuts can strengthen the hammer to some extent. Assemble the magnifying glass, utility knife, and measuring tape in the hammer handle. The handle is designed according to the shape of the human hand holding the geological hammer. Meanwhile, in order to reduce the vibration caused by the impact, the geological hammer has developed a shock-absorbing handle to enhance the use of comfort. The upper and lower ends of the handle are threaded inside, the upper end is connected with the hammer handle and the handle through the thread, and the lower end is connected with the bottom cover through the thread. The bottom cover is provided with a handle, which is convenient for geologists to carry. The upper end is provided with an LED light belt, the handle surface is provided with an LED light belt button switch, the handle is provided with a battery, and the surface can be removed to replace the battery. The tail end of the geological hammer can detect the strength, property, structure, structure and other parameters of the rock, and then automatically recommend the geological replacement head suitable for the rock. By using this multifunctional intelligent geological hammer, the efficiency of geological workers in the field has been improved to a certain extent.

As is shown in Figure 2, (where, 1 - hammer; 2 - hammer handle; 3 - Handle; 4 - magnifying glass; 5 - compass; 6 - threaded hole; 7 - utility knife; 8 - Tape measure; 9 - bottom cover; 10 -- handle; 11 - switch; 12 - battery; 13 -- LED).

Further description of the multi-functional intelligent geological hammer, including a variety of hammer head, hammer handle, hammer handle includes hammer rod and handle, the upper end of the hammer head and the middle part of the hammer rod through threaded connection, while the middle part of the hammer rod and the tail handle through threaded connection. A structure with a square head at one end of the hammer, the other end of the hammer head is flat head structure. The hammer head structure is more diverse and can be replaced. Both ends of the hammer rod are threaded, the measuring tape is designed on the surface of the hammer rod, and a compass is arranged at one third of the upper end of the hammer rod, and the hammer rod is respectively connected with a magnifying glass and a utility knife through the thread. The ergonomically designed plastic handle on the handle surface is made of environmentally friendly plastic material, which is easy for geologists to grasp. The bottom end of the handle is connected with the bottom cover through the thread. The bottom cover is provided with a handle, the handle surface is provided with a button switch, the handle is provided with a battery that can be removed and replaced on the watch surface, and the lower end of the handle is provided with an LED light belts as shown in Fig. 2.

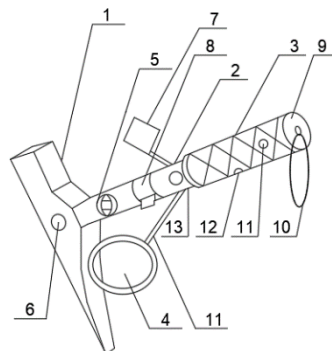


Figure 2: Multi-functional geological hammer structure diagram

3.2 Security

At present, the traditional geological hammer on the market, because there is not enough safety protection measures, when geological workers use geological hammer to knock rocks, it will cause the stone debris bursting, which is not conducive to the smooth development of geological workers and safety.

The multi-functional intelligent geological hammer is equipped with a protective umbrella in the hammer handle, and can be opened and closed by a switch on the handle, when the geological hammer is used to knock on the rock, it can prevent the bursting of stone debris. Compared with the traditional geological hammer, it can prevent the stone debris from bursting and injuring the geological workers, thus improving the feasibility and safety of the operation of the geological hammer and promoting the process of geological work.

At the same time, the existing geological hammer handle is made of one or two layers of rubber or plastic vulcanized to form a single layer structure with a certain thickness. When the grip is set on the hammer handle, the hammer handle is tightly supported in the plastic or rubber grip, so that between the hammer handle and the grip is surplus contact, the elasticity of the grip is weak, the shock absorber is reduced, and there is no anti-skid rough surface design on the surface of the grip, so that the elasticity of the grip is worse, not only because of the smooth surface of the grip, easy to slip and even out of the hand phenomenon, and, The vibration generated by the blow is directly transmitted to the hand through the hammer handle and grip, and it will cause damage to the palm and arm, which cannot work for a long time.

The multi-functional geological hammer handle grip structure is set on the geological hammer handle, including an inner sleeve and an outer sleeve, the inner sleeve is an elastic cylindrical structure of foam resin or foam rubber, the inner sleeve is sheathing on the geological hammer handle, the outer sleeve is a cylindrical structure on the outer surface of the inner sleeve, and the inner surface of the outer sleeve is bonded with the outer surface of the inner sleeve. The outer surface of the outer sleeve is provided with a raised anti-skid stripe or anti-skid protrusion. The geological hammer can reduce the vibration caused by the blow to the palm, arm injury, so as to increase the work efficiency, reduce the degree of fatigue.

