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论文

青藏高原冻土带天然气水合物的形成条件与分布预测

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摘要: 冻土带是天然气水合物发育的两个重要地质环境之一.青藏高原平均海拔在4000m以上,多年冻土面积约1.4×10⁶km².本文根据青藏高原冻土层厚度和地温梯度特征,运用天然气水合物的热力学稳定域预测方法,确定中低纬度高海拔区冻土带天然气水合物的产出特征.青藏高原多年冻土带热成因天然气水合物形成的热力学相平衡反映,水合物顶界埋深约27~560m,底界埋深约77~2070m.初步计算表明,青藏高原冻土带水合物天然气资源约1.2×10¹¹~2.4×10¹⁴m³.在冻土层越厚、冻土层及冻土层之下沉积层的地温梯度越小的地区,最有利于天然气水合物的发育.气温的季节性变化对天然气水合物影响不大.在全球气温快速上升的背景下,青藏高原天然气水合物将处于失稳状态,天然气水合物顶界下降、底界上升,与冻土带的退化相似,分布区逐渐缩小,最终将完全消失.

关键词: 天然气水合物 中低纬度高原冻土带 青藏高原

Formation and distribution prediction of gas hydrate in Qinghai-Tibet Plateau permafrost

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Abstract: Permafrost is one of the two major geological environments for gas hydrate occurrences. The Qinghai-Tibet Plateau has a mean altitude over 4000m and the permafrost area is about $1.4 \times 10^6 \text{ km}^2$. Based on the thickness of permafrost and the geothermal gradient in the Qinghai-Tibet Plateau permafrost, the occurrence and distribution of gas hydrate in permafrost were predicted by using the thermodynamic method based on the temperature and pressure of natural gas hydrate formation. The thermodynamic phase equilibrium for both thermogenic and biogenic gas hydrates in Qinghai-Tibet Plateau permafrost implies that the gas hydrate is accumulated within the stable zone that top boundary is buried at ca. 27~560m and bottom boundary is buried at ca. 27~2070m. The potential of natural gas resources as caged in hydrates in the Qinghai-Tibet Plateau permafrost is estimated at about $1.2 \times 10^{11} \sim 2.4 \times 10^{14} \text{ m}^3$. Gas hydrate is propitious to occur where permafrost is thicker and geothermal gradient is lower in Tibet Plateau permafrost. The seasonal change of air temperature in Qinghai-Tibet Plateau