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Abstract. new clean energy is essential for the rapid development of society. The appearance of natural gas, water and materials can timely alleviate the energy shortage in China. Natural gas water and substance is a kind of clean energy formed by hydrocarbon gas molecules such as water and methane under high pressure and ground temperature. At present, the main methods of land gas hydrate exploration are: high-precision seismic exploration technology, geophysical logging technology, geochemical exploration technology, remote sensing detection technology, audio magnetotelemental technology, and ultrasonic ground penetrating radar technology. In this paper, the basic exploration characteristics of different exploration technologies are introduced, which provides technical support for the rapid detection of terrestrial gas hydrate.

1. Introduction

As the material basis of our national economic construction, energy plays an important role in maintaining economic development and national security. China's oil and gas resources are particularly tense, therefore, to find a new alternative to conventional oil and gas energy in China is an urgent task. Natural gas hydrate is recognized as a clean and efficient energy with great potential in the world, which has attracted great attention from countries all over the world. More than 27% of the land areas and about 90% of the sea areas in the world have natural gas hydrates, with reserves of about 2 1016m3. At least 38 natural gas hydrates have been found in the land permafrost [1-4]. The natural gas hydrate in the land permafrost of China is mainly distributed in the qinghai-tibet plateau, the greater and lesser hinggan mountains, and the western plateau, with a distribution area of about 215 104km2, accounting for 22.4% of China's land area, and the resource amount is about 350 108 tons of oil equivalent [5]. Natural gas hydrate is a potential clean energy. With the global warming, it is likely to lead to the degradation of permafrost and the decomposition and release of methane gas hydrate, which has an important impact on global warming. Therefore, the investigation and evaluation of natural gas hydrate in permafrost region is of great energy and environmental

significance. However, currently, there is a lack of effective exploration technology for natural gas hydrate in the land tundra. Therefore, this paper comprehensively discusses the different detection techniques and methods of terrestrial natural gas hydrate, and provides a reference for the exploration of natural gas, water and materials.

2. The distribution of natural gas hydrate in the tundra of China

China's permafrost area accounts for about 10% of the global permafrost area, with an area of about 215×10^4 km^2, ranking the third in the world, second only to Russia and Canada, and accounting for 22.4% of China's total land area [6]. The natural gas hydrates mainly distributed in permafrost areas of China are mainly in qinghai-tibet plateau, western plateau and northeast greater and lesser hinggan mountains. The qinghai-tibet plateau and the western region are mainly located in the qilian mountain muli basin, the pliocene - middle pleistocene fault depression basin in the pass of kunlun mountain, the halahu region, and the qiangtang basin in Tibet. The land combustible ice in the greater and lesser hinggan mountains in northeast China is mainly distributed in mohe basin, genhe basin, dayangshu basin, sunwu-jiayin basin, labrador basin and hailar basin [7-8]. The natural gas hydrate reserves in qinghai-tibet plateau region of China are about 12.5×1012m3, accounting for 60% ~ 70% of the permafrost area in China and about 7% of the permafrost area in the world. The reserves of the northeast permafrost region are about 2.8×10^{12} m^3.

3. Exploration methods for onshore natural gas hydrate

3.1. High-precision seismic exploration technology

Seismic exploration is the most effective method in gas hydrate exploration. Due to complex geological conditions and harsh climate, it is difficult to form a set of effective technical methods for hydrate exploration in the land frozen soil area of China. Through yushania, hala lake, qiangtang basin, at mohe, etc of gas hydrates seismic exploration, formed a controlled source, path interval, small shot interval, high coverage observation system, multi-channel receiver field seismic data acquisition method and the high-resolution seismic data processing technology, dryland regions for get high quality seismic data in [9].

3.2. Geophysical logging technology

The logging data of geophysical logging are mainly used to divide oil, gas and water layer in oil and gas field logging. The porosity, permeability, oil saturation and other important parameters of the reservoir are determined to provide reliable basis for oil and gas exploration and development. Geophysical logging technology is also an important exploration method in gas hydrate exploration, which is very effective for identification and parameter evaluation of gas hydrate reservoir. The lithology of hydrate reservoir in muli area is analyzed by using the main parameters of geophysical logging technology, including natural gamma ray, p-wave velocity, density and apparent resistivity. Therefore, it is found that the gas hydrate reservoir in muli area shows the characteristics of "low density, high apparent resistivity, low natural gamma and high longitudinal wave velocity". In the case of complex surrounding rocks, apparent resistivity, density, natural gamma, and wave velocity can be used to accurately identify natural gas and water reservoirs, so as to provide a technical method for the detection of hydrate in the land permafrost region [10].