3.3 Intelligent

At the same time, the smart chip is applied to the geological hammer. The main function of the smart chip is geological modeling. The main research contents and steps of geological modeling:

(1) Basic data integration. Integrate geological stratification and various graphical data, establish a geological modeling software data platform, and generate layer maps. (2) 3D mesh establishment. Establish a fine three-dimensional geological framework, and apply related methods to make the simulation grid reach better orthogonality. Set different parameters to control the degree of grid, ensure the consistency of the layer, and prevent the layer from crossing the layer. (3) Structural modeling. Based on the seismic interpretation results, a structural model is established in the geological modeling software, the target horizon is tracked, and the structural interpretation results are used. (4) Petrophysical modeling. Deterministic and stochastic modeling uses lithofacies model as the constraints of the attribute model, so as to establish a model that can reflect the underground terrain parameters. (5) Data analysis and geological statistics. A variety of data conversion is carried out to describe the distribution law of attributes in space. (6) Model checking. Check the geological model, determine the basis of a reasonable geological model, and conduct a comparative analysis with the known geological model. (7) Model post-processing. Perform grid coarsening and post-processing on a reasonable geological model to provide a qualified geological model for numerical simulation [3].

Geological modeling can be used to analyze the nature of the landform of the region, to realize the collection of relevant data. Specifically, through the analysis of relevant data, to carry out certain calculations, and complete the preservation and transmission of relevant data, to obtain the rock type of the region, so as to automatically recommend the geological hammer suitable for the terrain of the region.

4. Multifunctional intelligent geological hammer put into use

It has a magnifying glass, utility knife, tape measure, compass, and LED light belt and other tools. Among them:

(1) The magnifying glass connected with thread realizes the combination of necessary tools for

geological exploration in the field, which improves the efficiency.

(2) The compass is set on the hammer handle, which is convenient for geological workers to determine the direction in field work.

(3) By setting the measuring tape on the hammer handle, the geological target body in a small range can be measured directly.

(4) The LED light belt can be used to illuminate areas where light is insufficient, improve field working conditions, extend single-day working time, and avoid the impact of objective light conditions [4-5].

Through the application of geological modeling at the tail end of geological hammer, data analysis and processing of rock and soil are carried out, and then data preservation and transmission are completed. It is mainly used to identify the nature of soil and soil in the field, and the hammer head suitable for the corresponding type of rock is replaced, which is convenient for geological workers to carry, thus improving the work efficiency.

5. Conclusions

First, geologists use geological hammers, magnifying glasses, utility knives and tape measures to investigate the field environment, so as to facilitate the determination of rock and soil properties, formation structure, experiments and other operations.

Second, application of intelligent chip, geological modeling is used in the use of geological hammer. Through data collection, calculation and analysis of geotechnical properties in the field, data preservation and data transmission, geological replacement head suitable for the rock is recommended to improve the working efficiency of geologists.

Third, the multi-functional geological hammer can integrate the functions of tape measure, magnifying glass and lighting, which can realize the sampling of geological body, measurement within a small range, lighting under the condition of insufficient light.

Fourth, suitable hammerheads can be selected in different field environments. The corresponding hammerheads are assembled by screws and rods, which enriches the functions of geological hammers and reduces the burden of geological workers.

Fifth, in order to reduce the shock caused by impact, the damping handle is developed. The ergonomically designed rubber handle on the handle surface is composed of environmentally friendly plastic materials, which is easy for geologists to master and enhance the comfort of geologists.

Sixth, multi-power earth hammer hammer handle tube can slide in series, can be locked by locking sleeve, hammer handle length can be adjusted. In addition, screw the lower end of the outer pipe fitting of the hammer handle into the spiral mounting hole, including the tool handle, knife and soil magnifying glass. The geologic hammer is easy to carry and prevents loss.

Seventh, in order to prevent the geological hammer in the work of the stone debris dashed injury and geological workers, equipped with a protective umbrella in the hammer handle, through the handle switch to realize the protection umbrella to open and close, so as to improve the feasibility and safety of the geological hammer operation, promote the process of geological work.

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