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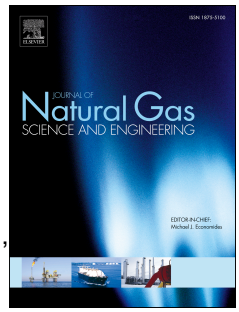

Geophysical characteristics of gas hydrate in the Muli area, Qinghai province

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Geophysical characteristics of gas hydrate in the Muli area, Qinghai province

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Abstract: The Muli area is the only region where gas hydrates have been found in the mid-latitude permafrost regions of the world. The use of geophysical method and certain geophysical parameters have a strong predominance in identifying gas hydrates and optimizing the effective gas hydrate detection methods in hard rock permafrost areas.. Since 2009, a series of tests has been performed in the Muli area, including seismic reflection and electromagnetic methods, and integrated geophysical well logging. The results show the presence of three types of gas hydrate reservoir, namely sandstone pore, mudstone fracture, and shale fracture types, with each showing a different well logging response. The gas hydrate reservoirs in the Muli area are characterized by high frequency and weak amplitude on the two-dimensional seismic profiles, and high horizontal resistivity on the electrical sections. The geophysical characteristics are complex, particularly as a result of the specific environments of gas hydrate reservoirs. These characteristics can be used to estimate the type and distribution of the gas hydrate reservoir, and to improve gas recovery rates by directing preliminary exploration.

Keywords: gas hydrate, geophysical well logging, reflection seismic response, electromagnetic response, Muli area

1. Introduction

Natural gas hydrates are widely distributed in marine sediment area and terrestrial permafrost, and their resource potential is equivalent to (1.8–2.1) × 10^{16} m^3 of methane gas, or twice the sum of known fossil fuel resources (coal, oil and natural gas) (Sloan, 1998). The natural gas hydrate resources in global permafrost may be as much as (1.4–3400) × 10^{13} m^3 (Collett et al., 2009). Permafrost-associated gas hydrates are primarily distributed in the high-latitude permafrost regions of the Arctic. These include the Prudhoe Bay-Kuparuk area in the North Slope of Alaska, USA; the Mackenzie Delta and Sverdrup Basin in Canada; the West-Siberian Basin, Lena-Tun-guska area, Timan-Pechora Basin, NE Siberia and Kamchatka areas in Russia; the Svalbard Peninsula in Norway; areas of Greenland; etc. China has the third largest permafrost zone (by surface area) worldwide, covering approximately 2.15 × 10^6 km^2. Gas hydrate samples were found in the Muli area of the Qilian Mountains for the first time in 2008, and made China the first country to discover natural gas hydrate in a mid-latitude permafrost region (Zhu et al., 2009). Zhu (2011) estimated that the amount of natural gas hydrate in permafrost areas of China could be as much as 3.8 × 10^{13} m^3. Permafrost is geologically unstable, and is extremely sensitive to