3.3. Geochemical exploration technology

Geochemical exploration technology has been paid more and more attention in gas hydrate exploration. Sun zhongjun et al. [11] of the Chinese academy of geological sciences carried out geochemical exploration experiments on combustible ice in muli area of the continental permafrost of qilian mountains, mainly including microbial method, geochemical well logging, acidolysis hydrocarbon method, pyrolysis mercury method, trace element method and other conventional geochemical methods for oil and gas exploration. Through experiments, it was found that microorganism activity

was strong in summer in muli region, so winter was the best season for hydrate sampling [12]. However, the ratio method of acidolytic hydrocarbon and pyrolytic hydrocarbon is not affected by the natural gas reservoir and can be directly detected. Through the geochemical exploration of soil, I and Cl in muli region, tang ruiling et al. revealed the abnormal patterns and influencing factors of NGH in soil I, Cl and I/Cl, and concluded that halogen elements I and Cl could be used as exploratory elements for NGH in land permafrost [13].

3.4. Remote sensing detection technology
The method of remote sensing can be used for the fast detection of gas hydrate in frozen soil. MODIS and ASTER data were used to analyze the accumulation mode and storage conditions of natural gas hydrate, combined with the spectral characteristics of rock minerals and ASTER data, and based on the visible and thermal infrared spectra, the information analysis method of alteration and symbiosis effect was developed. The ASTER data is used to identify the mineral distribution information of gas hydrate, and some rock information is enhanced. The MODIS data can be used to delineate the permafrost zone, classify the permafrost type, reflect the thickness of permafrost layer, and provide important temperature and pressure information. Remote sensing can obtain the information related to hydrate accumulation in a long distance, a wide range and quickly, which is a kind of natural gas hydrate exploration technology in land permafrost area worth further exploration [14].

3.5. Audio magnetotelluric detection technology
Audio-frequency magnetotelluric sounding (AMT) can detect the electrical distribution characteristics of geological bodies at depths ranging from a few meters to more than 1000 m, while there are significant electrical differences between land permafrost, natural gas hydrate and surrounding rocks [15]. Natural gas hydrate has "salt drainage effect", which can lead to high resistivity of pure natural gas hydrate. When natural gas hydrate occupies certain pores in the reservoir, the reservoir shows high resistivity. At the same time, the permafrost also shows higher resistivity than the non-permafrost. Therefore, the characteristic of high resistivity is the physical premise for the electromagnetic method to detect NGH and frozen soil [16].

3.6. Ultra-deep ground penetrating radar technology
Properties on gas hydrate research it was found that when the ground penetrating radar (GPR) to detect the basic physical properties of natural gas hydrate reservoir, but as a result of natural gas hydrate reservoir forming conditions and the limitations of ground penetrating radar application technology itself, ultra-deep ground penetrating radar (GPR) technology has been applied in the natural gas hydrate exploration for land. The first application of the ultra-deep ground penetrating radar technology is the low-frequency ground penetrating radar system realized in the land permafrost area with a detection depth of more than 200m. Obvious radar wave reflection signals are found in the natural gas hydrate reservoir, and its reflection characteristics of "high frequency and strong amplitude" can be used as the identification mark of the natural gas hydrate reservoir. The application of GPR technology in the exploration of natural gas hydrate reservoirs in the permafrost region of the qinghai-tibet plateau in China is an extension of the application of ultra-deep GPR and an innovation of effective detection methods and technologies in the field of natural gas hydrate exploration in China [17-18].

4. Conclusion
Although some progress has been made in the exploration technology of natural gas hydrate in permafrost areas, there are still some key problems to be solved. At present, high precision seismic exploration technology, geophysical well logging technology, audio magnetotem technology and geochemical exploration technology are widely used in the exploration of natural gas hydrate, while remote sensing detection technology and ultrasonic ground penetrating radar technology are relatively less applied, and their technologies are relatively immature and their applications have certain

limitations. At the same time, different exploration techniques and methods do not form a certain response relation between the occurrence state and formation process of natural gas hydrate in the land permafrost region and geophysical and geochemical parameters, making it difficult to form a reasonable basis in the future.

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